N.S.S. COLLEGE, CHERTHALA

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05/07/2024

No. *Date.....*

To whomsoever it may concern

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I hereby certify that the documents are authentic and belong to NSS College, Cherthala.

N.S.S. COLLEGE CHERTHALA

Principal
NSS COLLEGE, CHERTHALA

2022-23

സെമസ്റ്റർ	**:**	**III**
കോഴ്സ് കോഡ്	**:**	**ML 1331**
കോംപ്ലിമെന്ററി കോഴ്സ്:		**V**
സമയക്രമം	**:**	**ആഴ്ചയിൽ 3 മണിക്കൂർ (18 ആഴ്ചയിൽ 54 മണിക്കൂർ)**
ക്രെഡിറ്റ്	**:**	**3**

പരിസ്ഥിതിപഠനം

പരിസ്ഥിതിദർശനവുമായി ബന്ധപ്പെട്ട ആശയങ്ങൾ, തത്ത്വങ്ങൾ, പ്രവണതകൾ, പ്രതിഭാസങ്ങൾ എന്നിവയെക്കുറിച്ചുള്ള അറിവുകൾ നേടുക – പ്രകൃതിസ്രോതസ്സുകളെയും അവയുമായി ബന്ധപ്പെട്ട പ്രശ്നങ്ങളെയും കുറിച്ചു മനസ്സിലാക്കുക – പരിസ്ഥിതിയുടെ ജൈവ, സാമൂഹിക, സാംസ്കാരിക, രാഷ്ട്രീയ, സാമ്പത്തിക വശങ്ങൾ, പാരിസ്ഥിതിക മേഖലയിൽ മനുഷ്യനുള്ള സ്വാധീനത്തിന്റെ പ്രത്യേകത, ഭൂമിയിൽ ജീവൻ നിലനിർത്തുന്നതിനാവശ്യമായ സാഹചര്യങ്ങൾ എന്നിവയെക്കുറിച്ചു മനസ്സിലാക്കുക – സർഗ്ഗാത്മകതലത്തിൽ, പരിസ്ഥിതിദർശനത്തിന്റെ ഭൂമികയിൽ നിന്നുകൊണ്ട് കലയെയും സാഹിത്യത്തെയും കാണുവാനും വിലയിരുത്തുവാനുമുള്ള മനോഭാവം സൃഷ്ടിക്കുക.

പഠനഫലപ്രാപ്തി

1. പരിസ്ഥിതിയുടെ സംരക്ഷണത്തെപ്പറ്റി ജാഗ്രതയുണ്ടാകുന്നു.
2. അമിതമായ ചൂഷണവും കൈയേറ്റവും കൊണ്ട് പ്രകൃതിയ്ക്കുണ്ടാകുന്ന ആഘാതത്തെപ്പറ്റി ചിന്തിക്കാനും പരിഹാരങ്ങൾ കണ്ടെത്താനും സാധിക്കുന്നു.
3. മലയാള സാഹിത്യത്തിൽ പാരിസ്ഥിതികമായ ആശങ്കകൾ പ്രതിഫലിച്ചിരിക്കുന്നതിനെപ്പറ്റി വിലയിരുത്തുന്നു.
4. പ്രകൃതിനശീകരണം, മലിനീകരണം തുടങ്ങിയ വിഷയങ്ങളിൽ ഇടപെടാനും പ്രശ്നപരിഹാര മാർഗ്ഗങ്ങൾ കൂട്ടായി ചർച്ച ചെയ്യാനും ബദൽ മാർഗ്ഗങ്ങൾ കണ്ടെത്താനും ശ്രമിക്കുന്നു.
5. പരിസ്ഥിതി വിഷയങ്ങളെക്കുറിച്ച് എഴുതാനും സംവാദങ്ങളിൽ ഏർപ്പെടാനും സന്നദ്ധമാകുന്നു.

മൊഡ്യൂൾ : ഒന്ന് (9 മണിക്കൂർ)

പഠനഫലപ്രാപ്തി

1 സ്വന്തം പരിസരത്തെ നിരീക്ഷിച്ച് പരിസ്ഥിതിയുടെ പ്രാധാന്യം കണ്ടെത്തുന്നു.

2. പരിസ്ഥിതി സൗഹൃദത്തെപ്പറ്റി ഗൗരവമായി ചിന്തിക്കുകയും ഇടപെടലുകൾ നടത്തുകയും ചെയ്യുന്നു.

പരിസ്ഥിതി–ആവാസവ്യവസ്ഥ–ജൈവമണ്ഡലം–പരിസ്ഥിതിയിലെ ഘടകങ്ങൾ–ജൈവികവും അജൈവികവുമായ ഘടകങ്ങൾ – ഭൂമി, ജലം, വായു, അന്തരീക്ഷം, ജന്തുജാലങ്ങൾ സസ്യജാലങ്ങൾ, മനുഷ്യർ–വൈവിധ്യങ്ങളും വൈരുദ്ധ്യങ്ങളും–പ്രാചീന മനുഷ്യരും പ്രകൃതിയും തമ്മിലുണ്ടായിരുന്ന ബന്ധങ്ങൾ–ആധുനിക വ്യവസായങ്ങളും നഗരവത്ക്കരണവും

കൊണ്ട് പ്രകൃതിയ്ക്കുണ്ടായ മാറ്റങ്ങൾ-അമിതമായ ഉപഭോഗത്തിന്റെ പ്രശ്നങ്ങൾ, വനനശീകരണം-വായു-ജലമലിനീകരണങ്ങൾ-പാരിസ്ഥിതിക ആഘാതങ്ങൾ-കേരളത്തിന്റെ ഭൂപ്രകൃതിയും പാരിസ്ഥിതിക ദൗർബല്യങ്ങളും-ഉപഭോഗവും സംരക്ഷണവും തമ്മിലുണ്ടാകേണ്ട സന്തുലനാവസ്ഥ - പരിസ്ഥിതിനിയമങ്ങൾ

വിശദപഠനത്തിന്

1. പരിസ്ഥിതിപഠനത്തിന്റെ വിവിധമാനങ്ങൾ - ഡോ.ജി.ബാലമോഹൻതമ്പി
   ('പരിസ്ഥിതിദർശനം' എന്ന കൃതിയിൽ നിന്ന്)
2. കാലാവസ്ഥാ വ്യതിയാനവും നമ്മളും - ഡോ.വി.ശശികുമാർ
   ('ഭൂമിയുടെ ആവരണം' എന്ന കൃതിയിൽനിന്ന്)

മൊഡ്യൂൾ : രണ്ട് (18 മണിക്കൂർ)

പഠനഫലപ്രാപ്തി

1. പരിസ്ഥിതി ദർശനവുമായി ബന്ധപ്പെട്ട ആശയങ്ങൾ മനസ്സിലാക്കുന്നു.
2. പരിസ്ഥിതി സംരക്ഷണ പ്രസ്ഥാനങ്ങളെക്കുറിച്ചും പ്രവർത്തനങ്ങളെക്കുറിച്ചും മനസ്സിലാക്കിക്കൊണ്ട് അത്തരം പ്രവർത്തനങ്ങളിൽ പങ്കെടുക്കാൻ പ്രേരണയുണ്ടാകുന്നു.

പരിസ്ഥിതി ദർശനങ്ങൾ-ഗഹന പരിസ്ഥിതിവാദം (Deep Ecology) -- സാമൂഹിക പരിസ്ഥിതി വാദം (Social Ecology) - പരിസ്ഥിതി സ്ത്രീവാദം (Eco Feminism)- പാരിസ്ഥിതിക പ്രസ്ഥാനങ്ങൾ-

ഗ്രീൻസ്, ചിപ്കോ പ്രസ്ഥാനം - ഗ്രീൻ ബെൽറ്റ് പ്രസ്ഥാനം-കേരളത്തിലെ പാരിസ്ഥിതിക സമരങ്ങൾ -ചാലിയാർ സമരം-സൈലന്റ് വാലി പ്രക്ഷോഭം-പശ്ചിമഘട്ട സരക്ഷണ പ്രവർത്തനങ്ങൾ - ഗാഡ്ഗിൽ റിപ്പോർട്ടിന്റെ പശ്ചാത്തലം-പരിസ്ഥിതി സംരക്ഷണ നിയമങ്ങൾ-ഗാന്ധിയൻ ദർശനം-റേച്ചൽ കഴ്സന്റെ നിശ്ശബ്ദവസന്തം , ഫുക്കുവോക്കയുടെ ഒറ്റ വൈക്കോൽ വിപ്ലവം എന്നീ കൃതികളുടെ സ്വാധീനം - മാറുന്ന പാരിസ്ഥിതികാവബോധം

വിശദപഠനം

1. പട്ടുപോകാത്ത ഒറ്റമരം - ആർ.വിനോദ്കുമാർ
   ('കേരളത്തിന്റെ ഹരിതജാലകം തുറന്നവർ' എന്ന കൃതിയിൽ നിന്ന്)
2. കാടിനു കാവൽ നാം തന്നെ - സുഗതകുമാരി
   ('കാടിനു കാവൽ' എന്ന കൃതിയിൽ നിന്ന്)
3. ഒരു പക്ഷിയും പാടുന്നുമില്ല - റേച്ചൽ കാഴ്സൻ
   ('നിശ്ശബ്ദവസന്തം' എന്ന കൃതിയിൽ നിന്ന്)

   വിവർത്തനം : കെ.രതിമേനോൻ

മൊഡ്യൂൾ : മൂന്ന് (27 മണിക്കൂർ)

പഠനഫലപ്രാപ്തി

1. സാഹിത്യവും പരിസ്ഥിതിദർശനവുമായുള്ള ബന്ധങ്ങൾ സൂക്ഷ്മമായി വിലയിരുത്തുന്നു.
2. ആസ്വാദനത്തോടൊപ്പം ആശയങ്ങളുടെ പ്രായോഗികതയെക്കുറിച്ച് വിമർശനാത്മകമായി പരിശോധിക്കുന്നു.

3. പാരിസ്ഥിതിക പ്രശ്നങ്ങളും ദുരന്തങ്ങളും മലയാള കഥയിലും കവിതയിലും പ്രതിഫലിച്ചിരിക്കുന്നത് മനസ്സിലാക്കുന്നു.
4. സാഹിത്യാഭിരുചിയ്ക്കനുസരിച്ച് സമകാലിക പരിസ്ഥിതി പ്രശ്നങ്ങളെ പ്രതിഫലിപ്പിക്കുന്ന രചനകൾ നടത്താൻ പ്രേരണയുണ്ടാകുന്നു.

പാരിസ്ഥിതികാവബോധം സർഗാത്മകതലത്തിൽ - മലയാള സാഹിത്യവും പാരിസ്ഥിതിക ദർശനവും - കേവലമായ പ്രകൃതിവർണ്ണനകളിൽ നിന്ന് പാരിസ്ഥിതികമായ ആശങ്കകളിലേയ്ക്ക് സാഹിത്യം മാറുന്നു. മലയാള കഥയിലും കവിതയിലും പാരിസ്ഥിതിക വിഷയങ്ങളുടെ പ്രതിഫലനം - സമാനമായ വിഷയങ്ങൾ പ്രകടമാക്കുന്ന ഇതര സാഹിത്യ കൃതികളുടെ സാമാന്യ പരിചയം - പാരിസ്ഥിതിക പ്രാധാന്യമുള്ള കൃതികളുടെ കണ്ടെത്തൽ.

വിശദപഠനം

1. കുറ്റിപ്പുറം പാലം - ഇടശ്ശേരി ഗോവിന്ദൻ നായർ
2. പുതു വെളിച്ചം - ബാലാമണിയമ്മ
3. മരണത്തിനപ്പുറം - കെ.അയ്യപ്പപ്പണിക്കർ
4. അവസാനത്തെ നദി - കെ.സച്ചിദാനന്ദൻ
5. ഭൂമിയുടെ അവകാശികൾ - വൈക്കം മുഹമ്മദ് ബഷീർ
6. മംഗള സ്വരൂപൻ - എസ്സ്.വി.വേണുഗോപൻനായർ
7. കുന്നിൻചരുവിലെ വീട് - കെ.വി.മോഹൻകുമാർ

സഹായ ഗ്രന്ഥങ്ങൾ

1. ഇക്കോ-ഫെമിനിസം, ഇക്കോ ടൂറിസം, മാർക്സിസം - എൻ.എം.പിയേഴ്സൻ
2. കഥയും പരിസ്ഥിതിയും - ജി.മധുസൂദനൻ
3. കവിതയും പരിസ്ഥിതിയും - എസ്സ്.രാജശേഖരൻ
4. കാടിനു കാവൽ - സുഗതകുമാരി
5. കേരളത്തിന്റെ ഹരിതജാലകം തുറന്നവർ - ആർ.വിനോദ്കുമാർ
6. നിശ്ശബ്ദവസന്തം-റേച്ചൽ കാഴ്സൻ - കെ.രതിമേനോൻ (വിവ:)
7. പരിസ്ഥിതിബോധവും സംസ്കാരവും - പി.പി.കെ.പൊതുവാൾ
8. പരിസ്ഥിതി സൗന്ദര്യ ശാസ്ത്രത്തിനൊരു മുഖവുര - ടി.പി.സുകുമാരൻ
9. പരിസ്ഥിതി വിജ്ഞാനം - എൻ.ബാലകൃഷ്ണൻനായർ, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
10. പ്രകൃതി, പരിസ്ഥിതി, ദാരിദ്ര്യം, ഊർജ്ജം - ആനന്ദ്, ഡി.സി.ബുക്സ്.
11. ഹരിതദർശനം ആധുനികാനന്തര കവിതയിൽ - സി.ആർ.പ്രസാദ്, സെഡ് ലൈബ്രറി, തിരുവനന്തപുരം.
12. ഹരിത നിരൂപണം മലയാളത്തിൽ - ജി.മധുസൂദനൻ, കറന്റ് ബുക്സ്, തൃശ്ശൂർ
13. കഥയും പരിസ്ഥിതിയും - ജി.മധുസൂദനൻ, കറന്റ് ബുക്സ്, തൃശ്ശൂർ
14. ഹരിത സാഹിത്യദർശനം - എം.അച്യുതൻ
15. പരിസ്ഥിതി ചിന്തകൾ - ഡോ.എം.വിജയൻപിള്ള
16. പരിസ്ഥിതിദർശനം - (എഡി.) പ്രതാപൻ തായാട്ട്, ഹരിതം ബുക്സ്.
17. ജീവന്റെ കൈയൊപ്പ് - ആഷാമേനോൻ, ഡി.സി.ബുക്സ്
18. പ്രതിരോധചിന്തകൾ - ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്
19. പരിസ്ഥിതിയുടെ രാഷ്ട്രീയം - (എഡി.) സി.റഹിം, ഫേബിയൻ ബുക്സ്

UNIVERSITY OF KERALA

OUTCOME BASED REVISED SYLLABUS FOR BSc PROGRAMME IN

ENVIRONMENTAL SCIENCE AND ENVIRONMENT AND WATER MANAGEMENT

WITH EFFECT FROM 2021

Table 1. Scheme of Instruction and Evaluation

Seme-ster	Course Code	Study component	Instructional hours / week		Credits	Evaluation		Total Credits
			Theory	Practical		CE	ESE	
I	EN 1111.3	English I	4	-	3	20%	80%	18
	1111.3	Additional Language I	3	-	3	20%	80%	
	EE 1121	Foundation Course I	3	-	3	20%	80%	
	EE 1131	Complementary Course I	3	-	3	20%	80%	
	EE 1132	Complementary Course Practical	-	2	-	20%	80%	
	EE 1141	Core Course I	3	-	3	20%	80%	
	EE 1142	Core Course Practical		2		20%	80%	
	EE 1171	Vocational Course I	3	-	3	20%	80%	
	EE 1172	Vocational Course Practical	-	2	-	20%	80%	
II	EN 1211.3	English II	4	-	3	20%	80%	24
	1211.3	Additional Language II	3	-	3	20%	80%	
	EE 1221	Foundation Course II	2	-	2	20%	80%	
	EE 1231	Complementary Course II	3	-	3	20%	80%	
	EE 1232	Complementary Course Practical		2	2	20%	80%	
	EE 1241	Core Course II	4	-	4	20%	80%	
	EE 1242	Core Course practical		2	2	20%	80%	
	EE 1271	Vocational Course II	3	-	3	20%	80%	
	EE 1272	Vocational Course Practical	-	2	2	20%	80%	
III	EN 1311.3	English III	5	-	3	20%	80%	19
	EE 1331	Complementary Course III	3	-	3	20%	80%	
	EE 1332	Complementary Course Practical	-	2	-	20%	80%	
	EE 1341	Core Course III	3	-	3	20%	80%	
	EE 1342	Core Course IV	3	-	3	20%	80%	
	EE 1343	Core Course Practical	-	2	-	20%	80%	
	EE 1371	Vocational Course III	4	-	4	20%	80%	
	EE 1372	Vocational Course IV	3	-	3	20%	80%	
	EE 1372	Vocational Course Practical	-	2	-	20%	80%	
IV	EN 1411.3	English IV	5	-	3	20%	80%	22
	EE 1431	Complementary Course IV	3	-	3	20%	80%	
	EE 1432	Complementary Course Practical		2	2	20%	80%	
	EE 1441	Core Course V	5	-	4	20%	80%	
	EE 1442	Core Course VI	2	-	2	20%	80%	
	EE 1443	Core Course Practical	-	2	2	20%	80%	
	EE 1471	Vocational Course V	4	-	4	20%	80%	
	EE 1472	Vocational Course Practical	-	2	2	20%	80%	

Seme-ster	Course Code	Study component	Instructional hours / week		Credits	Evaluation		Total Credits
			Theory	Practical		CE	ESE	
V	EE 1541	Core Course VII	4	-	4	20%	80%	16
	EE 1542	Core Course VIII	4	-	4	20%	80%	
	EE 1543	*Core Course Practical*	-	5	-	20%	80%	
	EE 1551	*Open Course I*	2	-	2	20%	80%	
	EE 1571	*Vocational Course VI*	3	-	3	20%	80%	
	EE 1572	Vocational Course VII	3	-	3	20%	80%	
	EE 1572	Vocational Course Practical	-	4	-	20%	80%	
VI	EE 1641	Core Course IX	3	-	3	20%	80%	21
	EE 1642	Core Course III	2	-	2	20%	80%	
	EE 1643	Core Course Practical	-	4	2	20%	80%	
	EE 1661.1 EE 1661.2 EE 1661.3 EE 1661.4	Elective Course I	2	-	2	20%	80%	
	EE 1671	Vocational Course VIII	3	-	3	20%	80%	
	EE 1671	Vocational Course IX	3	-	3	20%	80%	
	EE 1673	Vocational Course Practical	-	4	2	20%	80%	
	EE 1644	Project and Factory Visit	4	-	4	20%	80%	

Table showing the credits for the programme

First language-English

Semester	Working hours/week	No of Courses	No of Credits
Sem 1	4	1	3
Sem 2	4	1	3
Sem 3	5	1	3
Sem 4	5	1	3

Total No. of credits = 12

Additional language (Hindi/Malayalam)

Semester	Working/ hours	No of Courses	No of Credits
Sem 1	3	1	3
Sem2	3	1	3

Total No. of credits = 6

Complementary course (Chemistry)

Semester	Working hours/week Theory Practicals	Total Hours	No of Courses	No of credits
Sem 1	3 2+2#	7	1	3
Sem 2	3 2+2#	7	1	3
Sem 3	3 2+2#	7	1	3
Sem 4	3 2+2#	7	1+1*	3 + 4 *

 # The additional 2 hrs as per university regulation of work load for practicals if number of students exceeds 15 in a batch

**Practical Examinations will be conducted only on even semester by the*

university Total No of Credits 12+4=16

Semester	Working hours/week Theory Practicals	Total Hours	No of Courses	No of credits
Sem 1	3	3	1	3
Sem 2	2 + 2 # *	6	1+1	2

2 hrs as per university regulation of work load for practicals; Total No of Credits = 5

*Practical examination for foundation course

Core Course (Environmental science)

Semester	Theory Hrs/ Week	Practical Hrs/week	Total Hrs	No of course	No of credits
Sem1	3	2 + 2#	7	1	3
Sem 2	4		4	1	4
Sem 3	6	2+2#	10	2	6
Sem 4	7	2+2#	11	2+1**	6+4**
Sem 5	8	4+4#	15	2	8
Open	3		3	1	2
Sem 6	5	4+4#	13	2+1***	5+4***
Elective	3		3	1	2

#2 hrs as per university regulation of work load for practicals

* Practical examination for foundation course and core course are conducted together as part I & II and the credit is included with core course of 2 credits

At the end of 4th semester; * At the end of 6th

semester *<u>*Practical Exam will be conducted by the*</u>

<u>*university;*</u> Total No of credits 32+6=38

Vocational Course (Water Management)

Semester	Theory Hrs/ Week	Practical Hrs/week	Total Hrs	No of course	No of credits
Sem1	3	2+2#	7	1	3
Sem2	3	2+2#	7	1+1	3+2=5*
Sem3	7	2+2#	11	2	4+3=7
Sem4	4	2+2#	8	1+1*	4+2=6*
Sem5	6	4+4#+4+4#	22	2	3+3=6
Sem6	6	4+4#	14	2+1 *	3+3+2=8*
Project		4+4#	8	1	4

#2 hrs as per university regulation of work load for practicals

Practical Exam will beconducted by the university;

Total No of Credits 27+8=35

B.Sc Environmental Sciences & Environment and Water Management

Six semesters; One semester-18 weeks

Total No of Courses : 43

Sl.No	Study component	No. of courses	Total credit
1	Language English	4	12
2	Additional Lan (Hin/Mal)	2	6
3	Foundation course	2	5
4	Complementary course	6	16
5	Core course	13	38
6	Vocational course	12	35
7	Open Course	1	2
8	Elective courses	1	2
9	Dissertation	1	4
10	Total	43	120

Total No of Credits = 12+6+16+5+38+35+2+2+4=120

Semester 1

Semester	Study component	Title of course	Instructional Hrs
EN1111.3	English I	-	4x18=72
1111.3	Additional Language (Hin/Mal) I	-	3x18=54
EE1121	Foundation Course I	1. Computer Basics and Informatics	3x18=54
EE1141	Core Course I	1. Research Methodology and Perspectives of Science	3x18=54
EE1142	Core Course Practical	2. Environmental Science lab	2x18=36
EE1171	Vocational Course I	1.Water Resources and Fluid Mechanics	3x18= 54
EE1172	Vocational course Practical	2.Water Management Lab	2x18=36
EE1131	Complementary Course I	1.Theoretical Inorganic chemistry	3x18=54
EE1132	Complimentary Course Practical	2.Chemistry lab	2x18=36

Eng-4; SL-3; FC-3; CoreC-5; Vo C-5; Comp C-5; Total=25 Instructional Hrs/week

Semester II

Semester	Study component	Title of course	Instructional Hrs
EE1211.3	English II	-	4x18=72
EE1211.3	Additional Language (Hin/Mal) II	-	3x18=54
EE1221	Foundation Course	1.ComputerApplication for Biostatistics	2x18=36
EE1241	Core Course II	1. Environmental studies	4 x 18=72
EE 1242	Core Course practical	Environmental Science lab	2 x 18 = 36
EE1271	Vocational Course II	1.Water Resources management	3x18=54
EE1272	Vocational Course Practical	2.Water Management lab	2x18=36
EE1231	Complementary course II	1. Organic and Environmental Chemistry	3x18=54
EE1232	Complementary course Practical	2.Chemistry lab	2x18=36

Eng-4; SL-3; FC-2; Core C- 6; Vo C-5; Comp C- 5; Total=25 Instructional Hrs/week

Semester 1II

Semester	Study component	Title of course	Instructional Hrs
EE1311.1	English III	-	3x18=54
EE1341	Core Course III	1. Fundamentals of Ecology and Current Environmental Issues	3x18=54
EE1342	Core Course IV	2 Environmental Management	3x18=54
EE1343	Core Course Practical	3.Environmental Science lab	2x18=36
EE1371	Vocational III	1.Hydrology	4x18=72

EE1372	Vocational IV	2.Water Quality Parameters and Assessment	3x18=54
EE1373	Vocational Practical	3.Water Management lab	2x18=36
EE1331	Complementary III	1.Analytical Chemistry and Biomolecules	3x18=54
EE1332	Complementary Practical	2.Chemistry lab	2x18=36

Eng-3; CoreC-8; Vo C-9; Comp C-5; Total =25 Instructional Hrs/week

Semester 1V

Semester	Study component	Title of course	Instructional Hrs
EE1411.3	1.English IV	-	5x18=90
EE1441	Core Course V	1.Environmental Biotechnology& Microbiology	5x18=90
EE1442	Core Course VI	2.Biophysics, Biostatistics and Computer Application	2x18=36
EE1443	Core Course Practical	3. Environmental Science lab	2x18=36
EE1471	Vocational V	1.Water Quality Management	4x18=72
EE1473	Vocational Practical	3.Water Management lab	2x18=36
EE1431	Complementary IV	1.Physical chemistry	3x18=54
EE1432	Complementary Practical	2.Chemistry lab	2x18=36

Eng-5; Core C- 9; Vo C- 6; Comp C-5; Total =25 Instructional Hrs/week

Semester V

Semester	Study component	Title of course	Instructional Hrs
EE1541	Core Course VII	1.Environmental Geology and Mineralogy	4x18=72
EE1542	Core course VIII	2.Disaster Management	4x18=72
EE1543	Core Course Practical	3.Environmental Science lab	5x18=90
EE1571	Vocational Course VI	1.Water pollution	3x18=54
EE1572	Vocational Course VII	2.Water quality Management- II	3x18=54
EE1573	Vocational course Practical	3.Water Management lab	4x18=72
EE1551	Open course	1.Solid Waste Management	2x18=36

Core C-13; Vo C-10; Open C-2; Total =25 Instructional Hrs/week

Semester VI

Semester	Study component	Title of course	Instructional Hrs
EE1641	Core course IX	1.Environmental Pollution and Control Measures-I	3x18=54

EE1642	Core course X	2 .Environmental Pollution and Control Measures-II	2x18=36
EE1643	Core Course Practical	3.Environmental Science lab	4x18=72
EE1671	Vocational Course VIII	1.WaterAnalysis	3x18=54
EE1672	Vocational Course IX	2Watershed Management	3x18=54
EE1673	Vocational Course practical	3.Water Management lab	4x18=72
EE1661.1 EE1641.2 EE1641.3 EE1641.4	4.Elective	a. Rain water Harvesting b. Environmental Aspects of Estuarine System c. Environmental Meteorology and Climate Change d. Elementary Concepts in GIS & GPS	2x18=36
EE1644	Project	Environmental Science/ Water Management	4 x 18 = 72

Core C-9; Vo C-10; Project -4; Elective-2; Total = 25 Instructional Hrs/week

FOUNDATION COURSE

SEMESTER I

FOUNDATION COURSE I

EE1121 COMPUTER BASICS AND INFORMATICS

Total Hours 54

Aim:

To introduce students the basics of Computer Science, Informatics and its applications

Objectives:

- To make students aware of the history and evolution of computer science and technology
- To introduce students to basics of internet and overview of Information Technology
- To make students sensitized to the social aspects of informatics
- To make students understand the applications of IT in various fields

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO1	Articulate the history and development of computers	Un, Re
2.	CO2	Describe the Internet governance	Un, Re
3.	CO3	Explain and access the various knowledge repositories of Internet	Re, Un, Ap
4.	CO4	Comprehend the societal applications of internet and use it during emergencies	Re, Un, Ap
5.	CO5	Describe the applications of internet in various fields of science and technology	Re, Un

Course Content:

Module I: History and development of computers: basic knowledge of computer systems - software and hardware - free software - M.S Word, Excel, Power point Computer ethics - software piracy – internet Piracy – privacy-computer security; computer crimes –hacking and cracking.

9 Hours

Module II: Internet: managing bodies of the internet - Internet Society - Internet Service Provider - Internet application software

9 Hours

Module III: **Overview of Information Technology**: Features of the modern personal computer and peripherals - Computer network

9 Hours

Module IV: Data information and knowledge: Internet as knowledge repository - Introduction to use of IT in teaching and learning. Educational software; INFLIBNET - academic services

9 Hours

Module V: Social Informatics: IT and society - overview of its application in medicine, health care, environmental studies-defense crime detection and communication

9 Hours

Module VI: Applications of IT: Applications in weather forecasting, education, film and media - virtual reality

9 Hours

References

1. Cultural Boundaries of Science. T.F.Gieryn, University of Chicago press, 1999
2. Alexis Leon & Mathew Leons, Computers Today, Leon Vikas.
3. Alexis Leon &Mathew Leons, ComputersToday, LeonVikas. Fundamentals of InformationTechnology. ISBN 08125907890
4. Learning Computer Fundamentals, Khanna Book Publishers, ISBN, 818752252b
5. John Ray 10 Minute Guide to Linnx PHI, ISBN 81-203-1549-9.

CORE COURSES

SEMESTER I

CORE COURSE I

EE1141 RESEARCH METHODOLOGY & PERSPECTIVES OF SCIENCE

Total Hours: 54

Aim:

To introduce students to the basics of Research_

Objectives:

- To introduce students to the basic terminology used in research
- To make students aware of the importance of using statistical techniques in improving the credibility of research
- To make students understand the basic methods used in a research

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO1	Plan a Research Process meticulously	Ap
2.	CO2	Frame an appropriate Research Design	Re, Un, Cr
3.	CO3	Identify and collect the latest and relevant data on a pertinent problem	Re, Un
4.	CO4	Analyze the collected data and process it applying suitable sampling techniques	An, Ap
5.	CO5	Articulate well-structured Research Reports	Cr

Course Content:

Module I: Introduction to Research Methodology: An overview of the meaning and significance of research - scientific thinking, application in various fields, tool in decision and policy making; Objectives of research

6 Hours

Module II: Research Process: Definition of research problem; Formulating Research Problem; Literature survey; development of hypothesis; sample design - deliberate sampling, simple random sampling, systematic sampling stratified sampling, cluster and area sampling, multi-stage sampling; definition of data; Types of data - Primary data, secondary data; data collection - personal observation, interviews, questionnaires, schedules

12 Hours

Module III: Perspective of Science: Research Design: Definition of research design; Concepts related to research design - dependent and independent variables, extraneous variables, control; experimental, treatments; Principles of experimental designs - principle of replication, principle of randomization, principle of local control

12 Hours

Module IV: Processing & analysis of data: Processing of data - editing, coding, classification, tabulation; Analysis of data - the role of statistics in research, measures of central tendency & dispersion

8 Hours

Module V: Interpretation & Report Writing: Definition of interpretation; significance of report writing; steps in report writing - logical analysis of matter, preparation of outline, preparation of rough draft, re-writing and polishing rough draft, preparation of final bibliography, writing the final report.

10 Hours

Module VI: Ethics in research: confidentiality, informed consent, role conflict, plagiarism

6 Hours

References

1. Kothari C. R. 2004. Research Methodology: Methods and Techniques. (II Edn) New Age International Publishers. Pp 1-498
2. Georgia Fouka and Marianna Mantzorou (2011) What are the Major Ethical Issues in Conducting Research? Is there a Conflict between the Research Ethics and the Nature of Nursing? Health Science Journal 5(1) pp 3 – 14.
3. Charmaz, K. (2004). Premises, Principles, and Practices in Qualitative Research: Revisiting the Foundations. Qualitative Health Research, 14(7), 976-993.
4. The Glen: What everyone should know about Science. H.Collins and T.Pinch, Cambridge University press, 1993.
5. Elements of Biostatistics. S.Prasad. ISBN 81-7133-613-2. Title code bc-33 First edition -2003. Rastogi publications, Gangotri, Shivagiroad-Meerut 250 002.
6. Introduction to Biostastitics. Pranab Kumar Banerjee and S.Chand. ISBN81-219-2329-8, First edition 2004. Rajendra Raveendra Printers Pvt. Ltd. Ram Nagar, New Delhi

SEMESTER - I

CORE COURSE PRACTICAL

EE1142 ENVIRONMENTAL SCIENCE LAB - I

Total Hours: 36

1. Sampling methods - Plant or animal community on land

2. Population censusing methods - Total count, sampling
3. Estimation of beetle in wheat flour
4. Study of common flora and fauna

VOCATIONAL COURSE I

EE1171 WATER RESOURCES AND FLUID MECHANICS

Total Hours: 54

Aim:

To introduce students the importance of water resources and concepts of fluid mechanics

Objectives:

- To make students understand the importance of water as a natural resource
- To introduce students to the principles of fluids
- To give students the basics of fluid mechanics
- To make students understand the need of using principles of fluid mechanics in real life situations

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Articulate the importance of water as a natural resource	Un, Re
2.	CO 2	Describe various principles of fluids	Un, Re
3.	CO 3	Explain the behaviour of fluids	Re, Un, Ap
4.	CO 4	Identify the flow patterns of fluids	Re, Un
5.	CO 5	Explain the mathematical expressions of fluid mechanics	Re, Un

Course Content:

Module I: Water as a Resource: Water as a natural resource, pressure on water resource – urbanization, population growth, increasing living standards, competition for water, over-consumption, climate change; Availability of freshwater in India with special reference to Kerala

10 Hours

Module II: Uses of Water: Multiple uses of water – Direct uses – drinking, bathing, cooking etc., Indirect uses – processing in industries, agriculture,

electricity; Consumptive uses – irrigation, Partial consumptive use – domestic use, institutional use, industrial use, use in thermal and nuclear power plants – Non-consumptive uses – Recreational use, Navigational use

10 Hours

Module III: Properties of fluids: Intensive property - temperature, pressure, density, viscosity, specific volume, specific gravity, surface tension; extensive property – volume, mass, size, weight and conjugate properties: enthalpy, entropy, heat capacity

10 Hours

Module IV: Fluid flow – steady and unsteady flow, uniform and non-uniform flow, one, two- and three-dimensional flow, laminar and turbulent flow

8 Hours

Module V: Fluid Mechanics: Reynold's number, Reynold's experiment, Flow in a pipe, flow in a wide duct, flow in an open channel, calculation of flow velocity, Head losses

8 Hours

Module VI: Equations in fluid dynamics: Darcy-Weisbach equation, HazenWilliam's formula, Manning's formula (No derivation).

8 Hours

References

1. David Keith (2004) Ground Water Hydrology 3 edn. Todd-Willey International. P 656
2. Asit K. Biswas (1997) Water Resources: Environmental Planning, Management, and Development McGraw-Hill P 737
3. Sharma RK (1987) Hydrology and Water Resources Engineering Dhanpat Rai 818 p
4. R. K. Sharma (1987) A Textbook of Hydrology and Water Resources Engineering Dhanpat Rai & sons 818 p
5. Er. R K Rajput (1998) A Textbook of Fluid Mechanics 6th Edn S. Chand Publishing P 1051
6. Gray N F (2010) Water Technology: An Introduction for Environmental Scientists and Engineers

SEMESTER- I
VOCATIONAL PRACTICAL
EE1172 WATER MANAGEMENT LAB - I

Total hours: 36

1. Measurement of rain fall
2. Measurement of Evaporation (Relative Humidity)
3. Measurement of atmospheric temperature
4. Record of humidity

SEMESTER II

FOUNDATION COURSE II

EE1221 COMPUTER APPLICATION FOR BIOSTATISTICS

Total Hours: 36

Aim:

To introduce students the basics of Computer applications and the basics of biostatistics

Objectives:

- To make students know the applications of computer in research
- To introduce students to various data collection and processing steps
- To make students know the various statistic that can be applied to collected data
- To make students understand the various types of statistical variability in research

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Describe the various techniques of sampling	Un, Re
2.	CO 2	Present collected data in an comprehensible form	Un, Re, Ap
3.	CO 3	Express data in various types of graphical representations	Re, Un, Ap
4.	CO 4	Perform basic statistical techniques in	Re, Un, Ap

		data	
5.	CO 5	Formulate null and alternate hypothesis on research topics	Re, Un

Course Content:

Module I: Computer applications: preliminary concepts - sampling, sampling designs - sampling techniques - sample random – systematic sampling data - data presentation – numeric –alphabetic – alphanumeric

9 Hours

Module II: Collection and representation of data: Collection and classification tabulation of data.

3 Hours

Module III: Graphical representation of data: - methods of preparation of graph – Frequency curve relative frequency map - cumulative frequency map - relative frequency map or o-give. Dot diagram -significance of graphic representation - limitations of graphic representation

6 Hours

Module IV: Measures of central tendencies - mathematical average, average of position - measures of dispersion - range-mean deviation - standard deviation - distribution patterns

5 Hours

Module V: Statistical inference and hypothesis: Tests for statistical significance: student t-test, Chi-square test, confidence level, Null and alternate hypothesis (Concept only).

4 Hours

Module VI: Types of variability-experimental variation-biological variability, real variability-experimental variability, error, subjective, objective instrumental and sampling error

9 Hours

References

1. Elements of Biostatistics -S.Prasad. ISBN 81-7133-613-2 Title code bc-33 First edition -2003 Rastogi publications, Gangotri, Shivagiroad-Meerut 250 002.
2. Methods in Biostatistics for Medical students & research works-V. K Mahajan. Jaypee Brothers Medical brothers Pvt Ltd, New Delhi- 6th edition.

3. Introduction to Biostastitics. Pranab Kumar Banerjee and S.Chand. ISBN81-219-2329-8. First edition 2004. Rajendra Raveendra Printers Pvt. Ltd., Ram Nagar, New Delhi 110 055.

SEMESTER - II

CORE COURSE - II

EE1241 ENVIRONMENTAL STUDIES

Total Hours: 72

Aim:

To introduce students to the importance of the Environment and its components

Objectives:

- To give students an understanding on the basic concepts of Environment
- To introduce students to the concept of ecosystem and the different types of it
- To introduce students to the biodiversity and the significance and uses of it
- To make students understand the various social issues related to environment

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO1	Articulate the basic concepts of Environmental Studies	Un, Re
2.	CO2	List out and describe the various Natural Resources and enumerate the conservation strategies of resources	Un, Re, Ap
3.	CO3	Explain different kinds of ecosystem	Re, Un
4.	CO4	Explain the concept of biodiversity and its type	Re, Un

Course Content:

Module I: Concepts of Environmental Studies: Multidisciplinary nature of environmental studies; Definition, scope and importance, need for public awareness

4 Hours

Module II: Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. d) Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer- pesticide problems, water logging, salinity. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources, equitable use of resources

16 Hours

Module III: Ecosystems: Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystems: a) Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

12 Hours

Module IV: Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

14 Hours

Module V: Social Issues and the Environment: From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its—problems and concerns. Case Studies; Environmental ethics: Issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies; Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest

Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

16 Hours

Module VI: Human Population and the Environment: Population growth, variation among nations; Population explosion – Family Welfare Programme; Environment and human health; Human Rights; Value Education; HIV/AIDS; Women and Child Welfare; Role of Information Technology in Environment and human health.

10 Hours

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad –380 013, India, Email:mapin@icenet.net
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
5. DeA.K., Environmental Chemistry, Wiley Eastern Ltd.
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7. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
8. Heywood, V.H &Waston, R.T. 1995. Global BiodiversityAssessment. Cambridge Univ. Press 1140p.
9. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
10. Mckinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
11. MhaskarA.K., Matter Hazardous, Techno-Science Publication (TB)
12. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
13. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
14. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.

15. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
16. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
17. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
18. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
19. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA499p

SEMESTER- II

CORE & FOUNDATION COURSE PRACTICAL

EE 1242 ENVIRONMENTAL SCIENCE LAB-II

Total Hours: 36

Computer Application for Biostatistics

1. Create a power point presentation of wild life population.
2. Graphical representation - Bar, Pie charts of flora and fauna.
3. Plotting straight lines
4. Determination of Central tendencies

Environmental Studies

1. Identification of flora and fauna – terrestrial, marine and freshwater ecosystems
2. Estimation of primary productivity – light and dark bottle method
3. Community study : quadrat and line transect method
4. Construction of food chain/ food web : terrestrial and aquatic ecosystems

SEMESTER II

VOCATIONAL COURSE II

EE1271 WATER RESOUCE MANAGEMENT

Total Hours: 54

Aim:

To introduce students to the importance of management of water resources

Objectives:

- To make students the distribution of water on earth
- To give students an understanding of impacts of human use of water
- To make students understand the various irrigation types for water resource management
- To make students aware of the importance of sustained use of water
- To make students understand and identify the means of meeting the demand of freshwater

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Describe the distribution of water on earth	Un and Re
2.	CO 2	Reflect the impact of human use of water	Un
3.	CO 3	Articulate the various types of irrigation and develop efficient irrigation methods	Re, Un and Ap
4.	CO 4	List out the various methods for meeting increasing water demand	Re, Un
5.	CO 5	Describe sustainable use of water	Re, Un

Course Content:

Module I: Water resources: Distribution of water on earth: Forms of water – Freshwater - Types – glaciers and ice caps, precipitation, surface water – lentic and lotic; ground water: Saline water

10 Hours

Module II: Effects of human use of water: landscape changes, deforestation, Pollution, ground water exploitation, Urbanisation, Agriculture

6 Hours

Module III: Irrigation: Definition, Types of irrigation and its advantages and ill effects – surface irrigation, localized irrigation, drip irrigation, sprinkler irrigation, centre pivot irrigation, free flooding/wild/inundation, perennial system, direct irrigation: Frequency of irrigation: standards of irrigation water: Irrigation efficiency

12 Hours

Module IV: Lift irrigation: definition, advantage, requirements of lift irrigation, case study of lift irrigation

6 Hours

Module V: Meeting water demand: Rainwater harvesting, diverting surface water, dams and reservoirs, transferring water between river basins, waste water reuse, desalinisation of salt water

10 Hours

Module VI: Sustainable use of water: Freshwater shortage, management of water and conservation of water resources, Urban Decision Support System (UDSS)

10 Hours

References

1. Santosh Kumar Garg (1976) Water Resources Engineering Irrigation Engineering & hydraulic Structures Khanna Publishers 1132 p
2. Loucks, Daniel P., van Beek, Eelco (2017) Water Resource Systems Planning and Management Springer
3. M. H. Ali (2010) Fundamentals of Irrigation and On-farm Water Management: Volume 1 Springer

SEMESTER- II

VOCATIONAL PRACTICAL

EE1272 WATER MANAGEMENT LAB - II

Total hours: 36

1. Determination of pH of water sample
2. Determination of Alkalinity of water sample
3. Determination of SPM load of water
4. Determination of Surface tension by drop weight method
5. Determination of Surface tension by drop number method
6. Determination of Viscosity of a sample by Ostwalds Viscometer method
7. Determination of Humidity by Psychrometer

SEMESTER – III

CORE COURSE - III
EE1341 FUNDAMENTALS OF ECOLOGY AND CURRENT ENVIRONMENTAL ISSUES

Total Hours: 54

Aim:

To impart a detailed knowledge among the students on ecology and current environmental problems

Objectives:

- To understand the basic principles and classifications of ecology
- To gain the practical knowledge on diversity indices.
- To give an idea about the causes and impacts of current environmental issues.

Course Outcomes

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Understand the basic concepts of ecology	Un
2.	CO 2	Know the structure and principles of different types of ecology	Un
3.	CO 3	Understand the basic idea of biogeochemical and nutrient cycles	Un
4.	CO 4	Apply the knowledge on diversity indices	Ap
5.	CO 5	Describe the impacts of current environmental problems	Un
6	CO6	Generate solutions for the impacts of human use of Environment	Re, Un, Ap

Course Content:

Module I: Ecology: Definition, scope and history of ecology. Basic concept of Ecology, Terminology of ecology- species, vegetation, flora, fauna, population, community, habitat Subdivisions of ecology-Autecology and Synecology. Categories of ecological factors: climatic factors-light, temperature, rainfall, humidity, atmosphere; topographic factors- altitude, direction of mountain chains and valleys, steepness and exposure of slope; edaphic factor- soil formation, soil profile, physical and chemical properties of soil; Biotic factors-different kinds of interactions between forms of life i.e. plants, animals and microorganisms.

12 Hours

Module II: Population ecology: Population characteristics: size and density, dispersion, age structure, natality, mortality, life tables. Population interactions- Intra and inter specific interactions, symbiosis, mutualism, commensalism, competition, predation and parasitism.

8 Hours

Module III: Community Ecology: characteristics of community - species diversity, growth form and structure, dominance, succession, trophic structure. Composition, structure, origin and development of community.

Trophic pyramids and food webs. Ecological succession and its classification. Competition exclusion principle and Gause's theory of niche. Wetlands and Ramsar sites

10 Hours

Module IV: Habitat ecology: Structure and classification of different ecosystems– Freshwater, Marine, forest, grassland and deserts, Biogeographic zones. Endemic and endangered species, Invasive species and control. Biogeochemical cycles and nutrient cycles: Nitrogen cycle, carbon cycle, phosphorous. cycle, sulphur cycle.

9 Hours

Module V: Applied ecology: Species diversity, community stability and disturbance, Measurement of diversity, Abundance and frequency, Basic concepts of Diversity indices- Shannon-Weiner index, Simpson Index**,** Importance value Index.

6 Hours

Module VI: Current Environmental issues: Causes and consequences of climate change and global warming, ozone layer depletion, pollution, deforestation, soil degradation, waste disposal, water scarcity, natural resource depletion, over population, epidemiological issues-water, air and vector borne diseases.

9 Hours

References

1. Odum,E.P. 1971. Fundamentals of Ecology, W.B.Saunders Company, Philadelphia
2. Sharma.P.D. (2001). Ecology and Environment, Rastogi Publications, Meerut.
3. Rana, S.V.S. (2015). Essentials of Ecology and Environmental Science, PHI Learning Private Limited, New Delhi.
4. Chapman, J. L. and Reiss, M. J.(1992). Ecology: Principles and Application, Cambridge University Press, Cambridge

SEMESTER III

CORE COURSE IV

EE1342 PAPER II ENVIRONMENTAL MANAGEMENT

Total Hours 54

Aim:

To enable the students to identify, describe, and compare core themes and principles of the subject_

Objectives:

- To teach basics of environmental management
- To make students interpret environmental risk levels to make management decisions
- To make students aware of the National Environmental Policy and other regulatory frameworks

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
6.	CO 1	Define Environment Impact Assessment (EIA)	Re
7.	CO 2	List out the major Environmental protection laws in India	Re
8.	CO 3	Explain National Environmental Policy and Regulatory Frame Work	Un
9.	CO 4	Differentiate Environment Impact Assessment (EIA) and Environmental Impact Statement (EIS)	An
10.	CO 5	Compare Sustainable development measures taken by India and other developed nations	Ev

Course Content:

Module I: Basics of Environmental Management: Definition –Basic principles of Environmental Management. Environment Impact Assessment (EIA) -Definition and aim, Principles and Concepts of EIA, Environmental inventory, Baseline data on EIA, EIA assessment methodologies, Environmental Impact Statement (EIS) and Environmental Management Plan (EMP)

9 Hours

Module II: Sustainable Development -Meaning , Concept and Need of Sustainable Development, Indicators of Sustainable Development, Policies, UN and International conferences - Rio summit, Earth Summit, Agenda 21, Johannesburg conference on sustainable development; Copenhagen summit, Sustainable Development Goals (SDGs) Models of sustainable development; Case studies – Sustainable development scenario – global and national level.

9 Hours

Module III: National Environmental Policy and Regulatory Frame Work: Constitutional and Statutory laws in India – Article 48A, Article 51A(g); National Environment Policy, 2006; Intellectual Property Rights; Public Liability Insurance Act, 1991; Biopiracy; Green funding and taxes; Green Bench; Central and State Pollution Control Boards.

9 Hours

Module IV: Environmental Laws in India - The Wildlife Protection Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest Conservation Act, 1980; The Air Act (Prevention and Control of Pollution), 1981; The Environment Protection Act, 1986; Solid Waste Management Rules, 2016

9 Hours

Module V: Environmental Economics: Nature and scope of Environmental Economics; Interrelationship with Economy and Environment

9 Hours

Module VI: Environmental Standards: Scheme of labeling environment friendly products (Ecomark); Environmental Management and ISO Certification; Environmental Management System (EMS); ISO 14000

9 Hours

References

1. Environmental laws of India. An introduction. CPR Environmental Education Centre Chennai, 2000.
2. A text book on Environmental Studies. D.K. Asthana and Meera Athana. S.Chand and Co.
3. Ecology and Sustainable Development. P.S.Ramakrishnan. NBS New Delhi, 2001.
4. Environmental laws. Gurudip Singh. Macmillan India ltd.
5. Introductory Text of Environmental policies and laws. V.K.Garg, M.S Bishnoi, C.P Malik Kalyani Publishers, New Delhi.
6. Environmental Laws, Dharmendra.S.Sengar, Prentice Hall of India Pvt.ltd, Dew Delhi, 2000.
7. Ricci, P.F., Environmental and Health Risk Assessment and Management: Principles and Practices, Springer, 2006.
8. Theobald, R.H., Environmental management, Nova Science Publishers, 2008.
9. Madu, C.N., Environmental planning and management, Imperial College Press, 2007

SEMESTER III
CORE COURSE PRACTICAL
EE1343 ENVIRONMENTAL SCIENCE LAB-III

Total Hours: 36

1. Measuring rainfall and calculation of normal rainfall
2. Recording of maximum -minimum temperature
3. Recording of humidity
4. Preparing a field map using prismatic compass
5. A Collection and submission of 5 Eco-friendly products
6. A report of visit to a factory where Pollution abatement technology is implemented
7. A report on environmental law case study in India
8. A case study of EIA

SEMESTER III

VOCATIONAL COURSE III

EE1371 PAPER (1) HYDROLOGY - I

Total Hours: 72

Aim:

To introduce students to the basics of Surface water and Ground water Hydrology

Objectives:

- To make students understand the various factors affecting occurrence and movement of ground water
- To make students aware of the importance of sustained use of ground water
- To make students understand the potential problems of saline water intrusion

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Articulate the importance of hydrological	Un and Re

		cycling and the factors affecting	
2.	CO 2	Describe formation of rain, the factors affecting and various measuring techniques	Un
3.	CO 3	Frame an outline depicting evapo-transpiration with factors mentioned	Re, Un and Ap
4.	CO 4	Describe infiltration of water, groundwater, its occurrence and movement and the factors affecting ground water	Re, Un
5.	CO 5	Articulate connections between groundwater usage and saline water intrusion	Re, Un, Ap and An

Course Content:

Module I: Surface water hydrology: Definition and importance of surface water hydrology, Hydrological cycle – description; climatic factors affecting hydrological cycle - humidity, temperature, radiation and wind.

10 Hours

Module II: Evaporation and transpiration: Evaporation – definition; factors affecting evaporation - temperature, movement of air and wind speed, surface area and humidity; Estimation of evaporation - evaporation pan method, estimation from water balance calculation; evaporation from soil surface, factors affecting soil water evaporation - soil characteristics, tillage and environmental interactions; Transpiration – definition, factors affecting transpiration - evaporative demand of surrounding atmosphere, humidity, temperature, wind and incident sunlight.

15 Hours

Module III: Precipitation: Precipitation – definition; forms of precipitation, causes of precipitation Measurement of rainfall: measurement using rain gauge - Graduated Cylindrical or Standard Rain Gauge, Tipping Bucket Rain Gauge, Optical Rain Gauge and Acoustic Rain Gauge, measurement using radars; Rainfall intensity - Light rain, moderate rain, heavy rain, violent rain; Mean and annual rainfall, Snowfall, measurement of snow fall - snow gauges: automated and snow pillow; Characteristics of precipitation in India;

15 Hours

Module IV: Infiltration and Runoff: Infiltration – Definition; infiltration rate; factors affecting infiltration rates - precipitation, soil type, soil moisture content, land cover and slope; Runoff – definition; factors affecting runoff - climatic factors and physiographic factors; Global Water Balance.

11 Hours

Module V: Ground Water Hydrology: Ground water – definition; sources of ground water - meteoric water, connate water, magmatic water and juvenile water; ground water fluctuations; factors affecting ground water fluctuations - topography, stream flow, meteorological phenomena, evapo-transpiration and urbanization;—major sources of ground water contamination.

11 Hours

Module VI: Saline Water Intrusion and Wells: Saline water intrusion – Definition; causes of surface and ground water intrusion; control of saline water intrusion; wells – definition, types of wells - open wells/ dug wells and bore wells/ tube wells.

10 Hours

References

1. Rk Sharma and Tk Sharma (2000) Text Book Of Hydrology & Water Resources Engineering, Dhanpat Rai Publications (P) Ltd
2. K. Subramanya (1994) Hydrology, Tata McGraw-Hill Education p. 392
3. N N Basak (2017) Irrigation Engineering, McGraw Hill Education; 1 edition p. 329
4. Santosh Kumar Garg (2010) Water Supply Engineering, Khanna Publishers, p. 1196
5. David Keith Todd and Larry W. Mays (2005) Groundwater Hydrology, John Wiley & Sons; 3rd edition John Wiley & Sons; p. 656.

SEMESTER III
VOCATIONAL COURSE IV
EE13712 PAPER (2) WATER QUALITY PARAMETERS AND ASSESSMENT

Total Hours: 54

Aim:

To train the students on the basic concepts of water sampling technique and analyzing the water quality parameters

Objectives:

- To give an in-depth knowledge on sampling and preservation of water sample for physical, chemical and biological analysis.
- To gain the practical knowledge on water analysis.
- To give an idea about the water quality guidelines.

Course Outcomes:

At the end of the course, the student will be able to:

Sl.No.	Course Outcome No.	Course outcome (CO)	Taxonomic Level (TL)
	CO-1	Understand the basic concepts of water and water quality parameters	Un
	CO-2	Know the principles of water sampling and preservation methods	Un
	CO-4	Understand the basic idea of drinking water quality guidelines	Un
	CO-5	Apply the knowledge on water quality monitoring	Ap

Course Content:

Module I: Physical properties of Water: Boiling Point, Melting Point, critical temperature, viscosity, Surface tension, dielectric constant, dipole moment, Heat of vaporization.

10 Hours

Module II: Water quality and Sampling: definition, importance of water quality measurement, Objectives of water quality assessment, sampling methods & collection of water samples -surface water and groundwater, Types of sampling -spot or grab samples and composite samples, sampling frequency. Types of water samplers –Van Dorn water sampler, Ruttner water sampler, Dussart-flask water sampler, Thermos-flask water sampler, pump

sampler, Niskin water sampler, Nansen water sampler, handling and preservation of water sample for physical, chemical and biological analysis.

12 Hours

Module III: Water quality parameters: physical- colour, temperature, odour, electrical conductivity, turbidity, transparency; chemical - pH, total dissolved solids, Dissolved Oxygen, Biochemical Oxygen Demand, Ca, Mg, hardness, alkalinity, acidity, Chemical Oxygen Demand, Nitrite, Nitrate, phosphate, Fluoride, chloride; bacteriological -total coliforms, faecal coliforms, E.coli and biological parameters - macrophytes, phytoplankton, chlorophyll. Tolerance limits for trace metals in drinking water- Al, B, Cd, Co, Pb, Mn, Ni. Fe, Zn, Cr, Cu, Mo, Se

12 Hours

Module IV: Analytical methods: pH, electrical conductivity, alkalinity, hardness by EDTA method, TDS, DO by Winkler method, Chloride by Titrimetry, Transparency by Seechi disc method, Coliforms by MPN method.

10 Hours

Module V: Biological Methods: Estimation of chlorophyll content, collection and preservation of phytoplankton, measurement of phytoplankton population -Sedgwick-Rafter cell method and Lackey's drop method.

8 Hours

Module VI: National and International Standards for drinking water quality: WHO, USPHS, CPCB, BIS.

2 Hours

References

1. APHA (1995). Standards methods for the examination of water and wastewater.19th Edition., American Public Health Association, Washington DC.
2. BIS (2012). Indian Standard Drinking Water-Specification (Second Revision) IS 10500 : 2012.
3. Saxena, M.M. (1998). Environmental Analysis: Air, Water and Soil. Agrobotanica, Bikaner, 184 p.
4. Trivedi, R.K. and Goel, P.K. (1986).Chemical and biological methods for water pollution studies. Environmental Publications, Karad, India, 247 p.
5. USPHS (1962). Public Health Service Drinking Water Standard (https://law.resource.org/pub/us/cfr/ibr/006/usphs.956.1962.pdf)
6. WHO (2008). Guidelines for drinking-water quality [electronic resource]:incorporating 1st and 2nd addenda, Vol.1,

Recommendations. – 3rd ed. https://www.who.int/water_sanitation_health/dwq/fulltext.pdf

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EMESTER – III

VOCATIONAL PRACTICAL

EE1373 WATER MANAGEMENT LAB - III

Total Hours: 36

1. Determination of Chlorine percentage in a sample of bleaching powder
2. Determination of concentration of chloride ion in a sample of water sample
3. Determination dissolved oxygen in a sample of water
4. Determination of density of water

SEMESTER – IV

CORE COURSE V

EE1441 - PAPER (1) ENVIRONMENTAL BIOTECHNOLOGY AND MICROBIOLOGY

Total Hours: 90

Aim:

To develop basic understanding of the principles and applications of microbiology and biotechnology in the environment

Objectives:

- To impart knowledge on the microbes in the environment and interactions of microorganisms in the various spheres of the environment
- To understand the principles of biotechnology applications of biotechnology in waste management

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO1	Describe the different types of microbes in the environment and differentiate microbes based on their metabolic	Re

		diversity	
2.	CO2	Define the various environmental factors that influence growth and activity of microbes	Re
3.	CO3	Explain the role of microorganisms in biogeochemical cycling of nutrients	Un
4.	CO4	Outline the environmental applications of biotechnology	Re
5.	CO5	Assess the bioremediation techniques for application in waste treatment	An

Course Content:

Module I: Environmental Microbiology: Microbes in the environment – diversity and types – bacteria, archaea, fungi, protozoa and algae: Growth of microorganisms Environmental factors and microbial growth: oxygen, temperature, pH, pressure. Extremophiles – microbes in the extreme environment.

15 Hours

Module II: Microbial ecology: Microbes in water; coliforms and indicators of fecal contamination; Microbiology of soil: role in soil fertility; interactions between microbes and plants – mycorrhizae; rhizobium - nitrogen fixation; microbiology of air: prevalence and environmental factors; air-borne pathogens.

15 Hours

Module III: Metabolic diversity: Phototrophs, autotrophs, heterotrophs, chemolithotrophs, heterotrophy; Aerobic and anaerobic respiration, fermentation

Role of microbes in geochemical cycles – Carbon, Nitrogen and Sulphur cycles; Microbial interactions; Interactions between microorganisms: commensalism, mutualism, parasitism and ammensalism

15 Hours

Module IV: Biotechnology-definitions: Scope of biotechnology in agriculture, food production and nutrition. Impact of biotechnology on sustainable development and sustainable agriculture: biofertilizer and biopesticides; Microorganisms in biomass and energy production: Microbes producing protein - single cell protein; Biogas production – Methane.

15 Hours

Module V: Genetic Engineering: Brief study of gene cloning in prokaryotes, Molecular tools for genetic engineering. Recombinant DNA technology and its applications; Release of genetically engineered

microorganisms; safety and environmental risks; impact of genetically modified crops

15 Hours

Module VI: Microbes in waste treatment: treatment of solid waste – biocomposting and vermicomposting: principles, technique and applications. Microbes in waste water treatment: aerobic and anaerobic waste water treatment

Bioremediation: principles and applications; in situ and ex situ remediation processes and applications; in situ remediation of groundwater contamination and petroleum hydrocarbon contamination

15 Hours

References

1. Ananthanarayanan and Panicker. 2009. Textbook of Microbiology, University Press.
2. Bhandar,S.C & L.L. Somani. 1994. Ecology and Biology of Soil microorganisms: Agretech Publishing, Udaipur.
3. Chandrawati Jee and Shagutta. 2007. Environmental Biotechnology, APH Publishing.
4. Ignacimuthu,S.J. Biotechnology: An Introduction. Tata Mc GrawHill Publication Company Ltd.
5. Kumar,H.D. Modern Concepts of Biotechnology. Vikas Publishing House.
6. Mohapatra,P.K. 2010. Textbook of Environmental Biotechnology, I.K.International Pvt.Ltd.
7. Pelczar,M. 2001. Microbiology.
8. Pepper,I. and C.P.Gerba. 2004. Environmental Microbiology (2nd Edition). Academic Press
9. Power,C.B. & Daginawala,H.F. 1982. General Microbiology Volume I & II. Himalaya Publishing house, New Delhi.
10. Purohit,S.S. 2004. A text book of Microbiology. Student edition, Jodhpur.
11. Raina M.Maier. 2000. Environmental Microbiology, Academic Press.
12. Sharma,P.D. 1989, Microbiology Restegi& Company, Meerut.
13. Singh,R.P. & Kamal. 1989. An Introduction to Microbiology Central Book Depot, Allahabad

SEMESTER IV

CORE COURSE VI

EE1442 PAPER (2) BIOPHYSICS, BIOSTATISTICS AND COMPUTER APPLICATION

Total Hours 36

Aim:

To introduce students to the instruments used in Environmental research

Objectives:

- To introduce students to the principles and techniques of various instruments
- To give students the basics of biostatistics
- To make students understand the need of using principles of statistics in environmental research
- To make students capable of browsing the internet through relevant websites for statistical analysis

Course Outcomes:

At the end of the course, the student will be able to:

Sl No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO1	Articulate the importance of light and its measurements in environmental analysis	Un, Re
2.	CO2	Describe various instruments used in environmental analysis with their principles and application	Un, Re
3.	CO3	Perform statistical analysis of data provided	Re, Un
4.	CO4	Explain the significance of Redox Potential in environmental analysis	Re, Un
5.	CO5	Describe the use of internet and computer based tools for information and statistical analysis	Re, Un

Course Content:

Module I: Biophysics - Introduction: Importance of instruments in environmental anaysis

1 Hour

Module II: Effects of Light in environmental analysis: Beer Lambert's Law - Law, mathematical expression of the law, explanation on its application in environmental research; Absorption spectrum; Photochemistry – definition; fluorescence and phosphorescence - definition and principle; Photochemical reactions such as photosynthesis; Bioluminescence and photo degradation - definition

10 Hours

Module III: Redox potential - definition and significance in environmental research

1 Hour

Module IV: Instruments and techniques: Light microscopy - principle and application; electron microscopy - principle and application; spectrophotometry - principle, instrumentation and application; mass spectroscopy - principle, instrumentation and application; absorption spectroscopy - principle, instrumentation and application; X ray analytical methods - principle and application

10 Hours

Module V: Biostatistics: Significance of biostatistics in environmental studies, Population and sample – definitions; Sampling methods - probability/ random - simple random sampling, systematic sampling, stratified sampling multistage sampling, cluster sampling and non-random methods - convenience sampling, purposive sampling and quota sampling; Measures of dispersion - range, deviance and variation – definition with examples; Test of significance - chi square test, student t-test – definition with example and analysis of these using computer

12 Hours

Module VI: Internet: Basic idea on browsing websites for information and statistical analysis

2 Hours

References

1. David Burns (2016) An Introduction to Biophysics. Wentworth Press P. 456
2. Daniel M. (2012) Basic Biophysics for Biologists (I edn) Agrobios (India)
3. Veerakumari L. (2015) Bioinstrumentation (I edn) MJP Publishers; P. 578
4. Wayne W. Daniel and Chad L. Cross (2014) Biostatistics: Basic Concepts and Methodology for the Health Sciences (X edn) Wiley P. 954
5. Banerjee Pranab Kumar (2007) Introduction to Bio-Statistics (III edn) S Chand & Company P. 2018

6. Rao S (2012) Introduction to Biostatistics and Research Methods (V edn) PHI Learning Pvt. Ltd P. 280

7. James Gatenby (2001) Basic Internet Skills. Bernard Babani Publishing P. 160

SEMESTER IV

CORE COURSE PRACTICAL

EE1443 ENVIRONMENTAL SCIENCE LAB-IV

Total Hours: 36

1. Demonstration of Sterilisation by dry heat and wet heat (SteamAutoclaving)

2. Cultutre media preparation using PDA (Potato DextroseAgar)

3. Growth of E.Coli in liquid media.

4. Slides of specimens - Paramecium, Spirogyra, Pencillium, coliform bacteria

SEMESTER IV

VOCATIONAL COURSE V

EE1471 WATER QUALITY MANAGEMENT - I

Total hours: 72

Aim:

This course is designed to provide the proper understanding and hands on training on determining water quality and thereby achieving an ecological and chemical good status of all water bodies by means of sampling, laboratory analysis and management strategies. Preventing and controlling pollution of the water resources is a major challenge facing today. Over large parts of the world, rivers and lakes show increasing trends of water pollution.

Objectives:

- To find out the scientific guidelines that are safe limits of the physical, chemical, or biological characteristics of water and sediments which protect water for different uses.
- To reduce to control and prevent pollution
- To adopt cost effective and sustainable management practices to conserve water resources for the sustainable utilization.

Course Outcomes:

At the end of the course, the student will be able to:

SL No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Recognize the concept of water quality criteria and standards for different purposes	Re
2.	CO 2	Understand and apply the different sampling methodologies and collection equipment needed for water quality monitoring	Un
3.	CO 3	Develop the analytical ability to set up the experiments	An
4.	CO 4	Analyze the different conventional and specific water treatment processes	An
5.	CO 5	Design sound and sustainable water quality management practices under specified conditions	Cr
6.	CO 6	Apply any of these treatment strategies wherever necessary	Ap

Course Content:

Module I: Water Quality Requirement and Standards for various uses: Water quality Criteria and standards (WHO and BIS)-drinking, industrial, irrigation, aquaculture.

6 Hours

Module II: Water Quality Monitoring and Sampling: Water quality parameters, Sampling methods for streams, lakes, waste water and sediment (Grab and Composite samples) Sampling equipments: Niskin water sampler, Nansen water sampler, Dussart flask

12 Hours

Module III: Water treatment process: Conventional methods-sedimentation, coagulation, flocculation, filtration, disinfection. Chemical methods-UV rays, ionizing radiation (X-rays, gamma rays, and electron beams), iodine and bromine, ozone, potassium permanganate, silver and chlorine. Types of chlorination- Plain chlorination, Pre-chlorination, Post-chlorination, Break point chlorination, Super chlorination, De-chlorination

18 Hours

Module IV: Specific water treatment processes: Desalination. Reverse osmosis; electrodialysis; freezing method; multi flash evaporators. Water softening methods- Lime soda process, Ion-exchange process and Permutit process

12 Hours

Module V: Methods for removal of iron and manganese-oxidation/filtration, ion exchange method. Methods for removal of chromium- Chemical precipitation, adsorption and biosorption, reverse osmosis, ion exchange, Electrodialysis. Methods for Removal of dissolved gases from water – Degasification. Methods for removal of oil from water- Oil skimming. Methods for removal of Radio materials (Uranium, Radon, Polonium) from water

14 Hours

Module VI: Water quality management: Definition, Management and conservation of water resources, national and state level policies in water quality management- The National Water Policy, 2002, The Water (Prevention & Control of Pollution) Act, 1974, Water Cess Act, 1977, Environment (Protection) Act, 1986. Polluter Pays principle

10 Hours

References

1. Annanmaki, M. and Turtiainen, T. (Eds.). Treatment Techniques for Removing Natural Radionuclides from Drinking Water, STUK—Radiation and Nuclear Safety Authority, Finland.
2. https://inis.iaea.org/collection/NCLCollectionStore/_Public/32/018/32018426.pdf
3. APHA (1995). Standards methods for the examination of water and wastewater.19th Edition. American Public Health Association, Washington DC.
4. Arceivala, S.J. Asolekar, S.R. (2007): Wastewater Treatment for Pollution Control and Reuse, Tata McGraw Hill Publishing Company Ltd, New Delhi.
5. Gray, N.F. (2010). Water Technology: An Introduction for Environmental Scientists and Engineers, Butterworth-Heinemann, 3rd Edition
6. Hammer, M.J. and Jr. Hammer, M.J. (2012). Water and Waste Water Technology, Printice Hall India Pvt. Ltd.
7. Punmia, B.C., Jain, A.K. and Jain, A.K. (1995). Water Supply Engineering, Lakshmi Publications, New Delhi.

8. Trivedi, R.K., Goel, R.K. (1984) Chemical and Biological Methods of water pollution studies. Environmental publication, Karad.
9. Michael, P. Ecological Methods for field and Laboratory Investigation, Tata McGraw Hill publishing Company. New Delhi.
10. Saxena, M.M. (1998). Environmental Analysis: Air, Water and Soil. Agrobotanica, Bikaner, 184 p.

SEMESTER IV
VOCATIONAL PRACTICAL
EE1473 WATER MANAGEMENT LAB - IV

Total Hours: 36

1. Determination of BOD of a sample of water
2. Determination of COD of a water sample
3. Determination of TDS in a sample of water
4. Determination of Salinity in a sample of water
5. Determination of hardness of water

SEMESTER V

CORE COURSE VII

EE1541 PAPER (1) ENVIRONMENTAL GEOLOGY AND MINERALOGY

Total Hours: 72

Aim:

To make them learn the basic principles of geology and develop an understanding of the methods geologists use to study the Earth.

Objectives:

- Recognize the Earth as a unique, closed system and composition of earth.
- To make students understand the role of natural geologic processes operating on earth.
- To make students aware of the different rocks and minerals – the building block of earth.

Course Outcomes:

At the end of the course, the student will be able to:

Sl No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Define the scope of Environmental Geology	Re
2.	CO 2	Compare Exogenous and Endogenous processes	Un
3.	CO 3	Explain Pedogenesis and soil profiles	Un
4.	CO 4	Explain the geological processes operating on earth	An
5.	CO 5	Analysing minerals and rocks-the building block of earth	An

Course Content:

Module I Introduction to Environmental Geology: Definition and scope; Origin and Evolution of Earth- Current views on origin of earth, Geological Time Scale; Plate Tectonics – Sea floor spreading and continental drift; Forces acting on the surface of the Earth – Tectonic and Diastrophic forces.

14 hours

Module II: Processes on Earth: Exogenous (weathering, erosion, transportation, and sedimentation) and endogenous (folding, faulting and volcanism) processes operating on earth. Study of the interior of earth: Crust, mantle and core; Earth's Surface Process- Weathering of rocks – physical, chemical and biological weathering; erosion, transportation, and deposition.

14 hours

Module III: Pedogenesis: Factors affecting soil formation, factors controlling formation of soil; soil profiles

6 hours

Module IV: Geological agents: Erosion, transportation and deposition of earth's materials by water, wind and glaciers; River as a geological agent - development of river; meandering of river; drainage pattern; drainage basin; energy in streams; Rivers in India; Glaciers - Types and geological activity, Glaciers as an index of climate change.

12 hours

Module V: Minerals: Definition of mineral; Physical properties of minerals such as colour, streak, luster, hardness and specific gravity. Composition and diagnostic properties of important rock forming minerals - quartz, feldspar, calcite, biotite

12 hours

Module VI: Rocks: Petrology- Igneous, Sedimentary and Metamorphic rocks; Igneous Petrology - Brief overview of formation, structures and classification of igneous rocks. Megascopic features of Granite, Syenite, Gabbro and Basalt; Sedimentary Petrology - Brief overview of formation, structures and characteristics of sedimentary rocks. Megascopic features of Sandstone, Limestone, Shale, Breccia, Conglomerate; Metamorphic Petrology – Origin and formation of metamorphic rocks. Megascopic features of Marble, Gneiss and Schist.

14 hours

References

1. Carla Montgomery (2020). Environmental Geology (11th Edition). Mc Graw Hill. ISBN13: 9780078022951.
2. Edward. A. Keller. 2018. Introduction to Environmental Geology (5th ed.). Pearson India. 792p.
3. Jim Reichard (2020). Environmental Geology (4th Edition). Mc Graw Hill. ISBN13: 9781260368277
4. LaMoreaux James. (2019). Environmental Geology. (1st edition). springer. p 472. Print ISBN: 978-1-4939-8786-3
5. Steven Eark. 2019. Physical geology. Press Books.
6. Duggal K. N. and J. P. Soni, (1996). Elements of water resource engineering; New Age International Publisher.
7. Read, H. H. Rutley's Elements of Mineralogy. John Wiley and Sons, New York.
8. Reghunath, H.M. (1996). Hydrology – Principles, analysis and design, New Age international publisher.
9. Singh V.P (1994). Elementary Hydrology, Prentice – Hall of India.
10. Strahler, A. N. and Strahler, A.H. (1987). Physical Geography, John Wiley and Sons, New York.
11. Todd, D. K. and L.W. Mays (2005). Ground Water Hydrology, 3rd Edn. Wiley Inc.
12. Tyrell, G. W. (1978). Principles of Petrology. Chapman & Hall Ltd.
13. Mukergee,P.K, 1986. A text book of Geology.
14. Parbin Singh, S.K.Katariah & sons Engineering & General Geology, Gurunank market, New Delhi.

SEMESTER V

CORE COURSE VIII

EE1542 PAPER (2) DISASTER MANAGEMENT

Total Hours: 72

Aim:

The aim of this elective course is to improve the scientific knowledge among students about various natural and man- made disasters through the teaching of policies, programs, administrative actions and operations undertaken. This will train them to cope with the different disaster management activities like preparedness, prevention and thereby to reduce or avoid the human, physical, and economic losses suffered by individuals, by the society, and by the country at large. Also train them to reduce their personal sufferings in connection with a disaster.

Objectives:

- To make students understand the concept of disaster, perception and management of various natural disasters like flood, earthquake, landslide, cyclone, coastal erosion etc.
- To make students know the role of Remote Sensing and GIS in disaster management etc.

Course Outcomes:

At the end of the course, the student will be able to:

Sl No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Understand the basic aspects of disaster	Un
2.	CO 2	Analyse the components in disaster management cycle	An
3.	CO 3	Identify the sectors in disaster management	Un
4.	CO 4	Understand the different types of natural disasters	Un
5.	CO 5	Understand the different types of anthropogenic disasters	An

Course Content:

Module I: Basic concept of disaster: Definition of hazard, vulnerability, risk, disaster.

Causative factors of disaster; Classification of disasters

8 Hours

Module II: Disaster management: Definition, components of disaster management cycle -crisis management & risk management. Crisis management- quick response and relief, recovery, rehabilitation; Risk management- risk identification, risk assessment, risk reduction in vulnerable areas – Preparedness, prevention, mitigation; Risk transfer.

15 Hours

Module III: **Important sectors in disaster management:** Health & Medical care; Communication, Insurance, Social work, NGO's, Media, Fire service, Police and Armed forces, parliamentary service

15 Hours

Module IV: Natural disasters: flood, drought, landslide, earthquake, cyclone, tsunami - causes, perception, mitigation, and management.

12 Hours

Module V: Man-made disasters: fire, industrial pollution, biological disaster, structural failure (building & Bridges), accidents (Road, rail & Water), dams

12 Hours

Module VI: Policies: Disaster management related Acts and Policies in India.

10 Hours

References

1. Gupta and Harsh, K. 2003. Disaster Management, Universities Press (India) Pvt. Ltd..
2. Janki Andharia (2020). Disaster Studies. Springer Singapore. p462. Hardcover ISBN 978-981-329-338-0
3. Jha and Kumar, M. 2010. Natural and Anthropogenic Disasters; Vulnerability, Preparedness and Mitigation, Springer.
4. Peijun Shi (2019). Disaster Risk Science. Springer Singapore. P 753. ISBN 978-981-13-6691-8
5. Singh, K .K .&. Singh, A .K. 2010. Natural and manmade disasters: vulnerability, preparedness and mitigation, Vol(1&2), M.D. publications. Pvt. Ltd. New Delhi.
6. Strahler, A.N. and Strahler, A.H. 1973. Environmental Geoscience – Interaction between natural systems and man: -Santa Barbara, California, Hamilton Publishing.
7. Talwar, A.K. &Juneja, S. 2009. Flood Disaster Management, Commonwealth publishers, New Delhi.

SEMESTER V

CORE COURSE PRACTICAL

EE1543 ENVIRONMENTAL SCIENCE LAB-V

Total Hours: 90

1. Identification of common minerals & rocks
2. Identification of soil types - red soil, alluvial soil, black soil
3. Identification of soil texture
4. Determination of soil moisture content
5. Determination of soil pH
6. Determination of conductivity.
7. Estimation of organic carbon of soil
8. Bulk density of soil
9. Soil organic matter
10. Particle density of soil
11. Soil nutrient analysis
12. Preparation of Disaster Management Plan for Flood/ Earth quake/
13. Preparation of Disaster Management Plan for Health disaster

SEMESTER V

VOCATIONAL COURSE VI

EE1571 PAPER (1) WATER POLLUTION

Total Hours: 54 Hours

Aim:

To develop basic understanding on the different sources of water pollution and its harmful effects

Objectives:

- To impart knowledge on the water quality standards, physical, chemical and bacteriological test methods
- To understand the factors responsible for surface water, marine water pollution and organic pollution.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Will be able to describe the sources influencing water pollution and common impurities in water	Re
2.	CO 2	To understand and analyze the physical, chemical, bacteriological testing methods, water quality standards and water borne diseases	Un, An
3.	CO 3	Will be able to explain the riverine, estuarine, marine water pollution and the extent of plastic pollution	Un
4.	CO 4	Can develop knowledge on identifying the sources and type of organic pollution	Un
5.	CO 5	To understand the role of microorganisms in cleaning up and purification of water	Un

Course Contents:

Module I: **Water pollution**: General properties of water; Brief history of water pollution; Sources of water pollution; Physical pollution of water; Chemical pollution of water; Biological pollution of water.

9 Hours

Module II: **Water impurities:** Common impurities in water; testing of water; physical test; chemical test; bacteriological test.

9 Hours

Module III: Water quality: Standards of drinking water; Maintenance of purity of water; Ground water pollution, factors affecting ground water pollution, harmful effects of ground water pollution; Water borne diseases, Bio monitoring of water pollution

9 Hours

Module IV: Surface water pollution: Sources of surface water pollution; Factors affecting surface water pollution - factors affecting nutrient loss in surface water – Monitoring and control of pollution in lakes, rivers and estuaries.

9 Hours

Module V: **Sea water pollution**: Global sea water pollution - Control of pollution in seawater; role of microorganisms in cleanup operation; current scenario of plastic pollution in marine water.

9 Hours

Module VI: **Organic pollution:** Organic pollutants - synthetic detergents; eco-friendly detergents containing enzymes; eutrophication, oceanic acidification, radionuclide pollution, thermal pollution in water; pesticide pollutants. Techniques for treatment of biological wastes

9 Hours

References

1. B K Sharma, Water pollution. Goel publishing House, Meerut.
2. B C Punmia, Ashok Jain and Arun Jain, Water supply Engineering. Lakshmi Publications, New Delhi
3. P K Goel, 2006. Water pollution: Causes, Effects and Control, New age International Publishers, New Delhi
4. Anupam Rajak, 2019. Micro plastic pollution. Published by Notion Press, Chennai

SEMESTER V
VOCATIONAL COURSE VII
EE1572 PAPER (2) WATER QUALITY MANAGEMENT-II

Total Hours: 54

Aim:

The course aims to impart basic knowledge of waste water treatment process among the students and to equip the students with the skills on the management of waste water generated in industries.

Objectives:

- To give students an overview of the characteristics of waste water, waste water treatment process, disposal methods of sewage and sludge
- To make students understand sophisticated methods adopted in industries.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Understand the basic concepts of waste	Un

		water and sewerage systems	
2.	CO 2	Articulate fundamental concepts in waste water treatment process	Un
3.	CO 3	Apply concepts and design the waste water treatment methods in industries	Ap
4.	CO 4	Know the basic principles of sewage and sludge disposal methods	Un
5.	CO 5	Develop a capacity for decision making on the management of waste generated in industries	Ap

Course Content:

Module I: Waste water or sewage: Definition, nature, sources. Types- grey water, black water, yellow water, brown water. Physical, chemical and biological properties of waste water

4 Hours

Module II: Sewage characteristics: types-domestic sewage, industrial sewage, storm sewage. Major pollutants in sewage- organic material, suspended solids, plant nutrients, microbes. Sewerage systems

2 Hours

Module III: Waste water treatment: Primary treatment - screening, skimming, grit chamber, coagulation and flocculation, filtration and sedimentation tank methods. Secondary treatment -activated sludge, trickling filters, oxidation ponds. Advanced treatment: Removal of nitrogen and phosphorous from waste water. Disinfection by chlorination

12 Hours

Module IV: Natural methods of sewage disposal: Dilution method, Sewage farming method: Sanitary water management - sanitary waste, definition, Systems of sewage disposal: Dry conservancy system & water carriage system

9 Hours

Module V: Treatment and disposal of sludge: thickening and digestion, conditioning and dewatering, incineration, anaerobic digestion, drying beds, Rotary drum filters, land filling.

9 Hours

Module VI: Characteristics and treatment of industrial waste water: breweries and wineries; distilleries; paper and pulp mill; sugar mill; oil refineries, Petrochemical industries; tanneries; pharmaceutical plants; fertilizer plant; electroplating industries; textile mills.

18 Hours

References

1. Abbasi, S.A. 1998. Environmental Pollution and its Control, Cogent International, Pondicherry.
2. Basak, N.N. (2014). Environmental Engineering, Tata Mc Graw Hill publishing company.
3. Garg, S.K. (2017). Water Supply Engineering: Environmental Engineering - Vol. I. Khanna Publishers.
4. Gray, N.F. (2010). Water Technology: An Introduction for Environmental Scientists and Engineers, Butterworth-Heinemann, 3rd Edition.
5. Mahajan, S.P. (1985). Pollution Control in Process Industries, Tata McGraw-Hill Education.

SEMESTER V

VOCATIONAL PRACTICAL

EE1573 WATER MANAGEMENT LAB - V

Total Hours: 72

1. Determination of chlorine demand a sample of water
2. Determination of residual chlorine in a municipal water sample
3. Determination of moisture percentage of soil
4. Determination of PH of soil

5. GRAVIMETRIC ESTIMATION OF

a) Sulphate, oxalate

b) Barium, calcium, iron, nickel

6. Colorimetry and turbidimetry

a) Sulphide

b) Fluoride

c) Silicate

d) Ammonia

e) Sulphate

SEMESTER V

OPEN COURSE

EE1551 SOLID WASTE MANAGEMENT

Total Hours: 36

Aim:

To make students understand the concept of Solid Waste, its composition and the problems associated and the management aspects of solid wastes and plastic wastes

Objectives:

- To introduce students to the concept and composition of solid wastes
- To make students aware of the activities creating solid wastes
- To make students understand the problems caused by hazardous wastes
- To introduce students the various management techniques of solid waste in general and plastic waste in particular

Course Outcomes:

At the end of the course, the student will be able to:

Sl.No.	Course Outcome No.	Course outcome (CO)	Taxonomic Level (TL)
1.	CO-1	Define and identify the different types of solid wastes	Re
2.	CO-2	Describe the solid waste management methods	Re
3	CO-3	Explain the management of agricultural wastes	Un
4	CO-4	Outline the types of hazardous solid wastes	Re
5	CO-5	List the waste management policies	Re
6	CO-6	Explain the functioning of sanitary landfill	Re

Course Content:

Module I: Introduction: Solid wastes and its characteristics; classification of solid waste – source; factors affecting quality & quantity. Physical and chemical characteristics - collection & transportation

4 Hours

Module II: Composition: The changing nature, quantity, composition of solid wastes in urban and rural areas of India and World. (Households, Institutions, markets, Recreational places and Parks, Corporate and Business Centers, Religious Institutions, Hotels)

4 Hours

Module III: Agricultural wastes: types and sources. Disposal techniques - composting; principles of composting; factors affecting composting; Types of composting - Windrow layout

6 Hours

Module IV: Hazardous wastes: Definition, source and characteristics; Management of medical and hospital wastes, Nuclear and radioactive wastes – classification, sources and disposal; e-waste and their management

8 Hours

Module V: Management of plastic wastes: Reuse and recycling; Waste management policies; Energy recovery from solid wastes

6 Hours

Module VI: Solid waste management: source reduction - Reuse and Recycling; sanitary landfill - advantages and disadvantages of sanitary landfill. Methods of landfill - Incineration - types of incinerators - reactions involved - advantages and disadvantages of incineration.

8 Hours

References

1. Agarwal,S.K. 2005. Green Management, APH Publishing corporation, New Delhi.
2. Agarwal,S.K. 2005. Wealth from waste, APH Publishing corporation, New Delhi
3. Bhatia,S.C. 2007. Solid and Hazardous Waste Management. Atlantic Publishers and Distributors, New Delhi
4. Bide,A.D. and R.R.Sundaresan. 2001. Solid Waste Management: Collection, processing and disposal. INSDOC, New Delhi
5. Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, 2000.2. Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001
6. George Techobanoglous et al.1993. Integrated Solid Waste Management, McGraw-Hill, 1993

7. Khan,M.K. 2004. Hospital waste Management: Principles and guidelines, Kanishka Publishers, New Delhi
8. Liu,D.H.F. and R.G.Liptak. 2000. Hazardous waste and solid waste. Lewis
9. Metcalf and Eddy. 1991. Waste Water Engineering – Treatment, Disposal and Reuse. McGraw Hill International Edition, New York.
10. Manser A.G.R. and Keeling A.A.," Practical Handbook of Processing and Recycling of Municipal solid Wastes", Lewis Publishers, CRC Press, 1996

On-line Sources

1. https://www.epa.gov/hw/hazardous-waste-recycling
2. https://www.journals.elsevier.com/waste-management
3. https://www.wm.com/us

SEMESTER - VI

CORE COURSE IX

EE1641 PAPER (1) ENVIRONMENTAL POLLUTION AND CONTROL MEASURES - I

Total Hours: 54

Aim:

To introduce students to the pollution issues related to air

Objectives:

- To understand the structure of atmosphere
- To understand the various sources of air pollution and to understand the need of control of air pollution
- To introduce students to hazardous wastes and the problems associated with it
- To give students a basic knowledge regarding the air quality standards.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Explain the structure of atmosphere with the features of each layer	Un, Re
2.	CO 2	Describe the quality parameters of air and	Un, Re

		air pollution with the various units for its measurements	
3.	CO 3	Explain the sources and effects of air pollution	Re, Un
4.	CO 4	Articulate the control techniques of various kinds of air pollution	Re, Un
5.	CO 5	Explain Hazardous waste and its management strategies	Re, Un

Course Content:

Module I: Atmosphere: Structure of atmosphere - troposphere, stratosphere, mesosphere and thermosphere – the features of these layers; the natural composition of air; air quality standards

6 Hours

Module II: Air pollution: Definition, units for quantification of air pollution - Micrograms per cubic meter ($\mu g/mm^3$), parts per million (ppm), parts per billion (ppb), newly introduced units of air pollution - olf and decipol; classification of air pollutants – according to origin, according to states of matter and sources - primary and secondary pollutants, photochemical smog; gaseous and particulate pollutants; according to sources – natural and manmade, case study of air pollution – Bhopal tragedy

10 Hours

Module III: Sources of Air pollution – automobile exhausts: emission standards of automobiles in India - CO_x, NO_x and SO_x; Specific emission standards such as Bharat stages – definition, BS I, BS II and BS III; air pollution from factories: hydrocarbons, polychlorinated hydrocarbons; Indoor air pollutants – definition and sources

10 Hours

Module IV: Effects of Air pollutants: Effect of particulate pollution and different gaseous pollutant on plants, human beings and materials

6 Hours

Module V: Control of Air pollution: control of pollution from factories - different methods of emission control - using impingers, electrostatic precipitators, bag houses and wet scrubbers; control of gaseous pollutants control of pollution from automobiles

12 Hours

Module VI: Hazardous wastes: definition and classification; sources and generation of hazardous wastes; health effects and environmental impacts of hazardous wastes; management of hazardous wastes - overview of: the

hazardous Wastes - Management, Handling and Trans-boundary Movement Rules, 2008 and amendment in 2009

10 Hours

References

1. Handbook Airborne Particulate Matter Pollution Prevention and Control, World Bank Group https://www.ifc.org/
2. Gopal Dutt N.H. (2016). Environmental Pollution and control (I edn) Neelkamal Publication. P 302.
3. Vincent King (2017). Air Pollution: Causes, Impacts and Control, Larsen and Keller Education, p. 240
4. Prabhakar V.K. (2004) Pollution Monitoring and Control Hardcover, Anmol Publisher p. 280
5. Cliff VanGuilder (2011). Hazardous Waste Management: An Introduction. Mercury Learning & Information; Har/Cdr edition, p. 300
6. E-Waste Rules http://cpcb.nic.in/e-waste-rules/

SEMESTER VI

CORE COURSE X

EE1642 PAPER (2) ENVIRONMENTAL POLLUTION AND CONTROL MEASURES II

Total Hours: 36

Aim:

The course aims to give the students an insight on the major environmental pollution problems and to acquire knowledge on the sources of different types of pollution and its impacts.

Objectives:

- To understand the main causes of aquatic and noise pollution, their harmful effects.
- To equip the students with the methods of control of different types of pollution.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level

1.	CO 1	Articulate the water quality for aquatic life and the classification of industrial wastes	Un, Re
2.	CO 2	Explain the sources of soil pollution and details of pesticide pollution. Also how to control soil pollution	Un, Re
3.	CO 3	Describe the sources of noise and effect of noise pollution on human health	Re, Un
4.	CO 4	Explain on the details of types of radiations, sources of radioactive pollution, radioactive wastes and effects of radiation pollution	Re, Un
5.	CO 5	Describe thermal pollution and effects on aquatic organisms	Re, Un

Course Content:

Module I: Introduction on water pollution: Physical and chemical parameters of water pollution - standards of aquatic life. Classification of industrial wastes and its characteristics

6 Hours

Module II: Sources of Land and soil pollution: Disposal of different types of wastes on land; pesticides pollution- control of soil pollution.

6 Hours

Module III: Noise pollution: definition; measurement - decibels; effect of noise pollution on people; traffic noise pollution; industrial noise pollution. Railway noise; aircraft noise; reduction of noise; absorption of sound; Control of noise pollution

6 Hours

Module IV: Radioactive pollution: Sources of radiation; nuclear reactions; natural sources of radioactive pollution; anthropogenic sources of radiation. Radioactive waste; biological effects of radiation pollution; dangers from nuclear plants

6 Hours

Module V: Control of radiation pollution: methods of control; minimizing X-ray hazard - Hazards of Radioactive pollution - Preventive measures from radiation.

6 Hours

Module VI: Thermal Pollution: sources, effects on aquatic organisms, methods to control thermal pollution

6 Hours

References

1. A Text book on Environmental Pollution and Control. Dr .H S. Bhatia. Galgotia Publications Pvt. Ltd., Delhi.
2. Industrial Pollution. V.P.Kudesia-PragatiPrakashan, Meerut.
3. Air Pollution. V.P.Kudesia, PragathiPrakasan Meerut.
4. Water Pollution. Sharma, B.K., Goel Publishing House, Meerut.
5. Manahan S.E., Environmental Chemistry, Lewis, 1994.

SEMESTER VI

CORE COURSE PRACTICAL

EE1643 ENVIRONEMTAL SCIENCE LAB- VI

Total Hours: 72

Instrumentation (demonstration only)

1. pH meter
2. Conductivity meter
3. Turbidity meter
4. Colorimeter
5. Spectrophotometer

Experiments

1. Determination of COD
2. Analysis of anion mixture solution (2Anions) among the following – Carbonate, sulphide, Thiosulphate, Oxalate, Chloride, Nitrate, Flouride, Sulphate, Phosphate
3. Thin layer Chromatographic separation of plant pigments

SEMESTER VI

VOCATIONAL COURSE VIII

EE1671 PAPER (1) WATER ANALYSIS

Total hours: 54

Aim:

The course aims to impart basics and practical knowledge of water analysis.

Objectives:

- To enable the students to identify, describe, and compare core themes, principles and gain hands on practical experience of the subject.
- To make the students able to analyse different water samples at the end of the course.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Define Water Analysis	Re
2.	CO 2	List out the major Water Quality Parameters	Re
3.	CO 3	Explain Protocols for Water Quality testing	Un
4.	CO 4	Differentiate Methods of Analysis for each parameter tested	An
5.	CO 5	Compare different methods of Water Quality Analysis	Ev

Course Content:

Module I: Various methods of analysis: Monitoring techniques and methodology ; Determination of pH – Specific Conductance-Dissolved Oxygen, NH_3, NO_3, NO_2, Cl^-, F^-, CN^-, S^{2-}, SO_4^{2-}, PO_4^{3-}; Method to determine the pH of given sample of water by colorimetric and electrometric method; Total hardness (Ca& Mg), B, silica, metals and metalloids As, Se, Be, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ag, Zn

9 Hours

Module II: Analysis of water: Method to determine the amount of dissolved oxygen (DO) of a water sample by Winkler Method. Chemical Oxygen Demand, Biological Oxygen Demand, Total Organic carbon, phenols, pesticides, surfactants, tannin and lignin

9 Hours

Module III: Analysis of Physical qualities of water sample: Determination of Turbidity of water sample - By Jacksons Turbidimeter, Baylis Turbidimeter and Nephelometer. Method to find the odour of given water sample; Method to find the colour of given water sample; Method to find out the Suspended solids (SS), Dissolved solids (DS) and Total Solids (TS) of a water sample

9 Hours

Module IV: Analysis of cations of water sample: Method to find the carbonate, bicarbonate and hydroxide alkalinity of a water sample. Method to determine the total hardness of a water sample by standard EDTA method

9 Hours

Module V: Method to determine the concentration of chlorides of given water sample; Method to determine the chlorine demand of a water sample; Method to determine the available chlorine percentage in a given sample of bleaching powder; Determination of residual chlorine in a given sample of water by (a) Orthotoludine Test (b) Starch Iodide Test (c) DPD Test

9 Hours

Module VI: Microbial examination of water samples: Coliforms (*Escherichia coli*) and total bacteria

9 Hours

References

1. Water supply Engineering B.C.Punmia, Asok Jain & Arun Jain. Lakshmi Publications, New Delhi.
2. Water and Waste Water Technology, Mark.J.Hammer. J Hammer, Printice Hall India Pvt. Ltd.
3. Waste Water Treatment for Pollution Control and Reuse, Tata Mac Graw Hill publishing company.
4. Water Technology, N.F Gray Butter Worth, Heimann Oxford.
5. Chemical and Biological Methods of water pollution studies. R.K. Trivedi & R. K. Goel Environmental publication, Karad 1984.
6. Standard Methods for Examination of Water and Waste Water. APHA-Washington DC1985.
7. Ecological Methods for field and Laboratory Investigation, P.Michael. Tata Macgraw Hill publishing Company. New Delhi.

SEMESTER VI

VOCATIONAL COURSE IX

EE1672 PAPER (2) WATERSHED MANAGEMENT

Total Hours: 54

Aim:

The aim of the course is to introduce the students to the concept of Watershed Management by generating a basic understanding of its principles, components and socio-economic aspects. It also enables a student to analyse and appreciate the significance of WM in the conservation of land , water and soil resources.

Objectives:

- To introduce students to the basc concepts of watershed and its management
- To establish a strong understanding of the resource components in a watershed and their significance
- To make them understand the inter relationship between the components and their impact on human socio-economy
- To introduce the technology of integrated and sustainable methods of watershed management aimed at ecosystem restoration.
- To familiarize students with the introductory concepts of watershed modelling
- To make students understand the need for a holistic approach in WM and generate a general awareness on the watershed management policies in India.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Define and Deduce the concepts and components of watershed & its management	Re
2.	CO 2	Understand the significance of land, water and soil as watershed resources	Un
3.	CO 3	Rationalize the socio-economic aspects of watershed management	Un
4.	CO 4	Comprehend the integrated and sustainable technologies for WM	Un
5.	CO 5	Outline the modelling aspects and the policies associated therein	An

Course Content:

Module I: Basic concepts of watershed management (WM): Watershed – definition - classification of watershed - sub, milli, micro and mini watershed. Basic watershed hydrology, delineation of watershed boundary.

9 Hours

Module II: Water as a resource in WM: - Watershed management for flood control, Water harvesting cum sediment detention tanks, earthen bunds, subsurface dams, Geo textiles in watershed management.

9 Hours

Module III: Land as a resource in WM: Land preparation-timely planting. Contour farming-multistoried cropping-mixed cropping-Intercropping- strip cropping; mulching-cover cropping- crop rotation, Land use changes and resource degradation in watersheds

9 Hours

Module IV: Soil as a resource in WM: Soil conservation, Vegetative hedges - barrier grass land management - agroforestery. Engineering measures - tank -vented cross bars and diversion weirs; stone pitched Contour bunds, contour trenches and embankments of drains.

9 Hours

Module V: Socio-economic aspects of WM: Agronomic measures for resource management in a watershed - choice of vegetation, Resource degradation in a watershed and its socio-economic mpact, WM and public health. Watershed Modelling**-**Introduction and concepts, An overview of watershed management policies in India

9 Hours

Module VI: Integrated and Sustainable Approaches in WM: Definition and principles Integrated water resources management, national water grid and river networking; Integrated attempts for watershed management in India. Ecosystem Restoration - Definition and guiding principles, Watershed ecology, Eco system in a watershed.

9 Hours

References

1. Allam, Gamal Ibrahim Y., Decision Support System for Integrated Watershed Management,Colorado State University, 1994.
2. American Socy. of Civil Engr., Watershed Management, American Soc. of Civil Engineers, New York, 1975.
3. Black Peter E., Watershed Hydrology, Prentice Hall, London, 1991.
4. Michael A.M., Irrigation Engineering, Vikas Publishing House, 1992.
5. Murty, J.V.S. “Watershed Management”, New Age Intl., New Delhi 1998.
6. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994 .
7. Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad, 1995.
8. Vir Singh, Raj , Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.

SEMESTER VI

VOCATIONAL PRACTICAL

EE1673 WATER MANAGEMENT LAB - VI

Total hours: 72

1. Volumetric Estimations
    a) Carbonate hardness-Hehner’s method
    b) Non- Carbonate hardness- Hehner’s method
    c) Mixture of Carbonate-Bi carbonate-warders method (N/20 HCL & std. sodium carbonate (2600 ppm)
    d) Sulphate ion in H2 SO4 (N/20 NaOH & std sodium carbonate (2600 ppm)
    e) Iodine in the solution (N/50 thiosulphate & std pot. dichromate (1000 ppm)
    f) Estimation of Ferrous iron (N/50 potassium permanganate and standard oxalic acid 1200ppm)
    g) Estimation of ferrous iron (N/50 potassium dichromate & standard Mohrs salt)
    h) Iodometric estimation of copper (demonstration only)
    i) Complexometric estimation of Zn (demonstration only)
2. Colorimetric estimations of
    i) Nitrite
    ii) Nitrate
    iii) Phosphate
    iv) total nitrogen
    v) total phosphorous
    vi) ferrous iron and total iron

SEMESTER VI

ELECTIVE COURSE

EE1661.1 RAIN WATER HARVESTING

Total Hours: 36

Aim:

To give a detailed knowledge on Rainwater harvesting systems and water recharge methods for sustainable development.

Objectives:

- To understand the basic principles and structure of rainwater harvesting systems.
- The course explains the direct and indirect methods for artificial recharge, importance of watershed management and legal provisions in rain water harvesting.

Course Outcomes:

At the end of the course, the student will be able to:

Sl.No.	Course Outcome No.	Course outcome (CO)	Taxonomic Level (TL)
1.	CO 1	Understand the principles of water harvesting and familiarize traditional water harvesting systems	Re
2.	CO 2	Know the importance and significance of Rainwater harvesting	Re
3.	CO 3	Develop an ability for problem solving skills to solve water scarcity issues	Un
4.	CO 4	Understand the legal aspects of rain water harvesting systems	Re
5.	CO 5	Apply the methods of water harvesting and conservation for sustainable development	Re

Course Content:

Module I: Principles of water harvesting and conservation: Traditional water harvesting systems in India and Kerala.

4 Hours

Module II: Introduction to Rainwater harvesting: Definition, purpose, importance and advantages. Rainwater harvesting process, collection and storage; Basic components in Rainwater harvesting - catchments, coarse

mesh, gutters, conduits, first flushing, filters and storage tank; Hydrological aspects of Rainwater harvesting.

7 Hours

Module III: Rainwater harvesting methodologies: surface runoff harvesting and roof top rain water harvesting. Concept of roof top rain water harvesting; Methods of Rooftop Rainwater Harvesting- Storage of Direct Use and Recharging groundwater aquifers-by Recharging of bore wells, Recharging of dug wells, Recharge pits, Recharge Trenches, Recharge Shafts, Percolation Tanks.

7 Hours

Module IV: Artificial recharge methods: Direct methods - Ditch and Furrows method, Bench Terracing, Contour Bunds, Contour Trenches, Gully Plugs, Nalah Bunds and Check Dams, Percolation Tanks Injection Wells or Recharge Wells, Recharge Pits and Shaft; Indirect method-induced recharge.

7 Hours

Module V: RWH methodologies: methods for rural, urban and industrial environment; Rain water harvesting for sustainable development, concept of zero run off; Applications of Rainwater harvesting with case studies, water quality of harvested rain water; The importance of watershed management in Kerala.

6 Hours

Module VI: Legal provisions in rain water harvesting in India and Kerala. Kerala Municipality Building Rules, 1999, Kerala Municipality Building (Amendment) Rules, 2004

5 Hours

References

1. Basu, M. and Xavier, S.(2016). Fundamental of environmental studies, Cambridge University Press, New Delhi
2. CGWB (2007). Manual on Artificial Recharge of Ground water. http://cgwb.gov.in/Documents/Manual-Artificial-Recharge.pdf.
3. Chatterjee, S.N. (2008). Water Resources, Conservation and Management. Atlantic Publishers, Edition edition.
4. Er. Kollegal and Meghashyam, K. (2014.). Rain Water Harvesting : A New Concept to Utilize Rainwater and Secure the Future. Published by J.M. Jaina & Brothers; 1St Edition edition.
5. Kumar, S.V. (2013). Rainwater Harvesting. LAP Lambert Academic Publishing.

6. Rooftop rain water harvesting arrangements in Kerala - Municipality Building (Amendment) Rules (2004)
7. Singh, D.K. (2012). Rain Water Harvesting. Oxford Book Company.

SEMESTER V& VI
EE 1644 PROJECT& FACTORY VISIT
AN INVESTIGATORY PROJECT REPORT

Total hour: 72

This work may be based on Environmental Science (significance for Environment) or, project based on Water quality parameters (Local, Regional, state level, or National level important issues can be the topic of interest) –To be carried out in 3rd year (Semester 5&6)

SEMESTER-V

ENVIRONMENTAL STUDIES AND PHYTOGEOGRAPHY

Course code: BO 1542 Number of Credits : 4

Number of contact hours : Lecture: 90 hrs; Practical: 36 hrs; Total: 126 hrs

Distribution of Hours	Theory	Practical
Environmental Studies	72 hrs	36 hrs
Disaster Management	09 hrs	00 hrs
Phytogeography	09 hrs	00 hrs
Total	90 hrs	36 hrs

Aim of the course: To inculcate environmental awareness among students for protecting the Nature.

Objectives:

1. To create awareness about ecosystem and Natural resources.
2. To generate knowledge about importance of Biodiversity conservation
3. To understand the need to mitigate pollution and strategies for disaster management
4. To impart knowledge about phytogeographical regions

MODULE-I

Natural resources and its conservation **12hrs**

5. Natural Resources - Renewable and Non-renewable - Land & Soil, Water, Energy, Minerals, Food and agriculture, Forests, Plants & Wild life resources. Degradation of natural resources - Land degradation, degradation of water resources, Loss of flora and fauna; Causes – population explosion, over exploitation, deforestation, agriculture mismanagement, desertification, overgrazing, soil erosion, mining, urbanization and industrialization- change in land use, depletion of water resources.
6. Conservation of Natural resources and sustainable life styles.
   Land and soil- Afforestation, regeneration of wasteland
   Water - Rain water harvesting, ground water dams
   Energy - Promoting use of renewable resources-solar, tidal and wind; biodiesel, biofuels.
   Forests- Reforestation, Community forestry programmes

MODULE- II

Ecosystems **22 hr**

1. Ecosystems - Concept, definition, structure and function; components- biotic and abiotic; energy flow
2. Food chains -Food web & ecological Pyramids, biogeochemical cycles - Carbon and Phosphorous cycle
3. Ecological succession-Definition, primary and secondary succession, climax

concept, hydrosere and xerosere.

4. Plant adaptations- Morphological, anatomical& physiological adaptations of – Hydrophytes, Xerophytes, Halophytes, Epiphytes, Parasites
5. Introduction- types, characteristic features, structure and functions of the following ecosystems.
6. Forest ecosystem, 2. Grassland ecosystem, 3. Desert ecosystem, 4. Aquatic ecosystems- Ponds, Streams, Rivers, Oceans, Estuaries (brief account only)

MODULE-III

Biodiversity and its conservation **18hrs**

1. Introduction, Definition- genetic, species and ecosystem diversity; biodiversity index (Shannon index)
2. Hot-spots of biodiversity; India as mega-diversity nation.
3. Threats to biodiversity: land use changes & habitat destruction, poaching of wild life- hunting & export, Overuse of pesticides, invasive species.
4. IUCN, Red data Book; Extinct and Threatened species- endangered & Rare; Endemic species of Western Ghats.
5. Conservation of biodiversity: In-situ (National parks and Wild life sanctuaries) and Ex-situ conservation (botanical gardens); Biosphere Reserves & World Heritage Sites in India-Ramsar sites, Chilka lake.
6. Global initiatives in biodiversity conservation- Stockholm Conference, Montreal Protocol, Convention on Biological diversity Regional initiatives- Chipko movement, National Biodiversity Authority (NBA), Access and Benefit sharing (ABS),A brief account on conservation efforts in Kerala- Kerala State Biodiversity Board (KSBB), People Biodiversity Register.

MODULE-IV

Environmental pollution **20hrs**

1. Definition, causes, effects and control measures of – 1. Air pollution, 2. Water pollution, 3. Soil pollution, 4. Marine pollution, 5. Noise pollution, 6. Thermal pollution.
2. Solid Waste Management- waste minimization, Recycling and Reuse, Consuming environment friendly products. E-waste management.
3. Environmental Legislations - Environment protection Act (1986); Air [prevention and control of pollution] Act (1981; Amended 1987); Water [prevention and control of pollution] Act (1974; Amended 1988); Wildlife Protection Act (1972); Forest conservation Act (1980). (Scope and relevance only)
4. Environmental Organisations –UNEP, IPCC, WWF, Central Pollution Control Board

MODULE-V

Disaster management **09hrs**

1. Introduction, Definition and terminologies; scope and concept of disaster management.
2. Natural and Environmental disasters-a brief description of the following disasters-

earth quake, flood, coastal disasters, landslides, tsunami(role of mangroves in controlling tsunami disaster), cyclone, dam collapse, nuclear disaster, chemical disaster, biological disaster.

3. Environmental Issues - Global warming and sea level rise, Acid rain, Ozone layer depletion- causes and effects.
4. Disaster management – four phases – mitigation, preparedness, responses, recovery. Emergency procedures and warning systems, application of GIS (brief account only).

MODULE-VI

Phytogeography 9 hrs

1. Concept & definition, species distribution- continental drift, continuous and discontinuous distribution.
2. Vegetation in India – Forests- tropical, temperate, sholas, sub alpine, alpine, mangroves & Grass lands.
3. Phytogeographical regions of India - Western and eastern Himalayas, Desert, Western Ghats, Deccan Peninsula, Gangetic Plain, North East India, Coasts & Islands

Practical 36hrs

1. Visit a local polluted site and report major pollutants.
2. Visit a mangrove vegetation and report diversity
3. Study of ecological and anatomical modifications of Xerophytes, Hydrophytes,
4. Halophytes, Epiphytes and Parasites.
5. Observation and study of different ecosystems mentioned in the syllabus.
6. Phytogeographical regions of India- Photos/Diagrams

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2. Ahluwalia VK and Sunitha Malhotra, (2009). Environmental science, Ane Books Pvt.Ltd.
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9. Chapman J.L. (2006). Ecology-Principles and Application. Cambridge UniversityPress India Pvt. Ltd
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17. Fisher Peter (1995). Innovations in GIS. Taylor and Francis (Pub.), New York.
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19. Heywood I., S. Cornelius, S. Carver (2011). An Introduction to GIS , 4th Edn., Prentice Hall.
20. Hill Mc Jurie, Ian Mason and C. Kilburn. (2002). Natural Hazards and Environmental Change. Oxford University Press, New York.
21. Jenson J.R. and R.R. Jensen (2012). Geographic Information Systems. Pearson Inc.
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23. Kumaresan B. (2009). Plant Ecology & Phytogeography– Rastrogi Publications :
24. Martin, D.(1991). Geographic Information Systems and their socio economic Applications. Routledge, N.Y.
25. Misra S P and Pandey S N. (2009). Essential Environmental studies, Ane Books Pvt. Ltd
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27. Patrick L. Abbott, (2008).Natural disasters Mc Graw Hill International Edition.
28. Periasamy, K. (1965) . Elements of Plant Ecology, M.K.Publications
29. Prithipal Singh, (2007). An Introduction to Biodiversity. Ane Books Pvt.Ltd
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33. Stephen Wise. (2002). GIS Basics, Taylor and Francis, New York.
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EXPECTED OUTCOME

- Develops awareness about natural resources, its conservation and importance of sustainable lifestyles.

SEMESTER-V

- Understands and identify different ecosystems and ecosystem processes.
- Develops deep understanding about biodiversity and importance of its conservation
- Develops skills to identify polluted sites, its major pollutants and recognize the need to mitigate environmental pollution
- Awareness about different types of disasters and to adopt strategies to overcome and reduce the impact
- Identify the importance of phytogeographical sites in India

SEMESTER-II

FOUNDATION COURSE

METHODOLOGY AND PERSPECTIVES IN PLANT SCIENCES

Course code : BO 1221, Number of credits : 3

Number of contact hours: 36 hrs (Lecture); 36hrs (Practical) Total= 72 hours

Distribution of Hours	Theory	Practical
Scientific Studies	08 hrs	0 hrs
Data handling in science	12 hrs	16 hrs
Microtechnique	06 hrs	08 hrs
Biophysics	10 hrs	12 hrs
Total	36 hrs	36 hrs

Aim of the course: To introduce the methodology and perspectives of Science in general so as to enable the students to systematically pursue his particular discipline in science in relation to other disciplines that come under the rubric of sciences.

Objectives:

- To familiarize the students with the fundamental characteristics of science and significance of scientific studies
- To apply scientific methods independently and familiarize instruments in biological labs
- To interpret scientific data using basic statistical methods
- To develop skills for microscopic specimen preparation.

MODULE-I

Scientific Studies **08hrs**

1. Types of knowledge: Practical, theoretical and scientific knowledge
2. Information: What is science; what is not science; laws of science; basis of scientific laws and factual truths.
3. Science as a human activity: scientific temper and empiricism, Science disciplines
4. Revolution in Science and Technology
5. Ethics in Science: Transparency and Honesty; danger of pre conceived ideas.
6. Scientific information: Depositories of scientific information, Primary, secondary and digital sources; sharing of knowledge.
7. Methods and tools in science: Steps in scientific method. Null hypothesis and alternative hypothesis. Inductive and deductive reasoning.

MODULE- II

Data handling in science **12hrs**

1. Nature and types of data - Typical examples, Data collection, Data presentation-

Classification and tabulation, diagrammatic presentation (bar & pie diagrams) and graphic presentation (Histogram, frequency polygon, frequency curve & Ogives).
2. Samples and sampling techniques.
3. Statistical treatment of data: Statistical terms and symbols. Measures of central tendencies (mean, median, mode), Measures of dispersion (range, mean deviation, variance, standard deviation, coefficient of variation), Significance tests (chi-square test).

Practicals **16hrs**

1. Workout problems on frequency distribution
2. Represent data using bar diagram and histogram
3. Measures of central tendencies (Mean, Median,Mode)
4. Workout problems on measures of dispersion (range, mean deviation, variance, standard deviation, coefficient of variation)
5. Workout problems on chi-square test.

MODULE-I11

Microtechnique **06hrs**

1. Introduction - microscopy - simple and compound – phase contrast; dark field illumination and electron microscopes (SEM and TEM).
2. Micrometry, Camera lucida
3. Sectioning - hand and microtome– rotary and sledge
4. Killing and fixation agents – Carnoy's formula, Farmers formula, F .A.A
5. Dehydration - reagents
6. Stains and staining techniques - double staining. General account; Stains: safranin, haematoxylin, acetocarmine.
7. Mounting media - D. P. X and Canadabalsam
8. Whole mounts - cytological methods: maceration, smear and squash preparation.

Practical **08hrs**

1. Familiarize stains, fixatives and mounting media
2. General awareness of Micro technique - maceration, smears &squash
3. Demonstration of microtome sectioning and hand sectioning
4. Measurement of specimens using micrometer (Demonstration only).
5. Photomicrography and Camera lucida drawings (Demonstration only).

MODULE-IV

Biophysics **10hrs**

1. Principles and applications of Colorimeter, Spectrophotometer (UV-Visible) and Centrifuge- centrifugation, types of rotors (swinging bucket, fixed angle), Density gradient and Differential centrifugation.
2. Basic knowledge of the separation methods: - Chromatography (Column chromatography, paper chromatography and TLC), Electrophoresis (PAGE and AGE).
3. Buffers -their functions in biological systems - Uses of buffers in biological research, pH meter.
4. Cryobiology – cryopreservation, freeze drying (lyophilisation) and its applications.

Practical **12hrs**

1. Separation of plant pigments by paper chromatography/TLC.
2. Preparation of buffer
3. Measurement of pH
4. Construct the absorption spectrum of any sample.

REFERENCE

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EXPECTED OUTCOME

- Students will be familiarized with the fundamental characteristics of Science.
- Develops an idea about involvement of science in improvement of human life.
- Create awareness of scientific approach towards life and learns the values of ethics in science.
- Develops skills to interpret scientific data using basic statistical methods.
- Create skills to prepare specimens for microscopic and gross anatomical studies and familiarize with different microscopic methods for sample analysis.
- Students become able to prepare buffers, measure pH, separate plant pigments and construct absorption spectrum of a sample.

SEMESTER-IV

PLANT PHYSIOLOGY, PLANT ECOLOGY, HORTICULTURE AND PLANT BIOTECHNOLOGY

Course code: BO1431
Number of credits: 3

Number of contact hours: 54 hrs (Lecture); 36 hrs (Practical)

Distribution of Hours	Theory	Practical
Plant Physiology	30hrs	14hrs
Plant Ecology	08hrs	12hrs
Horticulture	06hrs	02hrs
Plant Biotechnology	10hrs	08hrs
Total	**54 hrs**	**36 hrs**

MODULE-I

Plant Physiology **10 hrs**

1. General introduction: physiological processes, their significance and applications.

2. Water relations of plants: Importance of water to plant life.

a. Absorption of water- organs of absorption, root and root hair. Physical aspects of absorption- imbibition, diffusion and osmosis. Plant cell as an osmotic system;water potential and osmotic potential. Plasmolysis and its significance, practical applications. Mechanism of water absorption – active and passive absorption, root pressure. Pathway of water across root cells.

b. Ascent of sap- vital and physical theories.

c. Loss of water from plants: transpiration - cuticular, lenticular and stomatal mechanism - theories – starch sugar hypothesis, potassium - ion theory. Significance of transpiration - guttation, anti - transpirants, factors affecting transpiration.

MODULE-IV

Plant Ecology **8 hrs**

1. Definition-Scope and relevance to society and human environment. Need for public awareness
2. Ecosystems-Concept of an ecosystem- structure and function of an ecosystem-
3. Biotic and abiotic components- Energy flow in an ecosystem.
4. Ecological succession-Definition & types.
5. Food chains -Food web & ecological Pyramids.
6. Introduction- types,characteristic features, structure and functions of the following ecosystems.

A 1. Forest ecosystem 2. Grassland ecosystem 3. Desert ecosystem 4 .Aquatic ecosystems- Ponds, Estuaries.

B Morphological, anatomical & physiological adaptations of – Hydrophytes,Xerophytes, Halophytes, Epiphytes, Parasites.

Practical **12 hrs**

1. Study of ecological and anatomical modifications of Xerophytes, Hydrophytes, Halophytes, Epiphytes and Parasites.
2. Observation and study of different ecosystems mentioned in the syllabus.

MODULE-V

Horticulture **6 hrs**

1. Introduction to Horticulure
2. Garden tools and implements - Lawn mower, hand trowel, nursery spade, spade fork, garden hoe, weeder, tillers
3. Methods of vegetative propagation: Cutting, grafting, layering, special methods of propagation, propagation by seeds.
4. Media for propagation of plants — soil, sand, peat, sphagnum moss, vermiculture, soil mixture, nursery beds
3. Manures – organic and inorganic

SEMESTER I

Paper 1: CO 211- BUSINESS ETHICS AND CORPORATE GOVERNANCE

Objectives:

1. To convey basic understandings on the theories of Business Ethics
2. To provide a understanding on Corporate Governance practices and the provisions of the Companies Act relating to corporate governance

Module 1: Business Ethics and Ethical Practices: Ethics – Sources- Importance - factors influencing Business Ethics – Benchmarks on code of Ethics – Ethics Committees – Training Programmes – Ethical Decision Making – Ethics in Finance - Marketing and HR **(15Hrs)**

Module 2: Organization Culture: Features – Building and Maintaining Organization Culture – Organizational Socialization – Managing cultural Diversity – Work Ethics – Work Culture – Quality of Work Life – Work Life Balance – areas Improving Work Life Balance – Strategies of Work Life Balance **(20Hrs)**

Module 3: Corporate Governance: Importance – Objectives – Basic Ingredients of Corporate Governance – Principles - Theories – Phases of development of Corporate Governance in Global and Indian Perspectives – Code of Corporate Governance – Committees on Corporate Governance (Global and Indian) **(15Hrs)**

Module 4: Corporate Social Responsibility : CSR under Companies Act 2013 – Scope – Relevance – Importance – Areas of CSR – Arguments for and against CSR – Ackerman's model of CSR – SEBI – Clause 49 of listing agreement – Evaluation of Corporate Governance of a Company – Methods – Shareholder Value – EOCE, PAT, EPS, TSR, MVA, EVA and HVA - Corporate Philanthropy – Corporate Citizenship – Social Audit **(25 Hrs)**

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Module 5: Corporate Image and Excellence : Corporate image – building corporate image – Importance – Corporate Excellence – importance – Measures to achieve corporate excellence – New initiatives on corporate excellence - Role of Chairman – Qualifications – Power – Duties and Responsibilities – Board Committees – New Directions **(15Hrs)**

References:

1. Laura P Hartman, Perspectives in Business Ethics, Mc Graw Hill International
2. George A Steiner and John F Steiner, Business , Government and Society, Mc Graw Hill International
3. SK Chakraborthy, Ethics in Management Vedantic Perspectives, Oxford University Press
4. Subhash Sharma, Management in New Age: Western Windows – Eastern Doors, New Age International Publishing , New Delhi
5. Prof (Col.) PS Bajaj, Dr. Raj Agarwal – Business Ethics an Indian Perspectives, Biztantra2006.

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SEMESTER I

Paper 4: CO 214- PLANNING AND DEVELOPMENT ADMINISTRATION

Objectives:

1. To generate an overall insight on planning process in Indian Economy
2. To make the students aware about new planning initiatives in India

Module 1 - Structure of Indian Economy- Relevance of sectors in Indian Economy; Primary, Secondary and Tertiary Sectors-National Income-Methods of Computation-Inflation effects on Indian Economy- India's current National Income in comparison with leading economies of the world-Challenges. **(15Hrs)**

Module 2: Planning mechanism in India–Economic planning-features, types-Phases of Economic Planning-Growth and Planning Models-(Briefly mention) -State Planning Board-District Planning Board **(20Hrs)**

Module 3: Fiscal Policy-Centre-State financial relationship-Resource Allocation-Finance Commission-Development and Non Development expenditure-Preparation of budgets: Centre, State and Local Self Government-Deficit financing-Plan and Non-Plan Expenditure (Case Study: Evaluation of current Budget) **(20Hrs)**

Module 4 : Policy Initiatives in the Planning Process –Niti Aayog –Structure– Objectives –Functions-Guiding Principles -Vision Statement-Recent Policy initiatives: Make in India, Jan DhanYojana, Startup India, Swatch Bharath Abhiyan, Mudra Bank, Digital India – Future development initiatives **(20Hrs)**

Module 5: Role of State and Local Self Government-Planning initiatives in Kerala-Kerala Perspective Plan –Mission-Vision-Scope-Local Self Government –Role, Functions and Programmes **(15Hrs)**

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References:

1. Agarwal A.N. and Kundanlal (1999), Economics of Development and Planning, Vikas Publishing House, NewDelhi
2. Seth.M.L. and S.P. Singh (1998), Economic Planning: Theory andPractice, S.Chand and Company Ltd., Ram Nagar, NewDelhi
3. Dhingra.I.C. and V.K.Garg (2000), Economic Development and Planning in India, Sulthan Chand Publications, NewDelhi
4. Mishra S.K. and Puri V.K (2008), 26th Edition, Indian Economy,Himalaya Publishing House Pvt. Ltd.,Mumbai-
5. Desai and Bhale Rao (1986), Economic Planning and Policy,Himalaya Publishing House,Mumbai
6. Madan Mohan Batra (1987), Planning in India: development perspective towards the 21st century, V.K. Publishing House,Mysore
7. Misra and Puri (1999), Development and Planning Theory andPractice, Himalaya Publishing House,Mumbai
8. Gerald. M. Meier, and Robert E. Baldwin,(1957) (Reprint in 1975), Economic Development- Theory, History ,Policy, Asia Publishing House,Mumbai
9. Gerald. M. Meier, James E. Rauch,(2005), Leading Issues inEconomic Development, (8th Edition) Oxford University Press,Oxford,
10. Meier .G.M. (1995), Leading Issues in Economic Development (6thedition) Oxford University Press, NewDelhi.
11. Higgins Benjamin (1963), Economic Development, Principals, Problems and Policies, Central Book Depot,Allahabad
12. Kindleberger C.P. (1977), Economic Development (III edition) McGraw Hill NewYork.
13. Adelman. I (1961), Theories of Economic Growth and Development, Stanford Universities Press,Standford.
14. Bose. A, (1975), Marxian and Post Marxian Political Economy, PenuinLondon
15. Chakrvarthy S (1982), Alternative Approaches to the Theory of Economic Growth, Oxford University Press, NewDelhi.
16. Growth. S, (1986), An Introduction to Development Economics, Allen and Unwin
17. Little IMD (1982), Economic Development : Theory Policy and International Relations, Basic Books, NewYork
18. Schumpeter J.A., (1949), The Theory of Economic Development,Harvard University Press,Cambridige.
19. Bhagavathi J and Desai, (1970), India: Planning for Industrialization,Oxford University Press,Oxford
20. Jolly. R., (1973), Third World Employment, Penguin,Oxford
21. Sen.A.K. (1962), Choice of Techniques, Basil Backwall,Oxford

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B.Com I st Semester

Core Course I: CO 1141 – ENVIRONMENTAL STUDIES

No. of instructional hours per week: 4 No. of Credits: 3

Aim of the course: To develop knowledge and understanding of the environment and enable the students to contribute towards maintaining and improving the quality of the environment.

Course objectives:

1. To enable the students to acquire basic ideas about environment and emerging issues about environmental problems.
2. To give awareness about the need and importance of environmental protection

Module I: Environmental studies – meaning – scope – importance (4hrs)

Module II: Ecology and Ecosystems, Biodiversity and its Conservation, and Natural resources –meaning of ecology – structure and function of an ecosystem – producers – consumers – decomposers– energy flow in the ecosystem – ecological succession- food chain – food webs and ecological pyramids . Ecosystem – concept– types of ecosystems – structure and functions of forest ecosystem, grass land ecosystem- desert ecosystem, aquatic ecosystem. Biodiversity and its conservation introduction- definition- genetic, species and ecosystem diversity- value of biodiversity – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of diversity – threats to diversity – conservation of diversity in situ, ex-citu. Natural resources features- air resources, forest resources, water resources, mineral resources, food resources energy resources, land resources- over exploitation of natural resources- consequences conservation of natural resources- role of an individual in conservation of natural resources
(25 Hrs)

Module III: Industry and environment - pollution – environmental pollution – soil pollution – air pollution – water pollution – thermal pollution – noise pollution – causes, effect and control measures – waste management – waste minimisation through cleaner technologies – reuse and recycling - solid waste management.(18hrs)

Module IV: Social issues and environment – Unsustainable to sustainable development – urban problems related to energy - water conservation - water harvesting - resettlement and rehabilitation of people- environment ethics-waste land reclamation-consumerism and waste products. (15 hrs)

Module V: Human Population and environment – population growth – variation amoeg nations – population explosion – environment and human health – human rights – value education – Women and child welfare. (10hrs)

Note: All students must *visit a local area to document environmental issues and prepare a brief report on the same identifying issues involved and suggesting remedies.(This will be a part of the internal marks. i.e. for EVS the internal marks = attendance – 5 marks + test paper – 5 marks + field study report – 10 marks)*

Books recommended

Misra.S.P and Pandey .S.N. *Essential Environmental Studies*, Ane Books India, New Delhi.
Kiran B. Chokkas and others.*Understanding Environment*, Sage Publications New Delhi.
Arumugam N. and Kumaresan V. *Environmental Studies*, Saras Publications, Kanyakumari.
Benny Joseph. *Environmental Studies*, Tata McGraw-Hill Publishing Co.Ltd.,New Delhi.

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1	EN 1121	Foundation Course 1: Writings on Contemporary Issues
2	EN 1211.1	Language Course 3: Ability Enhancement Compulsory Course- Environmental Studies and Disaster Management
3	EN 1331	Complementary Course 5: Narratives of Resistance
4	EN 1641	Core Course 11: Gender Studies

Semester I

Foundation Course 1- EN 1121 (B A/ B. Sc) and CG 1121.3 [Career Related 2 (a) Programme]

Course Title: WRITINGS ON CONTEMPORARY ISSUES

Credits: 2

Hours: 4/week (72 hrs)

Learning Objectives:

1. To sensitize students to the major issues in the society and the world.
2. To provide students with a variety of perspectives on contemporary issues.
3. To encourage them to read literary pieces critically.

Learning Outcomes:

On completion of the course, the students should be able to

1. Have an overall understanding of some of the major issues in the contemporary world
2. Respond empathetically to the issues of the society
3. Read literary texts critically

Course Description

1. Living in the Planet of the Apps by Khyrunnisa A.
2. Ageing in India: Some Social Challenges to Elderly India by Abhay B. Mane
3. India's Women: The Mixed Truth by Amartya Sen
4. Drug Abuse: Causes and Solutions by Samudranil Mukherjee
5. Artificial Intelligence by Gareth Southwell
6. Universal Declaration of Human Rights by Leah Levin
7. What Secularism is and is not by Romila Thapar
8. The Globalisation of Inequality by P. Sainath

Textbook Prescribed:

Thoughts of Our Times

Edited by Dr. C.A. Lal, Associate Professor of English, School of Distance Education, University of Kerala and Vishnu Narayanan, Assistant Professor, Institute of English, University of Kerala

Publishers: Orient Blackswan

Additional Reading

1. Janaki Lenin, *My Husband & Other Animals*

2. Mark Tully, *No Fullstops in India*

3. Shashi Tharoor, *An Era of Darkness: The British Empire in India*

4. Alexander Frater, *Chasing The Monsoon: A Modern Pilgrimage Through India*

5. Bill Bryson, *A Short History of Nearly Everything*

Web sources

1. https://storycorps.org/stories/

2.https://www.fullspate.digitalcounterrevolution.co.uk/english-articles-advanced/

3. https://www.thehindu.com/

4. https://www.theguardian.com/international

5. http://epaper.indianexpress.com/

6. https://www.nytimes.com/

7. https://www.telegraph.co.uk/

8.https://ia601601.us.archive.org/26/items/in.ernet.dli.2015.460612/2015.460612.Jawaharlal-Nehrus-Speeches-Vol-2_text.pdf

Semester II

EN 1211.1

Language Course 3: Ability Enhancement Compulsory Course – EN 1211.1 (B.A / B.Sc)

Course Title: ABILITY ENHANCEMENT COMPULSORY COURSE: ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

Credits: 5

Hours: 5/week (90 hrs)

Learning Objectives:

To enable the student:

- to engage with a wide range of issues in environmental studies and disaster management.
- to acquire a set of values for environmental protection and conservation
- to recognize the ecological basis for regional and global environmental issues
- to manage natural disasters and other emergency situations
- to develop a critical vocabulary related to environmental studies and disaster management

Learning Outcomes:

The student will be able to:

- understand environmental crises and disaster management situations
- take lead in spreading environmental values and creating awareness among the public
- understand local environmental issues better
- respond in a better way to a natural calamity or disaster
- articulate environmental concerns using appropriate vocabulary

Course Description

Module 1

Understanding the Environment

Introduction: Environment-its importance-types of ecosystems

- "Chief Seattle's Speech"
- "The Religion of Forest" (An Essay by Rabindranath Tagore)
- "Trophic Cascade" (A poem by Camille T. Dungy)

A Glossary of relevant **key concepts** with examples

Comprehension Questions

Module 2

Resources and their Conservation

Introduction: Natural Resources-biodiversity- conservation

- An extract from *The Silent Spring*(A book by Rachel Carson)
- *On Killing a Tree* (A poem by Gieve Patel)
- *The Inheritors of the Earth* (A translation of Short Story by Vaikom Muhammed Basheer)

A Glossary of related **Key Concepts** with **examples**

Comprehension **Questions**

Module 3

Environmental Pollution

Introduction: Types-Causes-Effects-Waste management-Policies and practices

- *Beat Plastic Pollution* (An article from unenvironment.org)
- "Memory of Hiroshima" (A poem by K. Satchidanandan)
- *E is for E-waste* (Ellen Banda-Aaku)

A Glossary of Related **Key Concepts** with **examples**

Comprehension **Questions**

Module 4

Disaster Management

Introduction: Natural and Man-made- health emergency- handling hazardous materials-managing personal disasters- bomb threats- disasterpreparedness-management-rehabilitation

- An introductory essay on Disaster Management
- *The Truth about the Floods* (A poem by Nissim Ezekiel)
- An extract from Chapter 1 of *Patna Blues* by Abdullah Khan (Juggernaut Books)
- A newsletter on Bhopal Gas Tragedy

- Laboratory safety manual
- 'Relief Standard Operating Procedure for Natural & Man-made disaster,' an essay.

A Glossary of related **Key Concepts** with interesting **examples**

Comprehension Questions

Project report (10 Marks)

Students are expected to prepare a project report based on any one of the activities suggested below. General guidelines will be provided for preparing the Project Report.

1. Visit to a local area to document environmental assets: River/Forest/Grassland/Hill
2. Visit to a local polluted site: Urban/Rural/Industrial/Agricultural
3. Study of simple ecosystems: Pond/River/Hill slopes
4. Mock drill organized in their college by the local disaster management agencies

SEMESTER III

FIRST DEGREE PROGRAMME IN

BA ENGLISH LANGUAGE AND LITERATURE (CBCS SYSTEM)

Complementary Course 5: EN 1331 Narratives of Resistance Number of Credits: 3 No. of Instructional Hours: 3 [Total 54 Hours]

Aim Introduce the various narratives of resistance, literary and other wise.

Objectives

1. To understand the various modes of resistance needed to subvert oppressive socio- cultural structures.
2. To provide insight into the struggles of people from around the world for identity and rights and contribute proactively to social dynamics.
3. To understand how literature acts as a vehicle for voices of dissent and protest.

Course Outcome

CO 1: Be able to identify themes of resistance in different forms and genres of literature.

CO 2: Have a sense of the various kinds of injustice related to race, ethnicity, gender etc. prevalent in society.

CO 3: Develop an idea of literature as a form of resistance to all forms of totalitarian

authority. CO 4: Understand the inter connection between various genres in manifesting

resistance

CO 5: How resistance is an undeniable presence in the everyday narratives of literary and other artistic expressions.

COURSE OUTLINE

Module I Narratives of Resistance

Nature and Function of Resistance- Heterogeneous forms of Resistance-Gender-Dalit-Race-Totalitarianism-Nation State-Holocaust- Slave Narratives-War-Resistance and Social Change

Module II Poetry/Documentary

1. Adrienne Rich- ―What Kind of Times Are These‖ https://www.poetryfoundation.org/poems/51092/what-kind-of-times-are-these
2. Denise Levertov- ―Making Peace‖

https://www.poetryfoundation.org/poems/53900/making-peace

Mahmoud Darwish-—ID Card
https://www.wrmea.org/017-november-december/id-card-by-mahmoud-darwish-a-translation-and-commentary.html

3. S.Joseph : —Between These Lines‖ https://www.poetryinternational.org/pi/poem/17768/auto/0/0/S-Joseph/Between-These- Lines/en/nocache
4. Tishani Doshi- —Girls are coming out of the Woods‖ https://www.poetryfoundation.org/poems/152744/girls-are-coming-out-of-the-woods
5. Taslima Nasreen : —Garment Girls‖ https://www.poemhunter.com/poem/garment-girls/
6. Lucille Clifton: —poem in praise of menstruation‖ https://www.poetryfoundation.org/poems/54584/poem-in-praise-of-menstruation
7. Peter Davis (Dir): *Nelson Mandela: Prisoner to President* (Apartheid Documentary 1994) https://www.youtube.com/watch?v=Rk-Lxgp9NWg

Module III Prose and Fiction

1. Assange, Julian. —Conspiracy as Governance.‖ State and Terrorist Conspiracies. 7-12 https://cryptome.org/0002/ja-conspiracies.pdf(Article)
2. Sojourner Truth: —Ain't I A Woman?‖ (Speech) https://www.nps.gov/articles/sojourner-truth.htm
3. Jacinta Kerketta And Nighat Sahiba —On The Power of Poetry And Politics of Language‖.Huffpost article by Kavitha Muralidharan (Article) https://www.huffingtonpost.in/entry/jacinta-kerketta-nighat-sahiba-kashmir-jharkhand- poems-language_in_5c41f480e4b027c3bbc14a3a?guccounter=
4. Alice Munro: —Boys and Girls‖ (Short Story) http://www.giuliotortello.it/shortstories/boys_and_girls.pdf
5. K. Saraswathi Amma: —Life, In My View‖ (Memoir) (Translation J.Devika) https://swatantryavaadini.in/2020/08/30/life-in-my-view-k-saraswathi-amma/#more-982
6. Nemat Sadat :*Carpet Weavers* (Novel) Penguin, 2019.

Recommended Reading

Brueck , Laura. *Writing Resistance: The Rhetorical Imagination of Hindi Dalit Literature.*

Columbia University Press, 2014.

Darwish, Mahmoud.*Unfortunately, It Was Paradise: Selected Poems.*University of California Press, 2013.

De Santis, Christopher C., et al. *The Collected Works of Langston Hughes: The poems, 1941- 1950.* Italy,University of Missouri Press, 2001.

8. Doshi, Tishani. *Girls Are Coming Out of the Woods*. India, Harper Col

Dutta, Mohan J. *Voices of Resistance: Communication and Social Change*. Purdue University Press. 2012.

Harlow, Barbara. *Resistance Literature*. New York, Methuen, 1987.

Hosseini, Khaled. *A Thousand Splendid Suns*.Bloomsbury Publishing,

2009.

Jo Glanville, ed. Qissat: *Short Stories by Palestinian Women*. London, Telegram, 2006.

90-94. Levertov, Denise. *Selected Poems*.United States, New Directions, 2003.

Lewis, T. (2008).―Literature as Resistance‖.*The Hudson Review*,60(4), 655–664. www.jstor.org/stable/20464787

Manṭo, Sa'ādatḤasan. *Manto*: *Selected Short Stories: Including 'Toba Tek Singh' and 'The Dog of Tithwal'*. India, Random House India, 2012

Munro, Alice. *Selected Stories*. United Kingdom, Random House, 2012.

Neruda, Pablo. *The Poetry of Pablo Neruda*.United States, Farrar, Straus and Giroux, 2015.

Nguyen, Viet Thanh. *Race and Resistance: Literature and Politics in Asian America Race and American Culture.*USA,Oxford University Press, 2002.

Rich, Adrienne. *Collected Poems: 1950-2012.* United States,W. W. Norton, 2016.

Stoltz, Pauline. *Gender, Resistance and Transnational Memories of Violent Conflicts*.Germany, Springer International Publishing, 2020.

Williams, Nerys. *Contemporary Poetry*. United Kingdom, Edinburgh University Press, 2011.

Zimmermann, Jérémie, et al. Cypherpunks: *Freedom and the Future of the Internet*. United Kingdom, OR Books, 2016.

e-resources

https://swatantryavaadini.in/

https://www.thegoodtrade.com/features/inspiring-female-poe

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On Literature and Resistance

SEMESTER VI

FIRST DEGREE PROGRAMME IN

BA ENGLISH LANGUAGE AND LITERATURE (CBCS System)

Core Course 11: EN 1641 Gender Studies

No: of Credits: 4 **No of Instructional Hours: 5 [Total: 90hours]**

Aim: Introduce and problematize gender constructs.

Objectives

1. Explore the historical variables that have contributed towards the social norms of gender and sexuality
2. Understand the significance of making gender an integral concept of social analysis
3. Develop a conceptual understanding of the field of gender studies

Course Outcome

CO 1: Recognize the patriarchal bias in the formation of history and knowledge.

CO 2: Analyse the ways in which gender, race, ethnicity class, caste and sexuality construct the social, cultural and biological experience of both men and women in all societies.

CO 3: Recognize and use the major theoretical frames of analysis in gender studies

CO 4: CO 5: Interrogate the social constructions of gender and the limiting of the same in to the male-female binary in its intersections with culture, power, sexualities and nationalities

CO 5: Examine gender issues in relation to the sustainable goals of development

COURSE OUTLINE

Module I Introduction to Gender Studies

Gender, Patriarchy- Family- Identities- Essentialism- Difference- Ideology- Intersectionality- Feminisms-Womanism-Dalit Feminism-Islamic Feminism

1. bell hooks. ―Feminist Politics:Where we Stand‖ *Feminism is for Everybody*: *Passionate Politics*. London: Pluto, 2000: pp.1-6. https://excoradfeminisms.files.wordpress.com/2010/03/bell_hooks-feminism_is_for_everybody.pdf
2. Judith Lorber. ―The Social Construction of Gender.‖ https://ieas.unideb.hu/admin/file_9695.pdf
3. Vijila Chirappad: ―Wasteland‖ (poem) https://feminisminindia.com/2018/01/11/5-dalit-women-po

ets/

Module II Gender and Sexuality

Body-Sexualities-Performativity-Heterosexuality-Sexual Orientation-Non-normative Sexualities- Desire-Heteronormativity-Homosexuality-LGBTQI-Queer-Transgender-Pride Parade- Posthuman Orientation.

1. A. Revathi. *The Truth about Me:A Hijra Life Story*(Life Narrative)
2. Margaret Atwood: ―Helen of Troy Does Countertaps‖ Dancing (poem) https://apoemaday.tumblr.com/post/181494581744/helen-of-troy-does-counterto p- dancing
3. Kalki Subramaniam: ―Breaking Binaries, Establishing Identity‖ TEDxDumas https://www.youtube.com/watch?v=_j1NzEGMNdo

Module III Gender and Culture

Culture, Modernity, Consumption, Sexual Economies, Commodity Culture

1. Nivedita Menon: ―India: Section 377: How Natural is Normal?‖ http://www.sacw.net/SexualityMinorities/nivedita01Jan2004.html
2. Maya Angelou: ―Phenomenal Woman‖ (poem) https://www.poetryfoundation.org/poems/48985/phenomenal-woman
3. Meena Kandasamy: ―Mascara‖ (poem) https://www.poemhunter.com/poem/mascara-4/

Module IV: Gender, Power and Human Rights

Power, Sexual Politics, Discourse, Sexual Citizenship, Discrimination, Human Rights, Gender Justice

1. Alice Walker: *Meridian* (Novel)
2. Mahaswetha Devi: *Draupadi* (Short Fiction)
3. Mayilamma:Chapter 13. ―Protest: The First Year‖ (Pages 55 – 59) Jyothibai PariyadathuMayilamma: *The Life of a Tribal Eco-warrior*. Orient Blackswan, 2018.

Recommended Reading

Butler, Judith. Gender Trouble: *Feminism and the Subversion of Identity*. New York: Routledge, 1990.

Cranny-Francis,Anne. Wendy Waring, Pam Stavropoulos, Joan Kirkby. *Gender Studies Terms and Debates*.Macmillan, 2017.

Delap, Lucy. *Feminisms: A Global History*. Penguin,

2020. Foucault, Michel. *History of Sexuality*.Penguin

books: 1977

Kate, Millet. *Sexual Politics*. New York: Doubleday. 1969.

Kumar, A.*The History of Doing*, New Delhi: Kali for Women,1998.

Marao, Lori, J. *Fifty-One Key Feminist Thinkers*. Taylor and Francis, 2016.

Naples, Nancy A. *Companion to Women's and Gender Studies*. Wiley, 2020. Roth, Benita. *Separate Roads to Feminism*. CUP,2004.

Sullivan, Nikki. *A Critical Introduction to Queer Theory*.NYU, 2003.

e- resources

https://kalkisubramaniam.com/

https://www.e-ir.info/2017/02/06/online-resources-feminism/

https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)30239-9/fullte xt https://plato.stanford.edu/entries/feminist-philosophy/

http://www.gender.cawater-info.net/knowledge_base/rubricator/feminism_e.htm

https://guides.lib.purdue.edu/c.php?g=352219&p=2375079

Semester IV

Zoology Core course III

ECOLOGY, HABITAT DESTRUCTION & DISASTER MANAGEMENT

Course code – ZO 1441

No. of credits - 3 **Total hours 54**

Course Outcomes

- Students get basic knowledge on ecosystem, food chain, food web and energy flow.
- Students acquire general awareness on pollution and their impacts.
- Imparts basic knowledge on ecosystems and their functioning.
- Students learn about various types of anthropogenic pressures on ecosystem, related degradation and management measures.
- Students get awareness of toxicants, their impacts on human health and environment and remedial measures.
- Create awareness about disasters, prevention and mitigation measures.

ECOLOGY **4 hrs**

Module I

Components of ecosystem: Environmental factors - abiotic factors, light, temperature, soil, air; biotic factors- autotrophs, phagotrophs and saprotrophs; ecosystem interaction and relationship between biotic and abiotic factors, the cybernetic nature and the stability of the system. Pond as an ecosystem (self study)

Module II **5 hrs**

Biogeochemical cycles: Basic types of biogeochemical cycles - gaseous cycle-carbon and nitrogen cycles, mention sedimentary cycles (P and S), recycling pathways and recycle index.

Limiting Factors- basic concepts- Leibig's law of minimum, Shelford's law of tolerance, combined concept of limiting factors, Light and temperature as limiting factors.

Module III **8 hrs**

Habitat Ecology: Biosphere classification- lithosphere, hydrosphere and atmosphere physical features, fauna and their adaptations of aquatic, terrestrial and marine habitats (self study).

Population ecology: Properties of population- density, natality, mortality, age distribution, biotic potential, environmental resistance and carrying capacity, population growth forms, J and S shaped curves, emigration, immigration and migration, population fluctuation. Community ecology: Definition and characters, species diversity; stratification; dominance; ecotone and edge effect; ecological indicators; community periodicity, succession.

Module IV **5hrs**

Anthropogenic impact on ecosystem: Ionizing radiation and radioisotopes, ionizing radiation and human health, radiation accidents and other exposures, disposal of radioactive wastes, pesticides like DDT, endosulfan, furadan, insect repellants , e-wastes. Monitoring of pollutants - physical, chemical and biological.

Module V **3 hrs**

Wild life conservation and management: Significance, causes of extinction, concepts of threatened species, red data book, IUCN, WWF, CITES, Green Environment and Green peace; protected areas, biosphere reserves, national parks and sanctuaries in India, forests in India, desertification, deforestation, carbon trading; importance of mangroves in coastal ecosystems-conservation and management.

Module VII **9 hrs**

Environmental biotechnology: Biotechnological methods of pollution detection, biotechnological methods in pollution management, bioremediation, biotechnology and biodegradation, genetically engineered microbes in bio-treatment of waste, eco-friendly bioproducts for environmental health, bio-piracy, bio-pesticides and bio-fertilizers, organic farming and its merits. Green chemistry - designing a Green synthesis, basic principles of Green chemistry.

Module VIII **5 hrs**

Environment Movements

Environment and health - Environment and development: Environmental Movements (Chipko, Narmada Bachao Andolan). environmental movements in Kerala (Madhav Gadgil/Kasturi Rangan Reports. Ramsar sites Wetland Reclamations and localized anti-reclamation movements) Kerala state Biodiversity Board, Biodiversity Register.

DISASTER MANAGEMENT

Module IX **8 hrs**

Disruption in Ecosystem

Natural-flood, Draught, Earth quaque, Cyclone, Tsunamis, Volcanic eruption. Anthropognic influence on erosion, climate change and pollution. Mining activities Monoclonal plantations, genetically modified plants and their impact in ecosystem. Impact of Developmental projects such as construction of dams, Hydroelectric projects Thermal power station.

Module X **7 hrs**

Disaster Management – Meaning and Definition: Definitions of Disaster, Hazard, Risks. Vulnerability, and Resilience and their relationship: Classification of disasters- Human induced and Natural; Cause of Disasters; Impact of disasters. Factors affecting Vulnerability – Economic, Political, Environmental and Social Counselling.

Assignment/Seminar

Global warming, Green House Effect, Ozone depletion Climate change, Kyoto protocol

Reference

- Beck, W. S., Liem, K. F. & Simpson, G.G. (1991). *Life: An Introduction to Biology* (3rd Ed.) Harper Collins Publishers, New York, pp 1361. ISBN : 006500009 9
- Bharucha,E. (2005). *Textbook of Environmental Studies*. Universities Press (P)Ltd. India, pp 276. ISBN 81 7371 540 8.
- Chapman, J.L., & Reiss, M.J. () *Ecology: Principles and Applications* (2d Ed.) Cambridge University Press, UK. ISBN: 0 521 00575 2.
- Charry, S.N. (2008). *Environmental Studies*. MacMillan India Ltd. ISBN: 10:0230 63531 8, 13: 987 0230 6351 9.
- Cunningham, W.P. & Cunningham, M.A. (2003). *Principles of Environmental Science inquiry and Applications.* Tata McGraw Hill Publishing Company Ltd. New Delhi. ISBN 0 07 058112 6.
- Donald Van DeVeer & Christine Pierce (). *The Environmental Ethics & Policy Book* (3rd Ed.) Wadsworth – Thomson Learning, Canada. ISBN: 0 534 56188 8.
- Emmel, T.C. (1976). Population Biology. Harper & Row Publishers, New York. ISBN 06 041904 0

Disaster Management

- http://www.mnmk.ro/documents/2008/2008-6.pdf
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- Agarwal, A. and Sen, S.: The Citizen's Fifth Report, Centre for Science and Environment. New Delhi 1999
- Chandna, R.C.: Environmental Awareness, Kalyani Publishers, New Delhi, 1998
- Sharma, H.S.: RathambhoreSanctuary - Dilemma of Eco-development, Concept.
- www.ifrc.org/en/what-we-do/disaster-management/
- Coppola. Damon (2011), Introduction to International Disaster Management, Elsevier 1SBN: 978-0-12-3821744
- Abbott Leon (2008). Natural Disaster, McGraw-Hill.ISBN-13: 978 0072 428650.

HABITAT DESTRUCTION AND DISASTER MANAGEMENT

- Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
- Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
- Carter, W. Nick, 1991: Disaster Management, Asian Development Bank,
- Coppola P Damon, 2007. Introduction to International Disaster Management,
- Cuny, F. 1983. Development and Disasters, Oxford University Press. Manila.
- Ahluwalia, V. K. and Malhotra, S. (2006). Environmental science. Ane Books Pvt.Ltd.
- Aravind Kumar. (2004). Text Book of Environmental Science. APH Associates,Inc.Publishers. Massachusetts.
- Atchia. M. and Tropp.S. (1995). Environmental Management, John Wiley
- Bhatia .A.1. Current trends in Global EnvironmentNew India publishing_ Agency,
- Bishop.P.L. (2000). Pollution Prevention: Fundamentals and Practice,
- Brace, C.L. (1967). The stages of Human Evolution, Prentice Hall International.CambridgeUniversity Press.33.
- Chapman J.L.and M.J.. (1999). Ecology - Principles and Applications.
- Chatterjee B. (2003). Environmental Laws: Imple mentation problems

1644Environmental Economics and Disaster Management (Core)

Module I Basic Concepts (5 Hrs)

Basic Concepts of environmental economics – economics and ecology – ecology and eco system

Module II Theory of Externalities (15 Hrs)

Market system and environment of externalities – Pareto optimum and Market failure in the presence of Externalities – Property rights and the Coase theorem

Module III Environmental Policy Tools for Analysis (20 Hrs)

Pigouvian Taxes and Effluent Charges; Tradable Permits – Environmental Valuation – Types of Economic Values – Non Market Valuation Methods – Cost Benefit Analysis – Sensitivity and Risk analysis

Module IV Global Environmental Issues (7 Hrs)

Economics of Climate Change – Agreements and Institutions - Population Growth and the Environment – Trade and Environment – Concept and Measurement of Sustainable Development

Module V Disaster Management in india (8 Hrs)

Concept and Definitions (Disaster, Hazard, Vulnerability, resilence, Risk) – Hazard and Vulnerability Profile of India – Institutional Arrangeems (Mitigation, DM Act and Policy, Plans Programmes and Legislation),Disaster management in India

Basic Readings

1. Hussain, M, Ahmed. 2000. Principles of Environmental Economics. Routledge, London and New York
2. Charles Kolstad, Intermediate Environmental Economics, Oxford University Press, 2nd edition
3. Carter, Nick 1991. Disaster Management: Disaster Manager's Handbook, Asiaan Development Bank, Manila Pilippiens.
4. Gupta Anil K, Sreeja S Nair, 2011 Environmental Knowledge for Disaster Management, NIDM, New Delhi

5. ELECTIVE

6. EC1661.1 KERALA ECONOMY

7.

8. Inst Hours-4 Number of Credit-2

9. Course Objective

10. To understand the structural changes, Sector-wise contribution and features of the Kerala Economy since the formation of the state and enable the students to have a basic understanding of the emerging trends and issues of Kerala Economy

11.

12. MODULE I: Structure of Kerala Economy

13. Development experience of Kerala: An overview: Kerala's development since the formation of the state-Features of the Economy- Structural composition – Primary, Secondary and Tertiary Sectors – changes over the years NSDP,GSDP and PCI – "Kerala Model of Development" –A comparison with the highest SDP state in India – HDI Status

14.

15. MODULE II: Demographic change: A boost to Economic change

16.

17. Demographic Aspects (birth rate, death rate, infant mortality rate, sex ratio, age distribution)- why sex ratio is in favour of women in Kerala –need for women empowerment – Aging problem- Urbanisation, Migration and Emigration-Economic and social Impacts of Migration, return migration and interstate migration - Nature and Magnitude of Urban, Rural and Educated Unemployment - Trends in Urban and Rural Poverty in Kerala- Major poverty alleviation schemes.

18.

19. MODULE III: Kerala's Economic Development : Sector-wise Analysis

20.

21. Agricultural development since 1956: Objectives of Land reforms- Measures of Land

them to apply these tools in Economics.

MODULE I: Univariate Analysis, Correlation and Regression (35 Hours)

Univariate analysis – frequency tables, Measures of central tendency, dispersion, standard deviation, coefficient of variation, Lorenz Curve, Gini Concentration ratio-Geometric mean, Harmonic mean

Correlation--Simple, Partial and Multiple correlation- Scatter diagram-Karl Pearson's coefficient of correlation-Spearman's rank correlation- probable error- uses of correlation.

Simple and multiple linear regression- Method of Least Squares-Lines of regression- Regression coefficient-Relation between regression and correlation coefficients-Uses of regression in Economics.

MODULE II: Index Numbers and Time series Analysis (30 Hours)

Time series analysis-meaning-components- Measurement of trend-graphic method, semi-average method, moving average method and method of least squares.

Index numbers-Meaning and types of Index numbers – Simple and Weighted index numbers CPI and WPI- Problems in the construction of index numbers – Tests of index numbers- Fishers ideal index numbers- factor reversal test and time reversal test – Deflating – Base shifting – Splicing – Uses of Index numbers.

MODULE III: Probability (32 Hours)

Probability- Elements of probability theory (sample space, events) –definition of Probability: Classical and Modern , Relative frequency definition and Axiomatic approach – Addition theorem– multiplication theorem – Conditional Probability –

Random variable- discrete and continuous ,Expectation,Binomial and Normal distribution.

References

1. Murray R. Spiget (1999), Probability Theory Schaum's Series.
2. Lipshutz, (2000), Theory of Probability, Schaum 's Series,
3. S P Gupta,Statistical Methods,Sultan Chand and sons

Semester V

Core VIII EC1543 Readings in Political Economy

4 Hours **4 Credits**

Module I Passages from the Classics (15 hours)

Adam smith-Division of labour, Ricardo-On Rent and Of Machinery, Marx-CMC and MCM' circuit

1.Adam smith;Wealth of Nations,Book 1 ,Chapter 1 'of the division of labour'

,Chapter 3 ' That the division of labour is limited by the extent of market'

http://www.econlib.org/library/Smith/smWN1.html#B.I, Ch.1, Of the Division of Labor

2.David Ricardo ; On the Principles of Political Economy and Taxation Chapter 2 On Rent

http://www.econlib.org/library/Ricardo/ricP1a.html

David Ricardo;On the Principles o Political Economy and Taxation, chapter 31 on Machinery

http://www.econlib.org/library/Ricardo/ricP7.html#Ch.31, On Machinery

3.Karl Marx –Capital Volume 1

Part II The Transformation of money into Capital

Chapter-4 The General formula for Capital

https://www.marxists.org/archive/marx/works/1867-c1/ch04.htm

Robert Heilbroner (1998) Wonderful World of Adamsmith

, Worldly Phlosophers, Robert Heilbroner (1998), Updated Seventh Edition

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http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

Module II Political Economy : Different Perspectives (20 hours)

This section introduces the student to different perspectives of political economy : the perspectives of Adam Smith , John Maynard Keynes

1. Robert Heilbroner (1998) Wonderful World of Adamsmith

, Worldly Phlosophers, Robert Heilbroner (1998), Updated Seventh Edition

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http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

2. The Rise and fall of money- The Mandarin Revolution (Great Depression and the Ideas of Keynes)

3.Glabraith,John Kenneth,'The age of Uncertainty'Houghton Mifflin Company,Boston,1977

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

The Savage Society of Thorestein Veblen

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

The Contradictions of Joseph Schumpeter

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

Module III Global Economic Crisis and its Aftermath (20 hours)

THE Recent Crisis in Global Capitalism : Towards Marxian Understanding

1.Vamsi Vakulabharanam, EPW Vol.44,Issue No.13,March,2009 www.epw.in/system/files/pdf/2009_44/13/The_Recent_Crisis_in_Global_Capitalism_Towards_a_Marxian_Understanding.pdf

Module IV Issues in Political Economy and Development Thinking (20 hours)

Indian Development thinking, Gender equality and Women's empowerment. Social justice through affirmative action in India.

Naila Kabeer (2005)Gender equality and Women's empowerment Development

http://nailakabeer.net/wp-content/uploads/2005/09/13552070512331332273.pdf

Ashwini Deshpande (2012), Social Justice through Affirmative Action in India

http://research.economics.unsw.edu.au/scho/WEE/papers/Ashwini%20Deshpande1.pdf

Semester V

Core IX EC1544 Economic Growth and Development

3Hours **2 Credits**

Course Objectives:

1. To ensure that students begin to understand basic concepts of Economic Growth and Development and thereby enable them to acquire multi dimensional aspects of developmental issues

2. To convey knowledge about theoretical framework of Growth and Development under different Schools of economic thought.

3. To impart knowledge about Political institutions, the role of the state in Economic Development and problems that affect state Governance.

EC 222: ECONOMICS OF SOCIAL SECTOR AND ENVIRONMENT

(Hours per semester: 110
Hours per week: 6)

Objectives

This course is designed to enable students to: (1) Understand and apply the key economic concepts in the context of social sectors like education, environmentand healthcare, (2) Appreciate how economic factors contribute to the development and implementation of educational policies, (3) Identify the major theories governing the development of human resources, school improvement and development, (4) Recognize the important linkages between the environment and economics, (5) Be aware of the key environmental issues around the globe, and (6) Understand approaches to identify and value costs and outcomes to include in economic evaluation of the environment through benefit cost analysis.

Course Contents

Module 1: Economics of Education (20 hours)

Human Capital – Components of Human Capital – Education as an instrument for economic Growth – Demand for Education – Supply of Education – Determinants of demand for Education – Costs of Education - Private Costs and Social Costs- Benefits of Education – Direct, Indirect and Social Benefits – Wastage and Stagnation in Education – Causes and Measures-Manpower Planning-Meaning and Techniques of Forecasting.

Module 2: Economics of Health (20 hours)

Nature and Scope of Health Economics – Health Dimensions of Development – Determinants of Health – Economic Dimensions of Healthcare – Demand for and Supply of Healthcare – Healthcare Financing – Inequalities of Health – Class and Gender Perspectives – Healthcare Sector in India-Health Insurance Schemes in India-RSBY,ESIS,AABY, JBY.

Module 3: Economics of Environment and Environmental Valuation (25 hours)

Environmental Economics – Meaning and Significance – Interlinkage between economy and Environment – Material Balance Model – Law of Entropy – Environmental Kuznets' Curve

Environmental Valuation – Use Values, Non-use Values, Option Values – Approaches to Environmental Valuation – Direct Methods – Contingent Valuation Method, Trade off Games Method, Costless Choice Method, Delphi Method – Indirect Methods – Revealed Preference

Methods – Travel Cost Method, Hedonic Pricing Method, Preventive Expenditure Method, Surrogate Market Approach, Wage Differential Approach– Cost Based Methods and Other methods of Valuation – Cost Benefit Analysis.

Module 4: Environmental Policies and Issues (25 hours)

Environmental Externalities – Design of Environmental Policy – Quantity Based Instruments – Market based Instruments – Pigouvian tax and Subsidy Approach – Non-Market Instruments – Command and Control – Mixed Instruments – Marketable permits – Tradeable Pollution Permits -Bargaining Solution – Coase Theorem – Informal Regulation – Collective Action – Grass Root Movements (Chipko Movement, Save Silent Valley Movement, Narmada Bachao Andolan, Appiko Movement)– Monitoring and Enforcement – The New Model of Pollution Control – Major Environmental Policies and Legislations in India.

Global Environmental Issues – Climate Change Problems, Global Warming, Bio Diversity Loss, Acid Rain, Deforestation, Environmental Pollution.

Module 5: Economics of Natural Resource Management (20 hours)

Natural Resources – Resource Taxonomy – Theories of Optimum Use of Exhaustible and Renewable Resources – Common Property Resource Management – Tragedy of Commons.

Environment Development Trade off – Sustainable Development – Indicators of Sustainable Development – Equity and Sustainable Development – Environment and Trade in the WTO Regime – Environment and System of National Accounts – Green GDP.

Reading List

Module 1

1. Environmental Education in India (2002) Association of Indian Universities, New Delhi.
2. Schultz., T.W. (1971) Investment in human Capital, Free Press, New York
3. Joy A. Palmer, 1998, Environmental Education in 21st century, Routledge, London.
4. Kolstad, D. Charles (2010), Environmental Economics, Oxford University Press.
5. Cohn E. and T. Gaske (1989), Economics of Education, Pergamon Press, London.
6. McMohan, W.W. (1999), Education and Development: Measuring the Social Benefits, Oxford University Press.
7. Becker G.S. (1974), Human Capital (2nd Edition), National Bureau of Economic Research, New York.

UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME
2020 Admission onwards

Semester	I
Course	Core course-I
Course name	**INORGANIC CHEMISTRY I**
Course Code	CH 1141
Credit	2
Hours	36 hours
Lecture-Tutorial-Lab	2-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Discuss the course of development of structure of atom.	U	PSO1
2	Apply rules for filling electrons in classifying elements into s, p,d and f blocks	A	PSO10
3	Define various scales of electronegativities and their applications	U	PSO10
4.	Define Effective nuclear charge and Slater's rules	U,A	PSO10
5	Discuss about diagonal relationship and anomalous behaviour of hydrogen and other first element in each group.	U	PSO4
6	Correlate and predict general properties of s and p block elements based on their electronic configuration.	A	PSO4
7	Realise applications of s and p block elements in sustainable and renewable energy sources.	A	PSO14
8	Define various concepts of acids and bases.	U	PSO11
9	Understand reactions in non aqueous solvents.	U	PSO11
10	Realise various causes, effects and control measures of environmental pollution.	E	PSO13
11	Review national movements for environmental protection.	U, A	PSO21

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Atomic Structure and Periodicity**	**9**	
1.1	Introduction to structure of atom, Rutherford and Bohr model of atom,	1	1
1.2	Dual nature of electron-de Broglie equation-matterwaves and electromagnetic waves. Experimental verification by Davis and Germer method,Heisenberg's uncertainty principle- expression and significance.	1	1
1.3	Wave mechanical concept of the atom-Schrodinger	1	1

	equation and its significance (derivation not required.)		
1.4	Quantum numbers- Pauli's Exclusion principle- Aufbau Principle- Hund's rule- Electronic configuration of atoms- classification of elements into s,p,d and f blocks-	2	1
1.5	Electronegativity- Pauling's scale, Mulliken and Allred-Rochow scale(including numerical problems),	2	4
1.6	Effective nuclear charge, Slaters rule and its applications, diagonal relationship and anomalous behavior of first element with other elements.	2	4,5
2	**Representative elements**	**9**	
2.1	General properties of s and p block elements, Hydrogen – isotopes and its applications- uses as a fuel, water gas	2	6
2.2	Physical properties- atomic radii, ionization enthalpy, electron negativity, electron affinity, Flame colouration, inert pair effect	2	6
2.3	Chemical properties- solubility and thermal stability of alkali and alkaline earth metal oxides, sulphates and hydrides	2	6
2.4	p-block elements- oxides of nitrogen and phosphorus, oxyacids of halogens	1	6
2.5	Allotropism – carbon, sulphur and phosphorus	1	6
2.6	Applications- lithium battery, cesium in photovoltaic cells, selenium in xerography and barium x-ray	1	7
3	**Acids, Bases and non- aqueous solvents**	**9**	
3.1	Arrhenius concept, Lowery –Bronsted, Lewis concepts and Lux Flood concept and its limitations,	2	8
3.2	SHAB principle and its applications,	1	8
3.3	Non – aqueous solvents: General properties- classifications- self ionization and leveling effect-	2	9
3.4	Reaction in non-aqueous solvents- protic and aprotic non-aqueous solvents- examples-solutions of metal s in liquid ammonia- self ionization of liquid ammonia-liquid SO_2, liquid HF, alkali metals in liquid ammonia.	4	9
4	**Environmental chemistry- Air, water and soil pollution**	**9**	
4.1	Air pollution- Air pollution caused by fire works, harmful effects of fire works, acid rain, green house effect, smog- classic and photochemical smog	2	10

	Ozone layer depletion, ozone hole, protection of ozone umbrella. Management of air pollution.		
4.2	Water pollution: causes- heat, industrial waste, sewage water, detergents, agricultural pollutants Treatment of industrial waste water- Activated charcoal, synthetic resins, reverse osmosis and electro dialysis Quality of drinking water- Indian Standard and WHO standard- Dissolved oxygen- BOD , COD.	3	10
4.3	Soil pollution: pesticides, fertilizers, Industrial waste, Plastic. Control of Plastic threat- importance of Plastic identification codes and Plastic recycling, use of biodegradable plastics (PGA,PLA and PHBV(mention only)	2	10
4.3	Control of pollution. Pollution Control Board – Duties and responsibilities Mention environmental movements (Plachimada,Silent valley, movement against Endosulfan, Narmada Bachavo Andolan and Chipko movement)	2	11

Text Books

1. B.R.Puri, L.R,.Sharma, K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers New Delhi,2010
2. F.A.Cotton, G. Wilkinson, Advanced Inorganic Chemistry, Wiley, India(P)Ltd
3. J.D.Lee, Concise Inorganic Chemistry,5thEdn. Wiley, India(P)Ltd.
4. A.K.De,Environmental Chemistry,New Age International(P) Ltd. New Delhi
5. A.K.Ahluwalia, Environmental Chemistry, Ane Books, India, New Delhi.

For Further Reading

1. M.C.Day and J Selbin, Theoretical Inorganic Chemistry,2nd Edn.,Reinhold Book Corp.
2. S.Prakash,G.D.Tuli, S.K Basu, R.D.Madan,Advanced Inorganic Chemistry, Vol. 1.,S Chand
3. J.E.Huheey,E.A.Keiter, R.L.Keiter, O.K.Medhi. Inorganic Chemistry, 4th Edn. Pearson, 2006
4. S.S.Dara, A Textbook of Environmental Chemistry and Pollution Control, 8th Edn. S Chand& Sons, New Delhi.
5. M.N.Greenwood, A .earnshaw, Chemistry of the Elements, 2nd Edn. Butterworth, 1997.

30. How can metallic character change across a period?

31. Describe clearly the link between increasing effective nuclear charge across a period and the changes in van der Waals radius.

SECTION D

Each question carries 15 marks (essay type) Answer any two questions.

32. a.Explain about the pH changes of aqueous solutions of elements in the third period as the period is crossed.
    b. Explain how these changes are directly related to the changes in effective nuclear charge across the period.
    c. Describe the metallic character of elements in a period. (5x3 marks)

33. a.Explain the role of some chemicals in household items. (8 marks)
    b.Write a short note on food adultration. (7 marks)

34. a.Write a short note on the uses and hazards of fertilisers. (8 marks)
    b.Draw the structure of carbon and sodium (shell model) (7 marks)

35. a. Draw the structures showing shapes of methane, water and carbon dioxide (8 marks)
    b.compare the bonding structures of diamond – graphite. (7marks)

UNIVERSITY OF KERALA

OPEN COURSE FOR OTHER MAJORS

2020 Adimission onwards

Semester	V
Course	Open Course
Course name	**ENVIRONMENTAL CHEMISTRY**
Course Code	CH 1551.3
Credit	2
Hours	54 hours
Lecture-Tutorial-Lab	2-0-0

CO No.	**COURSE OUTCOME** *Upon completion of this course, students*	**Cognitive Level**	**PSO No.**
1	Discuss the structure and composition of the atmosphere	U	PSO14
2	Identify,Realise and enlist the causes of pollution to water, soil and air	U	PSO14
3	Become aware of environmental issues and its effect to man and other living beings	U	PSO12
4	Review major environmental disasters and suggest controlling and preventive measures	U	PSO12
5	Discuss the laws of environmental protection	U	PSO21

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Environmental Components** Structure and composition of the, Atmosphere, hydrosphere, biosphere and Lithosphere – composition of atmosphere	**9**	**1,2,3**
2	**Water pollution** Sources, its effect and control; Sampling and measurement of water quality and their analysis, water quality standards, BOD and COD Hard water – soft water Eutrophication and restoration of lakes.	**9**	**1,2,3**
3	**Air Pollution** Types and sources of air pollution, Common Air Pollutants - Effects of air pollution; Smog – ozone layer depletion green house effect – acid rain	**9**	**1,2,3**
4	**Soil Pollution** Sources, types, effects and control of: Land pollution, Marine pollution, Thermal Pollution and Radioactive pollution. Waste separation, storage and disposal ; Waste Reduction, Recycling and Recovery of materials.Plastics and their misuses.	**9**	**1,2,3**
5	**Major environmental disasters** Major environmental disasters - mercury poisoning in Minamata, Japan, Itaiitai disease due to cadmium poisoning in Japan - Love Canal toxic waste site, Seveso disaster chemical plant explosion - Bhopal disaster - Chernobyl incident	**9**	**4**
6	**Major environmental laws:** Environment (Protection Act) – The Air (Prevention and control of pollution) Act – The water (Prevention and control of pollution) Act – The wild life protection Act – Forest conservation Act – The Ozone Depleting Substances (Regulation and Control) Rules – The Plastic Waste (Management and Handling) Rules - Rio declaration- Montreal protocol, Kyoto protocol Introduction to Green chemistry (elementary ideas only)	**9**	**5**

Reference

1. Banerji, K Sameer"Environmental Chemistry", ISBN - 9788120315761.
2. K. De "Environmental Chemistry - An introduction" New Age International (P)Ltd.,2017
3. B. K. Sharma "Air Pollution", Goel Publishing House
4. V. K. Ahluwalia "Environmental Chemistry", books.google.co.in, 2017
5. G.W. vanLoon and S. J. Duffy "Environmental Chemistry: A Global Perspective"
6. S.K.Mohanty, Environment and Pollution Laws, Universal Law Publishing Co. (P)Ltd

സെമസ്റ്റർ	:	**IV**
കോഴ്സ് കോഡ്	:	**ML 1431**
കോംപ്ലിമെന്ററി കോഴ്സ്:		**VII**
സമയക്രമം	:	**ആഴ്ചയിൽ 3 മണിക്കൂർ (18 ആഴ്ചയിൽ 54 മണിക്കൂർ)**
ക്രെഡിറ്റ്	:	**3**

ദളിത് സാഹിത്യം, സ്ത്രീവാദസാഹിത്യം

ദളിത് പഠനമെന്ന വിജ്ഞാനമേഖലയുടെ പശ്ചാത്തലത്തിൽ മലയാളത്തിലെ ദളിത് സാഹിത്യത്തെ തിരിച്ചറിയുക – മലയാളികളുടെ സാംസ്കാരികവൈവിധ്യം സാഹിത്യവഴിയിൽ മനസ്സിലാക്കുക – ചരിത്രത്തിന്റെ വ്യത്യസ്ത ഇടങ്ങളിൽ പാർശ്വവൽക്കരിക്കപ്പെട്ട ജനവിഭാഗങ്ങളെയും അവരുടെ സംസ്കാരത്തെയും സാഹിത്യത്തെയും കുറിച്ച് അറിയുക – മുഖ്യധാരാസംസ്കാരത്തിന്റെ സാഹചര്യങ്ങൾക്കു പുറത്ത് രൂപപ്പെട്ട സംസ്കാരത്തിന്റെ ഒരു ജനകീയധാരയെക്കുറിച്ചു ബോധ്യപ്പെടുക.

സമീപകാല സൈദ്ധാന്തികപഠനങ്ങളിൽ ഏറെ പരാമർശിക്കപ്പെടുകയും വിമർശിക്കപ്പെടുകയും ചെയ്ത 'സ്ത്രീവാദ'ത്തെ പരിചയപ്പെടുക – ലിംഗപരമായ വ്യത്യസ്തതയുടെ അടിസ്ഥാനത്തിലുള്ള വിവേചനത്തിൽ നിന്നും സ്ത്രീകൾക്കു തുല്യനീതി ഉറപ്പാക്കുക എന്ന ലക്ഷ്യത്തോടെ രൂപപ്പെടുത്തിയ ചിന്താപദ്ധതിയും പ്രവർത്തനവും എന്ന നിലയിൽ അതിനെ തിരിച്ചറിയുക – സ്ത്രീകളുടെ വൈയക്തികവും സാമൂഹികവുമായ യാഥാർത്ഥ്യത്തെ വെളിപ്പെടുത്തുകയും ലിംഗകേന്ദ്രിതമായ എല്ലാത്തരം പാർശ്വവല്ക്കരണത്തെയും ചെറുക്കുകയുമാണ് അതിന്റെ രീതിശാസ്ത്രം എന്നു മനസ്സിലാക്കുക – ഫെമിനിസത്തിന്റെ ചരിത്രവികാസത്തിന്റെയും സിദ്ധാന്തങ്ങളുടെയും പൊതു പശ്ചാത്തലത്തിൽ മലയാളത്തിലെ സ്ത്രീപക്ഷരചനകളെ പഠിക്കുക.

സംസ്കാരത്തിലെ വംശ, വർഗ്ഗ, മത, ജാതി, ലിംഗനിർണയനങ്ങളെക്കുറിച്ചുള്ള ധാരണ നവീകരിക്കുകയും മാറുന്ന ലോകത്തിന്റെ പരിതഃസ്ഥിതികളിൽ നിന്നുകൊണ്ട് ഒരു പുതിയ മാനവീയതയെക്കുറിച്ചുള്ള അവബോധം സൃഷ്ടിക്കുകയും ചെയ്യുക ഇതൊക്കെയാണ് ഈ കോഴ്സിന്റെ സവിശേഷ ലക്ഷ്യങ്ങൾ.

പഠനഫലപ്രാപ്തി

1. വംശ വർഗ്ഗലിംഗ നിർണ്ണയനങ്ങളെക്കുറിച്ച് പുതിയ ധാരണകൾ രൂപപ്പെടുന്നു.
2. മാനവീയതയെക്കുറിച്ചുള്ള പുതിയ അവബോധം സ്വായത്തമാക്കുന്നു.
3. ദളിത് സാഹിത്യപഠനത്തിലൂടെ പാർശ്വവല്ക്കരിക്കപ്പെട്ട ജനതയുടെ സാംസ്കാരിക മുന്നേറ്റത്തെയും അവരുടെ സംസ്കാരത്തെയും സാഹിത്യത്തെയും കുറിച്ച് അറിവ് നേടുന്നു.
4. ദളിത് രചനകളുടെയും വാമൊഴി വഴക്കങ്ങളുടെയും പുനർവായനയുടെ ആവശ്യകത തിരിച്ചറിയുന്നു.
5. സ്ത്രീവാദ സാഹിത്യത്തിന്റെ സൈദ്ധാന്തിക നിലപാടുകളെക്കുറിച്ച് സാമാന്യ ജ്ഞാനം നേടുന്നു.

6. മലയാളത്തിലെ സ്ത്രീവാദ സാഹിത്യത്തിന്റെ ചരിത്രം ഗ്രഹിക്കുന്നു.

7. പുരോഗമന ചിന്താഗതിയുള്ള സർഗ്ഗാത്മകസൃഷ്ടികൾ വിലയിരുത്താനും സൃഷ്ടിക്കാനും ശേഷി നേടുന്നു.

മൊഡ്യൂൾ : ഒന്ന് (27 മണിക്കൂർ)

ദളിത് സാഹിത്യം

പഠനഫലപ്രാപ്തി

1. ദളിത് ജീവിതം, പാർശ്വവല്ക്കരിക്കപ്പെട്ടവരുടെ ഭാഷ, സാഹിത്യം എന്നിവ പരിശോധിക്കുന്നു.

2. സാഹിത്യകൃതികളുടെ ഉള്ളടക്കം വിശകലനം ചെയ്ത് അവയിലെ രാഷ്ട്രീയവും പ്രത്യയശാസ്ത്രവും തിരിച്ചറിയുന്നു.

ദളിത് എന്ന പദത്തിന്റെ നിഷ്പത്തി – ഇതര സംജ്ഞകൾ – ദളിത് പദത്തിന്റെ വ്യത്യസ്ത വ്യാഖ്യാനങ്ങൾ – ദളിത്പഠനത്തിന്റെ സാമാന്യചരിത്രം – ആഫ്രിക്കൻ – അമേരിക്കൻ എഴുത്തും കറുപ്പിന്റെ സാംസ്കാരിക മുന്നേറ്റങ്ങളും – ഇന്ത്യൻ പശ്ചാത്തലം – മലയാളത്തിലെ ദളിത് സാഹിത്യം – സാമാന്യാവലോകനം – വാമൊഴി – വരമൊഴി ഭേദങ്ങൾ.

വിശദപഠനം

എ. വാമൊഴി സാഹിത്യമാതൃക :

പാക്കനാർ പാട്ട് (ആദിയില്ലല്ലോ ലന്തമില്ലല്ലോ.....)

ബി. വരമൊഴി സാഹിത്യമാതൃകകൾ :

കവിത

1.	ജാതിക്കുമ്മി (ആദ്യത്തെ 20 ഖണ്ഡങ്ങൾ)–		കെ.പി.കറുപ്പൻ
2.	കണ്ടത്തി	–	രാഘവൻ അത്തോളി
3.	സർവ്വെ ഓഫ് ഇന്ത്യ	–	എം.ബി.മനോജ്

ചെറുകഥ

1.	ഉച്ചയുറക്കത്തിലെ സ്വപ്നങ്ങൾ	–	സി.അയ്യപ്പൻ
2	കളിവീടുകൾ	–	പി.എ.ഉത്തമൻ

നോവൽ

മുക്കണി – ഡി.രാജൻ

മൊഡ്യൂൾ : രണ്ട് (27 മണിക്കൂർ)
സ്ത്രീവാദസാഹിത്യം

സ്ത്രീവാദചിന്തയുടെ ആദ്യാങ്കുരങ്ങൾ – ഇക്കാലത്തെ ഫെമിനിസ്റ്റു ചിന്തയിലെ ശ്രദ്ധേയ വ്യക്തിത്വങ്ങൾ – കൃതികൾ – സ്ത്രീവാദത്തിലെ വ്യത്യസ്ത ധാരകൾ – ഒന്നാംതരംഗ സ്ത്രീവാദം – രണ്ടാംതരംഗസ്ത്രീവാദം – മൂന്നാംതരംഗസ്ത്രീവാദം, പ്രധാന വ്യക്തിത്വങ്ങളും കൃതികളും – ശ്രദ്ധേയങ്ങളായ ഉപധാരകൾ – ഉദാരസ്ത്രീവാദം (Liberal feminism), സോഷ്യലിസ്റ്റു സ്ത്രീവാദം, മാർക്സിസ്റ്റുസ്ത്രീവാദം, മൗലികസ്ത്രീവാദം (Radical feminism), കറുത്തസ്ത്രീവാദം (Black feminism), എക്കോ ഫെമിനിസം – സ്ത്രീവാദവും സാഹിത്യവും – സ്ത്രൈണ സർഗ്ഗാത്മകതയെക്കുറിച്ചുള്ള വ്യത്യസ്ത സമീപനങ്ങൾ – ഭാഷയുടെ

ലിംഗകേന്ദ്രിത സ്വഭാവം – കേരളത്തിലെ സ്ത്രീമുന്നേറ്റങ്ങളുടെ ചരിത്രപശ്ചാത്തലം – മലയാളത്തിലെ സ്ത്രീരചനാപാരമ്പര്യങ്ങൾ – ആദ്യകാല എഴുത്തുകാരികൾ – തുടർന്നുള്ള ഘട്ടങ്ങൾ – മുഖ്യസംഭാവനകൾ.

എ. കവിത

1. സ്വാതന്ത്ര്യം ഒരു പ്രതിമയല്ല – സാവിത്രി രാജീവൻ
2. ദിനചര്യകൾ – ഗിരിജ പാതേക്കര
3. കൈക്കലത്തുണികൾ – വിജില ചിറപ്പാട്

ബി. കഥ

1. സീതാഭാവനം – കെ.സരസ്വതിയമ്മ
2. മനുഷ്യപുത്രി – ലളിതാംബിക അന്തർജ്ജനം
3. ഫാന്റം ബാത്ത് – ഷാഹിന ഇ.കെ.

സി. നോവൽ

ഒസാത്തി – ബീന (ഡി.സി.ബുക്സ്)

സഹായകഗ്രന്ഥങ്ങൾ

1. ദലിത്പഠനം : സ്വത്വം, സംസ്കാരം, സാഹിത്യം – ഡോ. പ്രദീപൻ പാമ്പിരിക്കുന്ന്, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
2. ദലിത് തിരിച്ചറിവുകൾ (എഡി:) ഡോ. അജു. കെ. നാരായണൻ, ഭൂമിമലയാളം, യു.സി. കോളേജ്, ആലുവ.
3. ദലിത്പാതകൾ : (എഡി.) ബോബി തോമസ്, സൈൻ ബുക്സ്, തിരുവനന്തപുരം.
4. ബുദ്ധനിലേക്കുള്ള ദൂരം – കെ. കെ കൊച്ച്, ഡി. സി. ബുക്സ്.
5. ദലിത് സാഹിത്യപ്രസ്ഥാനം – കെ. എം. പുരുഷോത്തമൻ, സാഹിത്യഅക്കാദമി.
6. ദലിത് സാഹിത്യം – കവിയൂർ മുരളി, കറന്റ് ബുക്സ്, കോട്ടയം.
7. ദലിത് ഭാഷ – കവിയൂർ മുരളി.
8. കീഴാളജീവിതമുദ്രകൾ – ഡോ. പി. ജി. പത്മിനി, സമയം പബ്ലിക്കേഷൻസ്.
9. ദലിത് വർത്തമാനം (എഡി.) രാജേഷ് ചിറപ്പാട്, മൈത്രി ബുക്സ്, തിരുവനന്തപുരം.
10. 500 വർഷത്തെ കേരളം – ചില അറിവടയാളങ്ങൾ – (ജന. എഡി.) ഡോ. സ്കറിയാ സക്കറിയ, താരതമ്യപഠനസംഘം, കറന്റ് ബുക്സ്, കോട്ടയം.
11. വായനയുടെ ദലിത് പാഠം – കെ. കെ. കൊച്ച്, പൂർണ്ണ പബ്ലിക്കേഷൻസ്.
12. ദലിതന്റെ നിനവും നോവും നാടൻ പാട്ടുകളിൽ – ഡോ. കുമാരൻ വയലേരി, പാപ്പിയോൺ, കോഴിക്കോട്.
13. ദലിത് സാഹിത്യം പരസ്യകല – ഡോ. വി. സി. സുപ്രിയ/ ഡോ. കെ. കെ. ശിവദാസ്, ഡോ. സന്തോഷ് മാനിച്ചേരി – മാളുബൻ പബ്ലിക്കേഷൻസ്.
14. കീഴാളന്റെ പ്രതിരോധതന്ത്രം – ഷീബ എം. കുര്യൻ.
15. കാവ്യഭാവനയുടെ സ്ത്രീപഠനങ്ങൾ – ഡോ. എ. ഷീലാകുമാരി.
16. സമ്യക്ക് – ഡോ.എം.ബി.മനോജ് (എഡിറ്റർ)

2021-22

SEMESTER-II

FOUNDATION COURSE

METHODOLOGY AND PERSPECTIVES IN PLANT SCIENCES

Course code : BO 1221, Number of credits : 3

Number of contact hours: 36 hrs (Lecture); 36hrs (Practical) Total= 72 hours

Distribution of Hours	Theory	Practical
Scientific Studies	08 hrs	0 hrs
Data handling in science	12 hrs	16 hrs
Microtechnique	06 hrs	08 hrs
Biophysics	10 hrs	12 hrs
Total	36 hrs	36 hrs

Aim of the course: To introduce the methodology and perspectives of Science in general so as to enable the students to systematically pursue his particular discipline in science in relation to other disciplines that come under the rubric of sciences.

Objectives:

- To familiarize the students with the fundamental characteristics of science and significance of scientific studies
- To apply scientific methods independently and familiarize instruments in biological labs
- To interpret scientific data using basic statistical methods
- To develop skills for microscopic specimen preparation.

MODULE-I

Scientific Studies **08hrs**

1. Types of knowledge: Practical, theoretical and scientific knowledge
2. Information: What is science; what is not science; laws of science; basis of scientific laws and factual truths.
3. Science as a human activity: scientific temper and empiricism, Science disciplines
4. Revolution in Science and Technology
5. Ethics in Science: Transparency and Honesty; danger of pre conceived ideas.
6. Scientific information: Depositories of scientific information, Primary, secondary and digital sources; sharing of knowledge.
7. Methods and tools in science: Steps in scientific method. Null hypothesis and alternative hypothesis. Inductive and deductive reasoning.

MODULE- II

Data handling in science **12hrs**

1. Nature and types of data - Typical examples, Data collection, Data presentation-

Classification and tabulation, diagrammatic presentation (bar & pie diagrams) and graphic presentation (Histogram, frequency polygon, frequency curve & Ogives).
2. Samples and sampling techniques.
3. Statistical treatment of data: Statistical terms and symbols. Measures of central tendencies (mean, median, mode), Measures of dispersion (range, mean deviation, variance, standard deviation, coefficient of variation), Significance tests (chi-square test).

Practicals **16hrs**

1. Workout problems on frequency distribution
2. Represent data using bar diagram and histogram
3. Measures of central tendencies (Mean, Median,Mode)
4. Workout problems on measures of dispersion (range, mean deviation, variance, standard deviation, coefficient of variation)
5. Workout problems on chi-square test.

MODULE-I11

Microtechnique **06hrs**

1. Introduction - microscopy - simple and compound – phase contrast; dark field illumination and electron microscopes (SEM and TEM).
2. Micrometry, Camera lucida
3. Sectioning - hand and microtome– rotary and sledge
4. Killing and fixation agents – Carnoy's formula, Farmers formula, F .A.A
5. Dehydration - reagents
6. Stains and staining techniques - double staining. General account; Stains: safranin, haematoxylin, acetocarmine.
7. Mounting media - D. P. X and Canadabalsam
8. Whole mounts - cytological methods: maceration, smear and squash preparation.

Practical **08hrs**

1. Familiarize stains, fixatives and mounting media
2. General awareness of Micro technique - maceration, smears &squash
3. Demonstration of microtome sectioning and hand sectioning
4. Measurement of specimens using micrometer (Demonstration only).
5. Photomicrography and Camera lucida drawings (Demonstration only).

MODULE-IV

Biophysics **10hrs**

1. Principles and applications of Colorimeter, Spectrophotometer (UV-Visible) and Centrifuge- centrifugation, types of rotors (swinging bucket, fixed angle), Density gradient and Differential centrifugation.
2. Basic knowledge of the separation methods: - Chromatography (Column chromatography, paper chromatography and TLC), Electrophoresis (PAGE and AGE).
3. Buffers -their functions in biological systems - Uses of buffers in biological research, pH meter.
4. Cryobiology – cryopreservation, freeze drying (lyophilisation) and its applications.

Practical **12hrs**

1. Separation of plant pigments by paper chromatography/TLC.
2. Preparation of buffer
3. Measurement of pH
4. Construct the absorption spectrum of any sample.

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2. Bass, Joel, E et al. (2009). Methods for teaching Science as Inquiry, Allyn&Bacon
3. Blair E .J. (1987) Introduction to chemical instrumentation Mc-Graw Hill Book Company
4. Casey E. J. (1063) Biophysics – Concepts and Mechanisms Van Nostr and Reinhold Company
5. Collins H. and T Punch (1993). The Golem. What everyone should know about Science. Cambridge Univ. Press
6. Donald A. Johansen (1940) Plant Microtechnique- Mac Graw Hill Book company
7. Elizabeth Allman (2004). Mathematical Methods in Biology, Cambridge University Press India Pvt. Ltd
8. Gieryn T.F. (1999). Cultural Boundaries of Science, Univer. Chicago Press.
9. Hewitt, Paul G, Suzanne Lyons, John A, Suchocki and Jennifer Yeh (2007). Conceptual Integrated Science, Addison-Wesley
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11. Khan and Khanum (1994). Fundamentals of Biostatistics, Saras Publications
12. Marcello Pagano and Kimberlee Gauvreau (2018) Principles of Biostatistics 2nd Edition CRC Press, Chapman & Hall
13. Newton RG (2000) The truth of Science, 2nd edition, Harward University Press
14. Pattabhi V & Gautham N (2011)Biophysics, Narosa publishers
15. Peter Grey (2018) Hand book of microtechnique-Mac Graw Hill Book company
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17. Saha I and Paul B (2016) Essentials of Bio-statistics 2nd Edition Academic Publishers
18. Stephen W. Looney (2009). Biostatistical Methods, Humana Press, Springer International Edn.
19. Veer Bala Rastogi (2008). Fundamentals of Biostatistics, Ane Books Pvt. Ltd
20. Willard H. H., J .A. Dean, L. L. Merritt and F. A. Settle (2011) Instrumental methods of analysis, CBS Publishers and Distributors N. Delhi

EXPECTED OUTCOME

- Students will be familiarized with the fundamental characteristics of Science.
- Develops an idea about involvement of science in improvement of human life.
- Create awareness of scientific approach towards life and learns the values of ethics in science.
- Develops skills to interpret scientific data using basic statistical methods.
- Create skills to prepare specimens for microscopic and gross anatomical studies and familiarize with different microscopic methods for sample analysis.
- Students become able to prepare buffers, measure pH, separate plant pigments and construct absorption spectrum of a sample.

SEMESTER-V

ENVIRONMENTAL STUDIES AND PHYTOGEOGRAPHY

Course code: BO 1542 Number of Credits : 4

Number of contact hours : Lecture: 90 hrs; Practical: 36 hrs; Total: 126 hrs

Distribution of Hours	Theory	Practical
Environmental Studies	72 hrs	36 hrs
Disaster Management	09 hrs	00 hrs
Phytogeography	09 hrs	00 hrs
Total	90 hrs	36 hrs

Aim of the course: To inculcate environmental awareness among students for protecting the Nature.

Objectives:

1. To create awareness about ecosystem and Natural resources.
2. To generate knowledge about importance of Biodiversity conservation
3. To understand the need to mitigate pollution and strategies for disaster management
4. To impart knowledge about phytogeographical regions

MODULE-I

Natural resources and its conservation **12hrs**

5. Natural Resources - Renewable and Non-renewable - Land & Soil, Water, Energy, Minerals, Food and agriculture, Forests, Plants & Wild life resources. Degradation of natural resources - Land degradation, degradation of water resources, Loss of flora and fauna; Causes – population explosion, over exploitation, deforestation, agriculture mismanagement, desertification, overgrazing, soil erosion, mining, urbanization and industrialization- change in land use, depletion of water resources.
6. Conservation of Natural resources and sustainable life styles.
   Land and soil- Afforestation, regeneration of wasteland
   Water - Rain water harvesting, ground water dams
   Energy - Promoting use of renewable resources-solar, tidal and wind; biodiesel, biofuels.
   Forests- Reforestation, Community forestry programmes

MODULE- II

Ecosystems **22 hr**

1. Ecosystems - Concept, definition, structure and function; components- biotic and abiotic; energy flow
2. Food chains -Food web & ecological Pyramids, biogeochemical cycles - Carbon and Phosphorous cycle
3. Ecological succession-Definition, primary and secondary succession, climax

concept, hydrosere and xerosere.

4. Plant adaptations- Morphological, anatomical& physiological adaptations of – Hydrophytes, Xerophytes, Halophytes, Epiphytes, Parasites
5. Introduction- types, characteristic features, structure and functions of the following ecosystems.
6. Forest ecosystem, 2. Grassland ecosystem, 3. Desert ecosystem, 4. Aquatic ecosystems- Ponds, Streams, Rivers, Oceans, Estuaries (brief account only)

MODULE-III

Biodiversity and its conservation **18hrs**

1. Introduction, Definition- genetic, species and ecosystem diversity; biodiversity index (Shannon index)
2. Hot-spots of biodiversity; India as mega-diversity nation.
3. Threats to biodiversity: land use changes & habitat destruction, poaching of wild life- hunting & export, Overuse of pesticides, invasive species.
4. IUCN, Red data Book; Extinct and Threatened species- endangered & Rare; Endemic species of Western Ghats.
5. Conservation of biodiversity: In-situ (National parks and Wild life sanctuaries) and Ex-situ conservation (botanical gardens); Biosphere Reserves & World Heritage Sites in India-Ramsar sites, Chilka lake.
6. Global initiatives in biodiversity conservation- Stockholm Conference, Montreal Protocol, Convention on Biological diversity Regional initiatives- Chipko movement, National Biodiversity Authority (NBA), Access and Benefit sharing (ABS),A brief account on conservation efforts in Kerala- Kerala State Biodiversity Board (KSBB), People Biodiversity Register.

MODULE-IV

Environmental pollution **20hrs**

1. Definition, causes, effects and control measures of – 1. Air pollution, 2. Water pollution, 3. Soil pollution, 4. Marine pollution, 5. Noise pollution, 6. Thermal pollution.
2. Solid Waste Management- waste minimization, Recycling and Reuse, Consuming environment friendly products. E-waste management.
3. Environmental Legislations - Environment protection Act (1986); Air [prevention and control of pollution] Act (1981; Amended 1987); Water [prevention and control of pollution] Act (1974; Amended 1988); Wildlife Protection Act (1972); Forest conservation Act (1980). (Scope and relevance only)
4. Environmental Organisations –UNEP, IPCC, WWF, Central Pollution Control Board

MODULE-V

Disaster management **09hrs**

1. Introduction, Definition and terminologies; scope and concept of disaster management.
2. Natural and Environmental disasters-a brief description of the following disasters-

earth quake, flood, coastal disasters, landslides, tsunami(role of mangroves in controlling tsunami disaster), cyclone, dam collapse, nuclear disaster, chemical disaster, biological disaster.

3. Environmental Issues - Global warming and sea level rise, Acid rain, Ozone layer depletion- causes and effects.
4. Disaster management – four phases – mitigation, preparedness, responses, recovery. Emergency procedures and warning systems, application of GIS (brief account only).

MODULE-VI

Phytogeography 9 hrs

1. Concept & definition, species distribution- continental drift, continuous and discontinuous distribution.
2. Vegetation in India – Forests- tropical, temperate, sholas, sub alpine, alpine, mangroves & Grass lands.
3. Phytogeographical regions of India - Western and eastern Himalayas, Desert, Western Ghats, Deccan Peninsula, Gangetic Plain, North East India, Coasts & Islands

Practical 36hrs

1. Visit a local polluted site and report major pollutants.
2. Visit a mangrove vegetation and report diversity
3. Study of ecological and anatomical modifications of Xerophytes, Hydrophytes,
4. Halophytes, Epiphytes and Parasites.
5. Observation and study of different ecosystems mentioned in the syllabus.
6. Phytogeographical regions of India- Photos/Diagrams

REFERENCE

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2. Ahluwalia VK and Sunitha Malhotra, (2009). Environmental science, Ane Books Pvt.Ltd.
3. Ambasht R.S. (2008) Text book of Plant Ecology, Students and Friends &Co. Varanashi.
4. Anji Reddi M. (2000). Remote sensing and Geographic Information System. B.S. Publications, Hyderabad.
5. Aravind Kumar (2009). Pollution and Biodiversity, Biosocial aspects, , Daya Publishing House
6. Asthana D.K and Meera Asthana, (2006). A Text Book of Environmental Studies, S. Chand & Company Ltd. New Delhi.
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8. Chang Kang – Tsung (2007). Introduction to GIS. Tata McGraw Hill Education.
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21. Jenson J.R. and R.R. Jensen (2012). Geographic Information Systems. Pearson Inc.
22. Krishnamoorthy K V (2012)An Advanced text book of Biodiversity Conservation, Principles and Practise, Oxford& IBH publishers Co Pvt. Ltd
23. Kumaresan B. (2009). Plant Ecology & Phytogeography– Rastrogi Publications :
24. Martin, D.(1991). Geographic Information Systems and their socio economic Applications. Routledge, N.Y.
25. Misra S P and Pandey S N. (2009). Essential Environmental studies, Ane Books Pvt. Ltd
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27. Patrick L. Abbott, (2008).Natural disasters Mc Graw Hill International Edition.
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29. Prithipal Singh, (2007). An Introduction to Biodiversity. Ane Books Pvt.Ltd
30. Rajib Shaw and Krishnamurthy R. R., (2009).Disaster Management, Universities Press (India) Pvt. Ltd., Hyderabad.
31. Ronald Good (1974). The Geography of Flowering Plants 4 th editionAddison-Wesley Longman Ltd
32. Sharma, P.D. (1981) Elements of Ecology , Rastogi's Company Ltd.,Publications
33. Stephen Wise. (2002). GIS Basics, Taylor and Francis, New York.
34. Thomas M. Lillesand and Ralph W. Kiefe (1987). Remote sensing and Image interpretation 7th Edn., John Wiley and Sons, New York.
35. Vaidya K. S. (1987). Environmental Geology. Tata Mc Graw Hill (Pub.).
36. Vashista P.C (1984) Plant Ecology Edu. Vishali Publications.
37. Verma and Agarwal (2010) – Principles of Ecology, S. Chand andCo.
38. Verma, P. S. and V. K. Agrawal. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology.S. Chand & Company Ltd., NewDelhi.
39. White G.H. (ed). (1999)Natural hazards – local, national, global: Oxford University Press.

EXPECTED OUTCOME

- Develops awareness about natural resources, its conservation and importance of sustainable lifestyles.

SEMESTER-V

- Understands and identify different ecosystems and ecosystem processes.
- Develops deep understanding about biodiversity and importance of its conservation
- Develops skills to identify polluted sites, its major pollutants and recognize the need to mitigate environmental pollution
- Awareness about different types of disasters and to adopt strategies to overcome and reduce the impact
- Identify the importance of phytogeographical sites in India

Semester IV

Zoology Core course III

ECOLOGY, HABITAT DESTRUCTION & DISASTER MANAGEMENT

Course code – ZO 1441

No. of credits - 3 **Total hours 54**

Course Outcomes

- Students get basic knowledge on ecosystem, food chain, food web and energy flow.
- Students acquire general awareness on pollution and their impacts.
- Imparts basic knowledge on ecosystems and their functioning.
- Students learn about various types of anthropogenic pressures on ecosystem, related degradation and management measures.
- Students get awareness of toxicants, their impacts on human health and environment and remedial measures.
- Create awareness about disasters, prevention and mitigation measures.

ECOLOGY **4 hrs**

Module I

Components of ecosystem: Environmental factors - abiotic factors, light, temperature, soil, air; biotic factors- autotrophs, phagotrophs and saprotrophs; ecosystem interaction and relationship between biotic and abiotic factors, the cybernetic nature and the stability of the system. Pond as an ecosystem (self study)

Module II **5 hrs**

Biogeochemical cycles: Basic types of biogeochemical cycles - gaseous cycle-carbon and nitrogen cycles, mention sedimentary cycles (P and S), recycling pathways and recycle index.

Limiting Factors- basic concepts- Leibig's law of minimum, Shelford's law of tolerance, combined concept of limiting factors, Light and temperature as limiting factors.

Module III **8 hrs**

Habitat Ecology: Biosphere classification- lithosphere, hydrosphere and atmosphere physical features, fauna and their adaptations of aquatic, terrestrial and marine habitats (self study).

Population ecology: Properties of population- density, natality, mortality, age distribution, biotic potential, environmental resistance and carrying capacity, population growth forms, J and S shaped curves, emigration, immigration and migration, population fluctuation. Community ecology: Definition and characters, species diversity; stratification; dominance; ecotone and edge effect; ecological indicators; community periodicity, succession.

Module IV **5hrs**

Anthropogenic impact on ecosystem: Ionizing radiation and radioisotopes, ionizing radiation and human health, radiation accidents and other exposures, disposal of radioactive wastes, pesticides like DDT, endosulfan, furadan, insect repellants , e-wastes. Monitoring of pollutants - physical, chemical and biological.

Module V **3 hrs**

Wild life conservation and management: Significance, causes of extinction, concepts of threatened species, red data book, IUCN, WWF, CITES, Green Environment and Green peace; protected areas, biosphere reserves, national parks and sanctuaries in India, forests in India, desertification, deforestation, carbon trading; importance of mangroves in coastal ecosystems-conservation and management.

Module VII **9 hrs**

Environmental biotechnology: Biotechnological methods of pollution detection, biotechnological methods in pollution management, bioremediation, biotechnology and biodegradation, genetically engineered microbes in bio-treatment of waste, eco-friendly bioproducts for environmental health, bio-piracy, bio-pesticides and bio-fertilizers, organic farming and its merits. Green chemistry - designing a Green synthesis, basic principles of Green chemistry.

Module VIII **5 hrs**

Environment Movements

Environment and health - Environment and development: Environmental Movements (Chipko, Narmada Bachao Andolan). environmental movements in Kerala (Madhav Gadgil/Kasturi Rangan Reports. Ramsar sites Wetland Reclamations and localized anti-reclamation movements) Kerala state Biodiversity Board, Biodiversity Register.

DISASTER MANAGEMENT

Module IX **8 hrs**

Disruption in Ecosystem

Natural-flood, Draught, Earth quaque, Cyclone, Tsunamis, Volcanic eruption. Anthropognic influence on erosion, climate change and pollution. Mining activities Monoclonal plantations, genetically modified plants and their impact in ecosystem. Impact of Developmental projects such as construction of dams, Hydroelectric projects Thermal power station.

Module X **7 hrs**

Disaster Management – Meaning and Definition: Definitions of Disaster, Hazard, Risks. Vulnerability, and Resilience and their relationship: Classification of disasters- Human induced and Natural; Cause of Disasters; Impact of disasters. Factors affecting Vulnerability – Economic, Political, Environmental and Social Counselling.

Assignment/Seminar

Global warming, Green House Effect, Ozone depletion Climate change, Kyoto protocol

Reference

- Beck, W. S., Liem, K. F. & Simpson, G.G. (1991). *Life: An Introduction to Biology* (3rd Ed.) Harper Collins Publishers, New York, pp 1361. ISBN : 006500009 9
- Bharucha,E. (2005). *Textbook of Environmental Studies*. Universities Press (P)Ltd. India, pp 276. ISBN 81 7371 540 8.
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- Agarwal, A. and Sen, S.: The Citizen's Fifth Report, Centre for Science and Environment. New Delhi 1999
- Chandna, R.C.: Environmental Awareness, Kalyani Publishers, New Delhi, 1998
- Sharma, H.S.: RathambhoreSanctuary - Dilemma of Eco-development, Concept.
- www.ifrc.org/en/what-we-do/disaster-management/
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- Bhatia .A.1. Current trends in Global EnvironmentNew India publishing_ Agency,
- Bishop.P.L. (2000). Pollution Prevention: Fundamentals and Practice,
- Brace, C.L. (1967). The stages of Human Evolution, Prentice Hall International.CambridgeUniversity Press.33.
- Chapman J.L.and M.J.. (1999). Ecology - Principles and Applications.
- Chatterjee B. (2003). Environmental Laws: Imple mentation problems

1644Environmental Economics and Disaster Management (Core)

Module I Basic Concepts (5 Hrs)

Basic Concepts of environmental economics – economics and ecology – ecology and eco system

Module II Theory of Externalities (15 Hrs)

Market system and environment of externalities – Pareto optimum and Market failure in the presence of Externalities – Property rights and the Coase theorem

Module III Environmental Policy Tools for Analysis (20 Hrs)

Pigouvian Taxes and Effluent Charges; Tradable Permits – Environmental Valuation – Types of Economic Values – Non Market Valuation Methods – Cost Benefit Analysis – Sensitivity and Risk analysis

Module IV Global Environmental Issues (7 Hrs)

Economics of Climate Change – Agreements and Institutions - Population Growth and the Environment – Trade and Environment – Concept and Measurement of Sustainable Development

Module V Disaster Management in india (8 Hrs)

Concept and Definitions (Disaster, Hazard, Vulnerability, resilence, Risk) – Hazard and Vulnerability Profile of India – Institutional Arrangeems (Mitigation, DM Act and Policy, Plans Programmes and Legislation),Disaster management in India

Basic Readings

1. Hussain, M, Ahmed. 2000. Principles of Environmental Economics. Routledge, London and New York
2. Charles Kolstad, Intermediate Environmental Economics, Oxford University Press, 2nd edition
3. Carter, Nick 1991. Disaster Management: Disaster Manager's Handbook, Asiaan Development Bank, Manila Pilippiens.
4. Gupta Anil K, Sreeja S Nair, 2011 Environmental Knowledge for Disaster Management, NIDM, New Delhi

5. ELECTIVE

6. EC1661.1 KERALA ECONOMY

7.

8. Inst Hours-4 Number of Credit-2

9. Course Objective

10. To understand the structural changes, Sector-wise contribution and features of the Kerala Economy since the formation of the state and enable the students to have a basic understanding of the emerging trends and issues of Kerala Economy

11.

12. MODULE I: Structure of Kerala Economy

13. Development experience of Kerala: An overview: Kerala's development since the formation of the state-Features of the Economy- Structural composition – Primary, Secondary and Tertiary Sectors – changes over the years NSDP,GSDP and PCI – "Kerala Model of Development" –A comparison with the highest SDP state in India – HDI Status

14.

15. MODULE II: Demographic change: A boost to Economic change

16.

17. Demographic Aspects (birth rate, death rate, infant mortality rate, sex ratio, age distribution)- why sex ratio is in favour of women in Kerala –need for women empowerment – Aging problem- Urbanisation, Migration and Emigration-Economic and social Impacts of Migration, return migration and interstate migration - Nature and Magnitude of Urban, Rural and Educated Unemployment - Trends in Urban and Rural Poverty in Kerala- Major poverty alleviation schemes.

18.

19. MODULE III: Kerala's Economic Development : Sector-wise Analysis

20.

21. Agricultural development since 1956: Objectives of Land reforms- Measures of Land

them to apply these tools in Economics.

MODULE I: Univariate Analysis, Correlation and Regression (35 Hours)

Univariate analysis – frequency tables, Measures of central tendency, dispersion, standard deviation, coefficient of variation, Lorenz Curve, Gini Concentration ratio-Geometric mean, Harmonic mean

Correlation--Simple, Partial and Multiple correlation- Scatter diagram-Karl Pearson's coefficient of correlation-Spearman's rank correlation- probable error- uses of correlation.

Simple and multiple linear regression- Method of Least Squares-Lines of regression- Regression coefficient-Relation between regression and correlation coefficients-Uses of regression in Economics.

MODULE II: Index Numbers and Time series Analysis (30 Hours)

Time series analysis-meaning-components- Measurement of trend-graphic method, semi-average method, moving average method and method of least squares.

Index numbers-Meaning and types of Index numbers – Simple and Weighted index numbers CPI and WPI- Problems in the construction of index numbers – Tests of index numbers- Fishers ideal index numbers- factor reversal test and time reversal test – Deflating – Base shifting – Splicing – Uses of Index numbers.

MODULE III: Probability (32 Hours)

Probability- Elements of probability theory (sample space, events) –definition of Probability: Classical and Modern , Relative frequency definition and Axiomatic approach – Addition theorem– multiplication theorem – Conditional Probability –

Random variable- discrete and continuous ,Expectation,Binomial and Normal distribution.

References

1. Murray R. Spiget (1999), Probability Theory Schaum's Series.
2. Lipshutz, (2000), Theory of Probability, Schaum 's Series,
3. S P Gupta,Statistical Methods,Sultan Chand and sons

Semester V

Core VIII EC1543 Readings in Political Economy

4 Hours **4 Credits**

Module I Passages from the Classics (15 hours)

Adam smith-Division of labour, Ricardo-On Rent and Of Machinery, Marx-CMC and MCM' circuit

1.Adam smith;Wealth of Nations,Book 1 ,Chapter 1 'of the division of labour'

,Chapter 3 ' That the division of labour is limited by the extent of market'

http://www.econlib.org/library/Smith/smWN1.html#B.I, Ch.1, Of the Division of Labor

2.David Ricardo ; On the Principles of Political Economy and Taxation Chapter 2 On Rent

http://www.econlib.org/library/Ricardo/ricP1a.html

David Ricardo;On the Principles o Political Economy and Taxation, chapter 31 on Machinery

http://www.econlib.org/library/Ricardo/ricP7.html#Ch.31, On Machinery

3.Karl Marx –Capital Volume 1

Part II The Transformation of money into Capital

Chapter-4 The General formula for Capital

https://www.marxists.org/archive/marx/works/1867-c1/ch04.htm

Robert Heilbroner (1998) Wonderful World of Adamsmith

, Worldly Phlosophers, Robert Heilbroner (1998), Updated Seventh Edition

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http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

Module II Political Economy : Different Perspectives (20 hours)

This section introduces the student to different perspectives of political economy : the perspectives of Adam Smith , John Maynard Keynes

1. Robert Heilbroner (1998) Wonderful World of Adamsmith

, Worldly Phlosophers, Robert Heilbroner (1998), Updated Seventh Edition

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http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

2. The Rise and fall of money- The Mandarin Revolution (Great Depression and the Ideas of Keynes)

3.Glabraith,John Kenneth,'The age of Uncertainty'Houghton Mifflin Company,Boston,1977

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

The Savage Society of Thorestein Veblen

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

The Contradictions of Joseph Schumpeter

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

Module III Global Economic Crisis and its Aftermath (20 hours)

THE Recent Crisis in Global Capitalism : Towards Marxian Understanding

1.Vamsi Vakulabharanam, EPW Vol.44,Issue No.13,March,2009 www.epw.in/system/files/pdf/2009_44/13/The_Recent_Crisis_in_Global_Capitalism_Towards_a_Marxian_Understanding.pdf

Module IV Issues in Political Economy and Development Thinking (20 hours)

Indian Development thinking, Gender equality and Women's empowerment. Social justice through affirmative action in India.

Naila Kabeer (2005)Gender equality and Women's empowerment Development

http://nailakabeer.net/wp-content/uploads/2005/09/13552070512331332273.pdf

Ashwini Deshpande (2012), Social Justice through Affirmative Action in India

http://research.economics.unsw.edu.au/scho/WEE/papers/Ashwini%20Deshpande1.pdf

Semester V

Core IX EC1544 Economic Growth and Development

3Hours **2 Credits**

Course Objectives:

1. To ensure that students begin to understand basic concepts of Economic Growth and Development and thereby enable them to acquire multi dimensional aspects of developmental issues

2. To convey knowledge about theoretical framework of Growth and Development under different Schools of economic thought.

3. To impart knowledge about Political institutions, the role of the state in Economic Development and problems that affect state Governance.

EC 222: ECONOMICS OF SOCIAL SECTOR AND ENVIRONMENT

(Hours per semester: 110
Hours per week: 6)

Objectives

This course is designed to enable students to: (1) Understand and apply the key economic concepts in the context of social sectors like education, environmentand healthcare, (2) Appreciate how economic factors contribute to the development and implementation of educational policies, (3) Identify the major theories governing the development of human resources, school improvement and development, (4) Recognize the important linkages between the environment and economics, (5) Be aware of the key environmental issues around the globe, and (6) Understand approaches to identify and value costs and outcomes to include in economic evaluation of the environment through benefit cost analysis.

Course Contents

Module 1: Economics of Education (20 hours)

Human Capital – Components of Human Capital – Education as an instrument for economic Growth – Demand for Education – Supply of Education – Determinants of demand for Education – Costs of Education - Private Costs and Social Costs- Benefits of Education – Direct, Indirect and Social Benefits – Wastage and Stagnation in Education – Causes and Measures-Manpower Planning-Meaning and Techniques of Forecasting.

Module 2: Economics of Health (20 hours)

Nature and Scope of Health Economics – Health Dimensions of Development – Determinants of Health – Economic Dimensions of Healthcare – Demand for and Supply of Healthcare – Healthcare Financing – Inequalities of Health – Class and Gender Perspectives – Healthcare Sector in India-Health Insurance Schemes in India-RSBY,ESIS,AABY, JBY.

Module 3: Economics of Environment and Environmental Valuation (25 hours)

Environmental Economics – Meaning and Significance – Interlinkage between economy and Environment – Material Balance Model – Law of Entropy – Environmental Kuznets' Curve

Environmental Valuation – Use Values, Non-use Values, Option Values – Approaches to Environmental Valuation – Direct Methods – Contingent Valuation Method, Trade off Games Method, Costless Choice Method, Delphi Method – Indirect Methods – Revealed Preference

Methods – Travel Cost Method, Hedonic Pricing Method, Preventive Expenditure Method, Surrogate Market Approach, Wage Differential Approach– Cost Based Methods and Other methods of Valuation – Cost Benefit Analysis.

Module 4: Environmental Policies and Issues (25 hours)

Environmental Externalities – Design of Environmental Policy – Quantity Based Instruments – Market based Instruments – Pigouvian tax and Subsidy Approach – Non-Market Instruments – Command and Control – Mixed Instruments – Marketable permits – Tradeable Pollution Permits -Bargaining Solution – Coase Theorem – Informal Regulation – Collective Action – Grass Root Movements (Chipko Movement, Save Silent Valley Movement, Narmada Bachao Andolan, Appiko Movement)– Monitoring and Enforcement – The New Model of Pollution Control – Major Environmental Policies and Legislations in India.

Global Environmental Issues – Climate Change Problems, Global Warming, Bio Diversity Loss, Acid Rain, Deforestation, Environmental Pollution.

Module 5: Economics of Natural Resource Management (20 hours)

Natural Resources – Resource Taxonomy – Theories of Optimum Use of Exhaustible and Renewable Resources – Common Property Resource Management – Tragedy of Commons.

Environment Development Trade off – Sustainable Development – Indicators of Sustainable Development – Equity and Sustainable Development – Environment and Trade in the WTO Regime – Environment and System of National Accounts – Green GDP.

Reading List

Module 1

1. Environmental Education in India (2002) Association of Indian Universities, New Delhi.
2. Schultz., T.W. (1971) Investment in human Capital, Free Press, New York
3. Joy A. Palmer, 1998, Environmental Education in 21st century, Routledge, London.
4. Kolstad, D. Charles (2010), Environmental Economics, Oxford University Press.
5. Cohn E. and T. Gaske (1989), Economics of Education, Pergamon Press, London.
6. McMohan, W.W. (1999), Education and Development: Measuring the Social Benefits, Oxford University Press.
7. Becker G.S. (1974), Human Capital (2nd Edition), National Bureau of Economic Research, New York.

1	EN 1121	Foundation Course 1: Writings on Contemporary Issues
2	EN 1211.1	Language Course 3: Ability Enhancement Compulsory Course- Environmental Studies and Disaster Management
3	EN 1331	Complementary Course 5: Narratives of Resistance
4	EN 1641	Core Course 11: Gender Studies

Semester I

Foundation Course 1- EN 1121 (B A/ B. Sc) and CG 1121.3 [Career Related 2 (a) Programme]

Course Title: WRITINGS ON CONTEMPORARY ISSUES

Credits: 2

Hours: 4/week (72 hrs)

Learning Objectives:

1. To sensitize students to the major issues in the society and the world.
2. To provide students with a variety of perspectives on contemporary issues.
3. To encourage them to read literary pieces critically.

Learning Outcomes:

On completion of the course, the students should be able to

1. Have an overall understanding of some of the major issues in the contemporary world
2. Respond empathetically to the issues of the society
3. Read literary texts critically

Course Description

1. Living in the Planet of the Apps by Khyrunnisa A.
2. Ageing in India: Some Social Challenges to Elderly India by Abhay B. Mane
3. India's Women: The Mixed Truth by Amartya Sen
4. Drug Abuse: Causes and Solutions by Samudranil Mukherjee
5. Artificial Intelligence by Gareth Southwell
6. Universal Declaration of Human Rights by Leah Levin
7. What Secularism is and is not by Romila Thapar
8. The Globalisation of Inequality by P. Sainath

Textbook Prescribed:

Thoughts of Our Times

Edited by Dr. C.A. Lal, Associate Professor of English, School of Distance Education, University of Kerala and Vishnu Narayanan, Assistant Professor, Institute of English, University of Kerala

Publishers: Orient Blackswan

Additional Reading

1. Janaki Lenin, *My Husband & Other Animals*

2. Mark Tully, *No Fullstops in India*

3. Shashi Tharoor, *An Era of Darkness: The British Empire in India*

4. Alexander Frater, *Chasing The Monsoon: A Modern Pilgrimage Through India*

5. Bill Bryson, *A Short History of Nearly Everything*

Web sources

1. https://storycorps.org/stories/

2.https://www.fullspate.digitalcounterrevolution.co.uk/english-articles-advanced/

3. https://www.thehindu.com/

4. https://www.theguardian.com/international

5. http://epaper.indianexpress.com/

6. https://www.nytimes.com/

7. https://www.telegraph.co.uk/

8.https://ia601601.us.archive.org/26/items/in.ernet.dli.2015.460612/2015.460612.Jawaharlal-Nehrus-Speeches-Vol-2_text.pdf

Semester II

EN 1211.1

Language Course 3: Ability Enhancement Compulsory Course – EN 1211.1 (B.A / B.Sc)

Course Title: ABILITY ENHANCEMENT COMPULSORY COURSE: ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

Credits: 5

Hours: 5/week (90 hrs)

Learning Objectives:

To enable the student:

- to engage with a wide range of issues in environmental studies and disaster management.
- to acquire a set of values for environmental protection and conservation
- to recognize the ecological basis for regional and global environmental issues
- to manage natural disasters and other emergency situations
- to develop a critical vocabulary related to environmental studies and disaster management

Learning Outcomes:

The student will be able to:

- understand environmental crises and disaster management situations
- take lead in spreading environmental values and creating awareness among the public
- understand local environmental issues better
- respond in a better way to a natural calamity or disaster
- articulate environmental concerns using appropriate vocabulary

Course Description

Module 1

Understanding the Environment

Introduction: Environment-its importance-types of ecosystems

- "Chief Seattle's Speech"
- "The Religion of Forest" (An Essay by Rabindranath Tagore)
- "Trophic Cascade" (A poem by Camille T. Dungy)

A Glossary of relevant **key concepts** with examples

Comprehension Questions

Module 2

Resources and their Conservation

Introduction: Natural Resources-biodiversity- conservation

- An extract from *The Silent Spring*(A book by Rachel Carson)
- *On Killing a Tree* (A poem by Gieve Patel)
- *The Inheritors of the Earth* (A translation of Short Story by Vaikom Muhammed Basheer)

A Glossary of related **Key Concepts** with **examples**

Comprehension **Questions**

Module 3

Environmental Pollution

Introduction: Types-Causes-Effects-Waste management-Policies and practices

- *Beat Plastic Pollution* (An article from unenvironment.org)
- "Memory of Hiroshima" (A poem by K. Satchidanandan)
- *E is for E-waste* (Ellen Banda-Aaku)

A Glossary of Related **Key Concepts** with **examples**

Comprehension **Questions**

Module 4

Disaster Management

Introduction: Natural and Man-made- health emergency- handling hazardous materials-managing personal disasters- bomb threats- disasterpreparedness-management-rehabilitation

- An introductory essay on Disaster Management
- *The Truth about the Floods* (A poem by Nissim Ezekiel)
- An extract from Chapter 1 of *Patna Blues* by Abdullah Khan (Juggernaut Books)
- A newsletter on Bhopal Gas Tragedy

- Laboratory safety manual
- 'Relief Standard Operating Procedure for Natural & Man-made disaster,' an essay.

A Glossary of related **Key Concepts** with interesting **examples**

Comprehension Questions

Project report (10 Marks)

Students are expected to prepare a project report based on any one of the activities suggested below. General guidelines will be provided for preparing the Project Report.

1. Visit to a local area to document environmental assets: River/Forest/Grassland/Hill
2. Visit to a local polluted site: Urban/Rural/Industrial/Agricultural
3. Study of simple ecosystems: Pond/River/Hill slopes
4. Mock drill organized in their college by the local disaster management agencies

SEMESTER III

FIRST DEGREE PROGRAMME IN

BA ENGLISH LANGUAGE AND LITERATURE (CBCS SYSTEM)

Complementary Course 5: EN 1331 Narratives of Resistance Number of Credits: 3 No. of Instructional Hours: 3 [Total 54 Hours]

Aim Introduce the various narratives of resistance, literary and other wise.

Objectives

1. To understand the various modes of resistance needed to subvert oppressive socio- cultural structures.
2. To provide insight into the struggles of people from around the world for identity and rights and contribute proactively to social dynamics.
3. To understand how literature acts as a vehicle for voices of dissent and protest.

Course Outcome

CO 1: Be able to identify themes of resistance in different forms and genres of literature.

CO 2: Have a sense of the various kinds of injustice related to race, ethnicity, gender etc. prevalent in society.

CO 3: Develop an idea of literature as a form of resistance to all forms of totalitarian

authority. CO 4: Understand the inter connection between various genres in manifesting

resistance

CO 5: How resistance is an undeniable presence in the everyday narratives of literary and other artistic expressions.

COURSE OUTLINE

Module I Narratives of Resistance

Nature and Function of Resistance- Heterogeneous forms of Resistance-Gender-Dalit-Race-Totalitarianism-Nation State-Holocaust- Slave Narratives-War-Resistance and Social Change

Module II Poetry/Documentary

1. Adrienne Rich- ―What Kind of Times Are These‖ https://www.poetryfoundation.org/poems/51092/what-kind-of-times-are-these
2. Denise Levertov- ―Making Peace‖

https://www.poetryfoundation.org/poems/53900/making-peace

Mahmoud Darwish-—ID Card
https://www.wrmea.org/017-november-december/id-card-by-mahmoud-darwish-a-translation-and-commentary.html

3. S.Joseph : —Between These Lines‖ https://www.poetryinternational.org/pi/poem/17768/auto/0/0/S-Joseph/Between-These- Lines/en/nocache
4. Tishani Doshi- —Girls are coming out of the Woods‖ https://www.poetryfoundation.org/poems/152744/girls-are-coming-out-of-the-woods
5. Taslima Nasreen : —Garment Girls‖ https://www.poemhunter.com/poem/garment-girls/
6. Lucille Clifton: —poem in praise of menstruation‖ https://www.poetryfoundation.org/poems/54584/poem-in-praise-of-menstruation
7. Peter Davis (Dir): *Nelson Mandela: Prisoner to President* (Apartheid Documentary 1994) https://www.youtube.com/watch?v=Rk-Lxgp9NWg

Module III Prose and Fiction

1. Assange, Julian. —Conspiracy as Governance.‖ State and Terrorist Conspiracies. 7-12 https://cryptome.org/0002/ja-conspiracies.pdf(Article)
2. Sojourner Truth: —Ain't I A Woman?‖ (Speech) https://www.nps.gov/articles/sojourner-truth.htm
3. Jacinta Kerketta And Nighat Sahiba —On The Power of Poetry And Politics of Language‖.Huffpost article by Kavitha Muralidharan (Article) https://www.huffingtonpost.in/entry/jacinta-kerketta-nighat-sahiba-kashmir-jharkhand- poems-language_in_5c41f480e4b027c3bbc14a3a?guccounter=
4. Alice Munro: —Boys and Girls‖ (Short Story) http://www.giuliotortello.it/shortstories/boys_and_girls.pdf
5. K. Saraswathi Amma: —Life, In My View‖ (Memoir) (Translation J.Devika) https://swatantryavaadini.in/2020/08/30/life-in-my-view-k-saraswathi-amma/#more-982
6. Nemat Sadat :*Carpet Weavers* (Novel) Penguin, 2019.

Recommended Reading

Brueck , Laura. *Writing Resistance: The Rhetorical Imagination of Hindi Dalit Literature.*

Columbia University Press, 2014.

Darwish, Mahmoud.*Unfortunately, It Was Paradise: Selected Poems.*University of California Press, 2013.

De Santis, Christopher C., et al. *The Collected Works of Langston Hughes: The poems, 1941- 1950.* Italy,University of Missouri Press, 2001.

8. Doshi, Tishani. *Girls Are Coming Out of the Woods*. India, Harper Col

Dutta, Mohan J. *Voices of Resistance: Communication and Social Change*. Purdue University Press. 2012.

Harlow, Barbara. *Resistance Literature*. New York, Methuen, 1987.

Hosseini, Khaled. *A Thousand Splendid Suns*.Bloomsbury Publishing,

2009.

Jo Glanville, ed. Qissat: *Short Stories by Palestinian Women*. London, Telegram, 2006.

90-94. Levertov, Denise. *Selected Poems*.United States, New Directions, 2003.

Lewis, T. (2008).―Literature as Resistance‖.*The Hudson Review*,60(4), 655–664. www.jstor.org/stable/20464787

Manṭo, Sa'ādatḤasan. *Manto*: *Selected Short Stories: Including 'Toba Tek Singh' and 'The Dog of Tithwal'*. India, Random House India, 2012

Munro, Alice. *Selected Stories*. United Kingdom, Random House, 2012.

Neruda, Pablo. *The Poetry of Pablo Neruda*.United States, Farrar, Straus and Giroux, 2015.

Nguyen, Viet Thanh. *Race and Resistance: Literature and Politics in Asian America Race and American Culture.*USA,Oxford University Press, 2002.

Rich, Adrienne. *Collected Poems: 1950-2012.* United States,W. W. Norton, 2016.

Stoltz, Pauline. *Gender, Resistance and Transnational Memories of Violent Conflicts*.Germany, Springer International Publishing, 2020.

Williams, Nerys. *Contemporary Poetry*. United Kingdom, Edinburgh University Press, 2011.

Zimmermann, Jérémie, et al. Cypherpunks: *Freedom and the Future of the Internet*. United Kingdom, OR Books, 2016.

e-resources

https://swatantryavaadini.in/

https://www.thegoodtrade.com/features/inspiring-female-poe

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On Literature and Resistance

SEMESTER VI

FIRST DEGREE PROGRAMME IN

BA ENGLISH LANGUAGE AND LITERATURE (CBCS System)

Core Course 11: EN 1641 Gender Studies

No: of Credits: 4 **No of Instructional Hours: 5 [Total: 90hours]**

Aim: Introduce and problematize gender constructs.

Objectives

1. Explore the historical variables that have contributed towards the social norms of gender and sexuality
2. Understand the significance of making gender an integral concept of social analysis
3. Develop a conceptual understanding of the field of gender studies

Course Outcome

CO 1: Recognize the patriarchal bias in the formation of history and knowledge.

CO 2: Analyse the ways in which gender, race, ethnicity class, caste and sexuality construct the social, cultural and biological experience of both men and women in all societies.

CO 3: Recognize and use the major theoretical frames of analysis in gender studies

CO 4: CO 5: Interrogate the social constructions of gender and the limiting of the same in to the male-female binary in its intersections with culture, power, sexualities and nationalities

CO 5: Examine gender issues in relation to the sustainable goals of development

COURSE OUTLINE

Module I Introduction to Gender Studies

Gender, Patriarchy- Family- Identities- Essentialism- Difference- Ideology- Intersectionality- Feminisms-Womanism-Dalit Feminism-Islamic Feminism

1. bell hooks. ―Feminist Politics:Where we Stand‖ *Feminism is for Everybody*: *Passionate Politics*. London: Pluto, 2000: pp.1-6. https://excoradfeminisms.files.wordpress.com/2010/03/bell_hooks-feminism_is_for_everybody.pdf
2. Judith Lorber. ―The Social Construction of Gender.‖ https://ieas.unideb.hu/admin/file_9695.pdf
3. Vijila Chirappad: ―Wasteland‖ (poem) https://feminisminindia.com/2018/01/11/5-dalit-women-po

ets/

Module II Gender and Sexuality

Body-Sexualities-Performativity-Heterosexuality-Sexual Orientation-Non-normative Sexualities- Desire-Heteronormativity-Homosexuality-LGBTQI-Queer-Transgender-Pride Parade- Posthuman Orientation.

1. A. Revathi. *The Truth about Me:A Hijra Life Story*(Life Narrative)
2. Margaret Atwood: ―Helen of Troy Does Countertaps‖ Dancing (poem) https://apoemaday.tumblr.com/post/181494581744/helen-of-troy-does-counterto p- dancing
3. Kalki Subramaniam: ―Breaking Binaries, Establishing Identity‖ TEDxDumas https://www.youtube.com/watch?v=_j1NzEGMNdo

Module III Gender and Culture

Culture, Modernity, Consumption, Sexual Economies, Commodity Culture

1. Nivedita Menon: ―India: Section 377: How Natural is Normal?‖ http://www.sacw.net/SexualityMinorities/nivedita01Jan2004.html
2. Maya Angelou: ―Phenomenal Woman‖ (poem) https://www.poetryfoundation.org/poems/48985/phenomenal-woman
3. Meena Kandasamy: ―Mascara‖ (poem) https://www.poemhunter.com/poem/mascara-4/

Module IV: Gender, Power and Human Rights

Power, Sexual Politics, Discourse, Sexual Citizenship, Discrimination, Human Rights, Gender Justice

1. Alice Walker: *Meridian* (Novel)
2. Mahaswetha Devi: *Draupadi* (Short Fiction)
3. Mayilamma:Chapter 13. ―Protest: The First Year‖ (Pages 55 – 59) Jyothibai PariyadathuMayilamma: *The Life of a Tribal Eco-warrior*. Orient Blackswan, 2018.

Recommended Reading

Butler, Judith. Gender Trouble: *Feminism and the Subversion of Identity*. New York: Routledge, 1990.

Cranny-Francis,Anne. Wendy Waring, Pam Stavropoulos, Joan Kirkby. *Gender Studies Terms and Debates*.Macmillan, 2017.

Delap, Lucy. *Feminisms: A Global History*. Penguin,

2020. Foucault, Michel. *History of Sexuality*.Penguin

books: 1977

Kate, Millet. *Sexual Politics*. New York: Doubleday. 1969.

Kumar, A.*The History of Doing*, New Delhi: Kali for Women,1998.

Marao, Lori, J. *Fifty-One Key Feminist Thinkers*. Taylor and Francis, 2016.

Naples, Nancy A. *Companion to Women's and Gender Studies*. Wiley, 2020. Roth, Benita. *Separate Roads to Feminism*. CUP,2004.

Sullivan, Nikki. *A Critical Introduction to Queer Theory*.NYU, 2003.

e- resources

https://kalkisubramaniam.com/

https://www.e-ir.info/2017/02/06/online-resources-feminism/

https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)30239-9/fullte xt https://plato.stanford.edu/entries/feminist-philosophy/

http://www.gender.cawater-info.net/knowledge_base/rubricator/feminism_e.htm

https://guides.lib.purdue.edu/c.php?g=352219&p=2375079

B.Com I st Semester

Core Course I: CO 1141 – ENVIRONMENTAL STUDIES

No. of instructional hours per week: 4 No. of Credits: 3

Aim of the course: To develop knowledge and understanding of the environment and enable the students to contribute towards maintaining and improving the quality of the environment.

Course objectives:

1. To enable the students to acquire basic ideas about environment and emerging issues about environmental problems.
2. To give awareness about the need and importance of environmental protection

Module I: Environmental studies – meaning – scope – importance (4hrs)

Module II: Ecology and Ecosystems, Biodiversity and its Conservation, and Natural resources –meaning of ecology – structure and function of an ecosystem – producers – consumers – decomposers– energy flow in the ecosystem – ecological succession- food chain – food webs and ecological pyramids . Ecosystem – concept– types of ecosystems – structure and functions of forest ecosystem, grass land ecosystem- desert ecosystem, aquatic ecosystem. Biodiversity and its conservation introduction- definition- genetic, species and ecosystem diversity- value of biodiversity – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of diversity – threats to diversity – conservation of diversity in situ, ex-citu. Natural resources features- air resources, forest resources, water resources, mineral resources, food resources energy resources, land resources- over exploitation of natural resources- consequences conservation of natural resources- role of an individual in conservation of natural resources
(25 Hrs)

Module III: Industry and environment - pollution – environmental pollution – soil pollution – air pollution – water pollution – thermal pollution – noise pollution – causes, effect and control measures – waste management – waste minimisation through cleaner technologies – reuse and recycling - solid waste management.(18hrs)

Module IV: Social issues and environment – Unsustainable to sustainable development – urban problems related to energy - water conservation - water harvesting - resettlement and rehabilitation of people- environment ethics-waste land reclamation-consumerism and waste products. (15 hrs)

Module V: Human Population and environment – population growth – variation amoeg nations – population explosion – environment and human health – human rights – value education – Women and child welfare. (10hrs)

Note: All students must *visit a local area to document environmental issues and prepare a brief report on the same identifying issues involved and suggesting remedies.(This will be a part of the internal marks. i.e. for EVS the internal marks = attendance – 5 marks + test paper – 5 marks + field study report – 10 marks)*

Books recommended

Misra.S.P and Pandey .S.N. *Essential Environmental Studies*, Ane Books India, New Delhi.
Kiran B. Chokkas and others.*Understanding Environment*, Sage Publications New Delhi.
Arumugam N. and Kumaresan V. *Environmental Studies*, Saras Publications, Kanyakumari.
Benny Joseph. *Environmental Studies*, Tata McGraw-Hill Publishing Co.Ltd.,New Delhi.

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SEMESTER I

Paper 4: CO 214- PLANNING AND DEVELOPMENT ADMINISTRATION

Objectives:

1. To generate an overall insight on planning process in Indian Economy
2. To make the students aware about new planning initiatives in India

Module 1 - Structure of Indian Economy- Relevance of sectors in Indian Economy; Primary, Secondary and Tertiary Sectors-National Income-Methods of Computation-Inflation effects on Indian Economy- India's current National Income in comparison with leading economies of the world-Challenges. **(15Hrs)**

Module 2: Planning mechanism in India–Economic planning-features, types-Phases of Economic Planning-Growth and Planning Models-(Briefly mention) -State Planning Board-District Planning Board **(20Hrs)**

Module 3: Fiscal Policy-Centre-State financial relationship-Resource Allocation-Finance Commission-Development and Non Development expenditure-Preparation of budgets: Centre, State and Local Self Government-Deficit financing-Plan and Non-Plan Expenditure (Case Study: Evaluation of current Budget) **(20Hrs)**

Module 4 : Policy Initiatives in the Planning Process –Niti Aayog –Structure– Objectives –Functions-Guiding Principles -Vision Statement-Recent Policy initiatives: Make in India, Jan DhanYojana, Startup India, Swatch Bharath Abhiyan, Mudra Bank, Digital India – Future development initiatives **(20Hrs)**

Module 5: Role of State and Local Self Government-Planning initiatives in Kerala-Kerala Perspective Plan –Mission-Vision-Scope-Local Self Government –Role, Functions and Programmes **(15Hrs)**

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References:

1. Agarwal A.N. and Kundanlal (1999), Economics of Development and Planning, Vikas Publishing House, NewDelhi
2. Seth.M.L. and S.P. Singh (1998), Economic Planning: Theory andPractice, S.Chand and Company Ltd., Ram Nagar, NewDelhi
3. Dhingra.I.C. and V.K.Garg (2000), Economic Development and Planning in India, Sulthan Chand Publications, NewDelhi
4. Mishra S.K. and Puri V.K (2008), 26th Edition, Indian Economy,Himalaya Publishing House Pvt. Ltd.,Mumbai-
5. Desai and Bhale Rao (1986), Economic Planning and Policy,Himalaya Publishing House,Mumbai
6. Madan Mohan Batra (1987), Planning in India: development perspective towards the 21st century, V.K. Publishing House,Mysore
7. Misra and Puri (1999), Development and Planning Theory andPractice, Himalaya Publishing House,Mumbai
8. Gerald. M. Meier, and Robert E. Baldwin,(1957) (Reprint in 1975), Economic Development- Theory, History ,Policy, Asia Publishing House,Mumbai
9. Gerald. M. Meier, James E. Rauch,(2005), Leading Issues inEconomic Development, (8th Edition) Oxford University Press,Oxford,
10. Meier .G.M. (1995), Leading Issues in Economic Development (6thedition) Oxford University Press, NewDelhi.
11. Higgins Benjamin (1963), Economic Development, Principals, Problems and Policies, Central Book Depot,Allahabad
12. Kindleberger C.P. (1977), Economic Development (III edition) McGraw Hill NewYork.
13. Adelman. I (1961), Theories of Economic Growth and Development, Stanford Universities Press,Standford.
14. Bose. A, (1975), Marxian and Post Marxian Political Economy, PenuinLondon
15. Chakrvarthy S (1982), Alternative Approaches to the Theory of Economic Growth, Oxford University Press, NewDelhi.
16. Growth. S, (1986), An Introduction to Development Economics, Allen and Unwin
17. Little IMD (1982), Economic Development : Theory Policy and International Relations, Basic Books, NewYork
18. Schumpeter J.A., (1949), The Theory of Economic Development,Harvard University Press,Cambridige.
19. Bhagavathi J and Desai, (1970), India: Planning for Industrialization,Oxford University Press,Oxford
20. Jolly. R., (1973), Third World Employment, Penguin,Oxford
21. Sen.A.K. (1962), Choice of Techniques, Basil Backwall,Oxford

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SEMESTER I

Paper 1: CO 211- BUSINESS ETHICS AND CORPORATE GOVERNANCE

Objectives:

1. To convey basic understandings on the theories of Business Ethics
2. To provide a understanding on Corporate Governance practices and the provisions of the Companies Act relating to corporate governance

Module 1: Business Ethics and Ethical Practices: Ethics – Sources- Importance - factors influencing Business Ethics – Benchmarks on code of Ethics – Ethics Committees – Training Programmes – Ethical Decision Making – Ethics in Finance - Marketing and HR **(15Hrs)**

Module 2: Organization Culture: Features – Building and Maintaining Organization Culture – Organizational Socialization – Managing cultural Diversity – Work Ethics – Work Culture – Quality of Work Life – Work Life Balance – areas Improving Work Life Balance – Strategies of Work Life Balance **(20Hrs)**

Module 3: Corporate Governance: Importance – Objectives – Basic Ingredients of Corporate Governance – Principles - Theories – Phases of development of Corporate Governance in Global and Indian Perspectives – Code of Corporate Governance – Committees on Corporate Governance (Global and Indian) **(15Hrs)**

Module 4: Corporate Social Responsibility : CSR under Companies Act 2013 – Scope – Relevance – Importance – Areas of CSR – Arguments for and against CSR – Ackerman's model of CSR – SEBI – Clause 49 of listing agreement – Evaluation of Corporate Governance of a Company – Methods – Shareholder Value – EOCE, PAT, EPS, TSR, MVA, EVA and HVA - Corporate Philanthropy – Corporate Citizenship – Social Audit **(25 Hrs)**

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Module 5: Corporate Image and Excellence : Corporate image – building corporate image – Importance – Corporate Excellence – importance – Measures to achieve corporate excellence – New initiatives on corporate excellence - Role of Chairman – Qualifications – Power – Duties and Responsibilities – Board Committees – New Directions **(15Hrs)**

References:

1. Laura P Hartman, Perspectives in Business Ethics, Mc Graw Hill International
2. George A Steiner and John F Steiner, Business , Government and Society, Mc Graw Hill International
3. SK Chakraborthy, Ethics in Management Vedantic Perspectives, Oxford University Press
4. Subhash Sharma, Management in New Age: Western Windows – Eastern Doors, New Age International Publishing , New Delhi
5. Prof (Col.) PS Bajaj, Dr. Raj Agarwal – Business Ethics an Indian Perspectives, Biztantra2006.

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UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME
2020 Admission onwards

Semester	I
Course	Core course-I
Course name	**INORGANIC CHEMISTRY I**
Course Code	CH 1141
Credit	2
Hours	36 hours
Lecture-Tutorial-Lab	2-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Discuss the course of development of structure of atom.	U	PSO1
2	Apply rules for filling electrons in classifying elements into s, p,d and f blocks	A	PSO10
3	Define various scales of electronegativities and their applications	U	PSO10
4.	Define Effective nuclear charge and Slater's rules	U,A	PSO10
5	Discuss about diagonal relationship and anomalous behaviour of hydrogen and other first element in each group.	U	PSO4
6	Correlate and predict general properties of s and p block elements based on their electronic configuration.	A	PSO4
7	Realise applications of s and p block elements in sustainable and renewable energy sources.	A	PSO14
8	Define various concepts of acids and bases.	U	PSO11
9	Understand reactions in non aqueous solvents.	U	PSO11
10	Realise various causes, effects and control measures of environmental pollution.	E	PSO13
11	Review national movements for environmental protection.	U, A	PSO21

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Atomic Structure and Periodicity**	**9**	
1.1	Introduction to structure of atom, Rutherford and Bohr model of atom,	1	1
1.2	Dual nature of electron-de Broglie equation-matterwaves and electromagnetic waves. Experimental verification by Davis and Germer method,Heisenberg's uncertainty principle- expression and significance.	1	1
1.3	Wave mechanical concept of the atom-Schrodinger	1	1

	equation and its significance (derivation not required.)		
1.4	Quantum numbers- Pauli's Exclusion principle- Aufbau Principle- Hund's rule- Electronic configuration of atoms- classification of elements into s,p,d and f blocks-	2	1
1.5	Electronegativity- Pauling's scale, Mulliken and Allred-Rochow scale(including numerical problems),	2	4
1.6	Effective nuclear charge, Slaters rule and its applications, diagonal relationship and anomalous behavior of first element with other elements.	2	4,5
2	**Representative elements**	**9**	
2.1	General properties of s and p block elements, Hydrogen – isotopes and its applications- uses as a fuel, water gas	2	6
2.2	Physical properties- atomic radii, ionization enthalpy, electron negativity, electron affinity, Flame colouration, inert pair effect	2	6
2.3	Chemical properties- solubility and thermal stability of alkali and alkaline earth metal oxides, sulphates and hydrides	2	6
2.4	p-block elements- oxides of nitrogen and phosphorus, oxyacids of halogens	1	6
2.5	Allotropism – carbon, sulphur and phosphorus	1	6
2.6	Applications- lithium battery, cesium in photovoltaic cells, selenium in xerography and barium x-ray	1	7
3	**Acids, Bases and non- aqueous solvents**	**9**	
3.1	Arrhenius concept, Lowery –Bronsted, Lewis concepts and Lux Flood concept and its limitations,	2	8
3.2	SHAB principle and its applications,	1	8
3.3	Non – aqueous solvents: General properties- classifications- self ionization and leveling effect-	2	9
3.4	Reaction in non-aqueous solvents- protic and aprotic non-aqueous solvents- examples-solutions of metal s in liquid ammonia- self ionization of liquid ammonia-liquid SO_2, liquid HF, alkali metals in liquid ammonia.	4	9
4	**Environmental chemistry- Air, water and soil pollution**	**9**	
4.1	Air pollution- Air pollution caused by fire works, harmful effects of fire works, acid rain, green house effect, smog- classic and photochemical smog	2	10

	Ozone layer depletion, ozone hole, protection of ozone umbrella. Management of air pollution.		
4.2	Water pollution: causes- heat, industrial waste, sewage water, detergents, agricultural pollutants Treatment of industrial waste water- Activated charcoal, synthetic resins, reverse osmosis and electro dialysis Quality of drinking water- Indian Standard and WHO standard- Dissolved oxygen- BOD , COD.	3	10
4.3	Soil pollution: pesticides, fertilizers, Industrial waste, Plastic. Control of Plastic threat- importance of Plastic identification codes and Plastic recycling, use of biodegradable plastics (PGA,PLA and PHBV(mention only)	2	10
4.3	Control of pollution. Pollution Control Board – Duties and responsibilities Mention environmental movements (Plachimada,Silent valley, movement against Endosulfan, Narmada Bachavo Andolan and Chipko movement)	2	11

Text Books

1. B.R.Puri, L.R,.Sharma, K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers New Delhi,2010
2. F.A.Cotton, G. Wilkinson, Advanced Inorganic Chemistry, Wiley, India(P)Ltd
3. J.D.Lee, Concise Inorganic Chemistry,5thEdn. Wiley, India(P)Ltd.
4. A.K.De,Environmental Chemistry,New Age International(P) Ltd. New Delhi
5. A.K.Ahluwalia, Environmental Chemistry, Ane Books, India, New Delhi.

For Further Reading

1. M.C.Day and J Selbin, Theoretical Inorganic Chemistry,2nd Edn.,Reinhold Book Corp.
2. S.Prakash,G.D.Tuli, S.K Basu, R.D.Madan,Advanced Inorganic Chemistry, Vol. 1.,S Chand
3. J.E.Huheey,E.A.Keiter, R.L.Keiter, O.K.Medhi. Inorganic Chemistry, 4th Edn. Pearson, 2006
4. S.S.Dara, A Textbook of Environmental Chemistry and Pollution Control, 8th Edn. S Chand& Sons, New Delhi.
5. M.N.Greenwood, A .earnshaw, Chemistry of the Elements, 2nd Edn. Butterworth, 1997.

UNIVERSITY OF KERALA

OUTCOME BASED REVISED SYLLABUS FOR BSc PROGRAMME IN

ENVIRONMENTAL SCIENCE AND ENVIRONMENT AND WATER MANAGEMENT

WITH EFFECT FROM 2021

Table 1. Scheme of Instruction and Evaluation

Seme-ster	Course Code	Study component	Instructional hours / week		Credits	Evaluation		Total Credits
			Theory	Practical		CE	ESE	
I	EN 1111.3	English I	4	-	3	20%	80%	18
	1111.3	Additional Language I	3	-	3	20%	80%	
	EE 1121	Foundation Course I	3	-	3	20%	80%	
	EE 1131	Complementary Course I	3	-	3	20%	80%	
	EE 1132	Complementary Course Practical	-	2	-	20%	80%	
	EE 1141	Core Course I	3	-	3	20%	80%	
	EE 1142	Core Course Practical		2		20%	80%	
	EE 1171	Vocational Course I	3	-	3	20%	80%	
	EE 1172	Vocational Course Practical	-	2	-	20%	80%	
II	EN 1211.3	English II	4	-	3	20%	80%	24
	1211.3	Additional Language II	3	-	3	20%	80%	
	EE 1221	Foundation Course II	2	-	2	20%	80%	
	EE 1231	Complementary Course II	3	-	3	20%	80%	
	EE 1232	Complementary Course Practical		2	2	20%	80%	
	EE 1241	Core Course II	4	-	4	20%	80%	
	EE 1242	Core Course practical		2	2	20%	80%	
	EE 1271	Vocational Course II	3	-	3	20%	80%	
	EE 1272	Vocational Course Practical	-	2	2	20%	80%	
III	EN 1311.3	English III	5	-	3	20%	80%	19
	EE 1331	Complementary Course III	3	-	3	20%	80%	
	EE 1332	Complementary Course Practical	-	2	-	20%	80%	
	EE 1341	Core Course III	3	-	3	20%	80%	
	EE 1342	Core Course IV	3	-	3	20%	80%	
	EE 1343	Core Course Practical	-	2	-	20%	80%	
	EE 1371	Vocational Course III	4	-	4	20%	80%	
	EE 1372	Vocational Course IV	3	-	3	20%	80%	
	EE 1372	Vocational Course Practical	-	2	-	20%	80%	
IV	EN 1411.3	English IV	5	-	3	20%	80%	22
	EE 1431	Complementary Course IV	3	-	3	20%	80%	
	EE 1432	Complementary Course Practical		2	2	20%	80%	
	EE 1441	Core Course V	5	-	4	20%	80%	
	EE 1442	Core Course VI	2	-	2	20%	80%	
	EE 1443	Core Course Practical	-	2	2	20%	80%	
	EE 1471	Vocational Course V	4	-	4	20%	80%	
	EE 1472	Vocational Course Practical	-	2	2	20%	80%	

Seme-ster	Course Code	Study component	Instructional hours / week		Credits	Evaluation		Total Credits
			Theory	Practical		CE	ESE	
V	EE 1541	Core Course VII	4	-	4	20%	80%	16
	EE 1542	Core Course VIII	4	-	4	20%	80%	
	EE 1543	*Core Course Practical*	-	5	-	20%	80%	
	EE 1551	*Open Course I*	2	-	2	20%	80%	
	EE 1571	*Vocational Course VI*	3	-	3	20%	80%	
	EE 1572	Vocational Course VII	3	-	3	20%	80%	
	EE 1572	Vocational Course Practical	-	4	-	20%	80%	
VI	EE 1641	Core Course IX	3	-	3	20%	80%	21
	EE 1642	Core Course III	2	-	2	20%	80%	
	EE 1643	Core Course Practical	-	4	2	20%	80%	
	EE 1661.1 EE 1661.2 EE 1661.3 EE 1661.4	Elective Course I	2	-	2	20%	80%	
	EE 1671	Vocational Course VIII	3	-	3	20%	80%	
	EE 1671	Vocational Course IX	3	-	3	20%	80%	
	EE 1673	Vocational Course Practical	-	4	2	20%	80%	
	EE 1644	Project and Factory Visit	4	-	4	20%	80%	

Table showing the credits for the programme

First language-English

Semester	Working hours/week	No of Courses	No of Credits
Sem 1	4	1	3
Sem 2	4	1	3
Sem 3	5	1	3
Sem 4	5	1	3

Total No. of credits = 12

Additional language (Hindi/Malayalam)

Semester	Working/ hours	No of Courses	No of Credits
Sem 1	3	1	3
Sem2	3	1	3

Total No. of credits = 6

Complementary course (Chemistry)

Semester	Working hours/week Theory Practicals	Total Hours	No of Courses	No of credits
Sem 1	3 2+2#	7	1	3
Sem 2	3 2+2#	7	1	3
Sem 3	3 2+2#	7	1	3
Sem 4	3 2+2#	7	1+1*	3 + 4 *

 # The additional 2 hrs as per university regulation of work load for practicals if number of students exceeds 15 in a batch

**Practical Examinations will be conducted only on even semester by the*

university Total No of Credits 12+4=16

Semester	Working hours/week Theory Practicals	Total Hours	No of Courses	No of credits
Sem 1	3	3	1	3
Sem 2	2 + 2 # *	6	1+1	2

2 hrs as per university regulation of work load for practicals; Total No of Credits = 5

*Practical examination for foundation course

Core Course (Environmental science)

Semester	Theory Hrs/ Week	Practical Hrs/week	Total Hrs	No of course	No of credits
Sem1	3	2 + 2#	7	1	3
Sem 2	4		4	1	4
Sem 3	6	2+2#	10	2	6
Sem 4	7	2+2#	11	2+1**	6+4**
Sem 5	8	4+4#	15	2	8
Open	3		3	1	2
Sem 6	5	4+4#	13	2+1***	5+4***
Elective	3		3	1	2

#2 hrs as per university regulation of work load for practicals

* Practical examination for foundation course and core course are conducted together as part I & II and the credit is included with core course of 2 credits

At the end of 4th semester; * At the end of 6th

semester *<u>*Practical Exam will be conducted by the*</u>

<u>*university;*</u> Total No of credits 32+6=38

Vocational Course (Water Management)

Semester	Theory Hrs/ Week	Practical Hrs/week	Total Hrs	No of course	No of credits
Sem1	3	2+2#	7	1	3
Sem2	3	2+2#	7	1+1	3+2=5*
Sem3	7	2+2#	11	2	4+3=7
Sem4	4	2+2#	8	1+1*	4+2=6*
Sem5	6	4+4#+4+4#	22	2	3+3=6
Sem6	6	4+4#	14	2+1 *	3+3+2=8*
Project		4+4#	8	1	4

#2 hrs as per university regulation of work load for practicals

Practical Exam will beconducted by the university;

Total No of Credits 27+8=35

B.Sc Environmental Sciences & Environment and Water Management

Six semesters; One semester-18 weeks

Total No of Courses : 43

Sl.No	Study component	No. of courses	Total credit
1	Language English	4	12
2	Additional Lan (Hin/Mal)	2	6
3	Foundation course	2	5
4	Complementary course	6	16
5	Core course	13	38
6	Vocational course	12	35
7	Open Course	1	2
8	Elective courses	1	2
9	Dissertation	1	4
10	Total	43	120

Total No of Credits = 12+6+16+5+38+35+2+2+4=120

Semester 1

Semester	Study component	Title of course	Instructional Hrs
EN1111.3	English I	-	4x18=72
1111.3	Additional Language (Hin/Mal) I	-	3x18=54
EE1121	Foundation Course I	1. Computer Basics and Informatics	3x18=54
EE1141	Core Course I	1. Research Methodology and Perspectives of Science	3x18=54
EE1142	Core Course Practical	2. Environmental Science lab	2x18=36
EE1171	Vocational Course I	1.Water Resources and Fluid Mechanics	3x18= 54
EE1172	Vocational course Practical	2.Water Management Lab	2x18=36
EE1131	Complementary Course I	1.Theoretical Inorganic chemistry	3x18=54
EE1132	Complimentary Course Practical	2.Chemistry lab	2x18=36

Eng-4; SL-3; FC-3; CoreC-5; Vo C-5; Comp C-5; Total=25 Instructional Hrs/week

Semester II

Semester	Study component	Title of course	Instructional Hrs
EE1211.3	English II	-	4x18=72
EE1211.3	Additional Language (Hin/Mal) II	-	3x18=54
EE1221	Foundation Course	1.ComputerApplication for Biostatistics	2x18=36
EE1241	Core Course II	1. Environmental studies	4 x 18=72
EE 1242	Core Course practical	Environmental Science lab	2 x 18 = 36
EE1271	Vocational Course II	1.Water Resources management	3x18=54
EE1272	Vocational Course Practical	2.Water Management lab	2x18=36
EE1231	Complementary course II	1. Organic and Environmental Chemistry	3x18=54
EE1232	Complementary course Practical	2.Chemistry lab	2x18=36

Eng-4; SL-3; FC-2; Core C- 6; Vo C-5; Comp C- 5; Total=25 Instructional Hrs/week

Semester 1II

Semester	Study component	Title of course	Instructional Hrs
EE1311.1	English III	-	3x18=54
EE1341	Core Course III	1. Fundamentals of Ecology and Current Environmental Issues	3x18=54
EE1342	Core Course IV	2 Environmental Management	3x18=54
EE1343	Core Course Practical	3.Environmental Science lab	2x18=36
EE1371	Vocational III	1.Hydrology	4x18=72

EE1372	Vocational IV	2.Water Quality Parameters and Assessment	3x18=54
EE1373	Vocational Practical	3.Water Management lab	2x18=36
EE1331	Complementary III	1.Analytical Chemistry and Biomolecules	3x18=54
EE1332	Complementary Practical	2.Chemistry lab	2x18=36

Eng-3; CoreC-8; Vo C-9; Comp C-5; Total =25 Instructional Hrs/week

Semester 1V

Semester	Study component	Title of course	Instructional Hrs
EE1411.3	1.English IV	-	5x18=90
EE1441	Core Course V	1.Environmental Biotechnology& Microbiology	5x18=90
EE1442	Core Course VI	2.Biophysics, Biostatistics and Computer Application	2x18=36
EE1443	Core Course Practical	3. Environmental Science lab	2x18=36
EE1471	Vocational V	1.Water Quality Management	4x18=72
EE1473	Vocational Practical	3.Water Management lab	2x18=36
EE1431	Complementary IV	1.Physical chemistry	3x18=54
EE1432	Complementary Practical	2.Chemistry lab	2x18=36

Eng-5; Core C- 9; Vo C- 6; Comp C-5; Total =25 Instructional Hrs/week

Semester V

Semester	Study component	Title of course	Instructional Hrs
EE1541	Core Course VII	1.Environmental Geology and Mineralogy	4x18=72
EE1542	Core course VIII	2.Disaster Management	4x18=72
EE1543	Core Course Practical	3.Environmental Science lab	5x18=90
EE1571	Vocational Course VI	1.Water pollution	3x18=54
EE1572	Vocational Course VII	2.Water quality Management- II	3x18=54
EE1573	Vocational course Practical	3.Water Management lab	4x18=72
EE1551	Open course	1.Solid Waste Management	2x18=36

Core C-13; Vo C-10; Open C-2; Total =25 Instructional Hrs/week

Semester VI

Semester	Study component	Title of course	Instructional Hrs
EE1641	Core course IX	1.Environmental Pollution and Control Measures-I	3x18=54

EE1642	Core course X	2 .Environmental Pollution and Control Measures-II	2x18=36
EE1643	Core Course Practical	3.Environmental Science lab	4x18=72
EE1671	Vocational Course VIII	1.WaterAnalysis	3x18=54
EE1672	Vocational Course IX	2Watershed Management	3x18=54
EE1673	Vocational Course practical	3.Water Management lab	4x18=72
EE1661.1 EE1641.2 EE1641.3 EE1641.4	4.Elective	a. Rain water Harvesting b. Environmental Aspects of Estuarine System c. Environmental Meteorology and Climate Change d. Elementary Concepts in GIS & GPS	2x18=36
EE1644	Project	Environmental Science/ Water Management	4 x 18 = 72

Core C-9; Vo C-10; Project -4; Elective-2; Total = 25 Instructional Hrs/week

FOUNDATION COURSE

SEMESTER I

FOUNDATION COURSE I

EE1121 COMPUTER BASICS AND INFORMATICS

Total Hours 54

Aim:

To introduce students the basics of Computer Science, Informatics and its applications

Objectives:

- To make students aware of the history and evolution of computer science and technology
- To introduce students to basics of internet and overview of Information Technology
- To make students sensitized to the social aspects of informatics
- To make students understand the applications of IT in various fields

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO1	Articulate the history and development of computers	Un, Re
2.	CO2	Describe the Internet governance	Un, Re
3.	CO3	Explain and access the various knowledge repositories of Internet	Re, Un, Ap
4.	CO4	Comprehend the societal applications of internet and use it during emergencies	Re, Un, Ap
5.	CO5	Describe the applications of internet in various fields of science and technology	Re, Un

Course Content:

Module I: History and development of computers: basic knowledge of computer systems - software and hardware - free software - M.S Word, Excel, Power point Computer ethics - software piracy – internet Piracy – privacy-computer security; computer crimes –hacking and cracking.

9 Hours

Module II: Internet: managing bodies of the internet - Internet Society - Internet Service Provider - Internet application software

9 Hours

Module III: **Overview of Information Technology**: Features of the modern personal computer and peripherals - Computer network

9 Hours

Module IV: Data information and knowledge: Internet as knowledge repository - Introduction to use of IT in teaching and learning. Educational software; INFLIBNET - academic services

9 Hours

Module V: Social Informatics: IT and society - overview of its application in medicine, health care, environmental studies-defense crime detection and communication

9 Hours

Module VI: Applications of IT: Applications in weather forecasting, education, film and media - virtual reality

9 Hours

References

1. Cultural Boundaries of Science. T.F.Gieryn, University of Chicago press, 1999
2. Alexis Leon & Mathew Leons, Computers Today, Leon Vikas.
3. Alexis Leon &Mathew Leons, ComputersToday, LeonVikas. Fundamentals of InformationTechnology. ISBN 08125907890
4. Learning Computer Fundamentals, Khanna Book Publishers, ISBN, 818752252b
5. John Ray 10 Minute Guide to Linnx PHI, ISBN 81-203-1549-9.

CORE COURSES

SEMESTER I

CORE COURSE I

EE1141 RESEARCH METHODOLOGY & PERSPECTIVES OF SCIENCE

Total Hours: 54

Aim:

To introduce students to the basics of Research_

Objectives:

- To introduce students to the basic terminology used in research
- To make students aware of the importance of using statistical techniques in improving the credibility of research
- To make students understand the basic methods used in a research

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO1	Plan a Research Process meticulously	Ap
2.	CO2	Frame an appropriate Research Design	Re, Un, Cr
3.	CO3	Identify and collect the latest and relevant data on a pertinent problem	Re, Un
4.	CO4	Analyze the collected data and process it applying suitable sampling techniques	An, Ap
5.	CO5	Articulate well-structured Research Reports	Cr

Course Content:

Module I: Introduction to Research Methodology: An overview of the meaning and significance of research - scientific thinking, application in various fields, tool in decision and policy making; Objectives of research

6 Hours

Module II: Research Process: Definition of research problem; Formulating Research Problem; Literature survey; development of hypothesis; sample design - deliberate sampling, simple random sampling, systematic sampling stratified sampling, cluster and area sampling, multi-stage sampling; definition of data; Types of data - Primary data, secondary data; data collection - personal observation, interviews, questionnaires, schedules

12 Hours

Module III: Perspective of Science: Research Design: Definition of research design; Concepts related to research design - dependent and independent variables, extraneous variables, control; experimental, treatments; Principles of experimental designs - principle of replication, principle of randomization, principle of local control

12 Hours

Module IV: Processing & analysis of data: Processing of data - editing, coding, classification, tabulation; Analysis of data - the role of statistics in research, measures of central tendency & dispersion

8 Hours

Module V: Interpretation & Report Writing: Definition of interpretation; significance of report writing; steps in report writing - logical analysis of matter, preparation of outline, preparation of rough draft, re-writing and polishing rough draft, preparation of final bibliography, writing the final report.

10 Hours

Module VI: Ethics in research: confidentiality, informed consent, role conflict, plagiarism

6 Hours

References

1. Kothari C. R. 2004. Research Methodology: Methods and Techniques. (II Edn) New Age International Publishers. Pp 1-498
2. Georgia Fouka and Marianna Mantzorou (2011) What are the Major Ethical Issues in Conducting Research? Is there a Conflict between the Research Ethics and the Nature of Nursing? Health Science Journal 5(1) pp 3 – 14.
3. Charmaz, K. (2004). Premises, Principles, and Practices in Qualitative Research: Revisiting the Foundations. Qualitative Health Research, 14(7), 976-993.
4. The Glen: What everyone should know about Science. H.Collins and T.Pinch, Cambridge University press, 1993.
5. Elements of Biostatistics. S.Prasad. ISBN 81-7133-613-2. Title code bc-33 First edition -2003. Rastogi publications, Gangotri, Shivagiroad-Meerut 250 002.
6. Introduction to Biostastitics. Pranab Kumar Banerjee and S.Chand. ISBN81-219-2329-8, First edition 2004. Rajendra Raveendra Printers Pvt. Ltd. Ram Nagar, New Delhi

SEMESTER - I

CORE COURSE PRACTICAL

EE1142 ENVIRONMENTAL SCIENCE LAB - I

Total Hours: 36

1. Sampling methods - Plant or animal community on land

2. Population censusing methods - Total count, sampling
3. Estimation of beetle in wheat flour
4. Study of common flora and fauna

VOCATIONAL COURSE I

EE1171 WATER RESOURCES AND FLUID MECHANICS

Total Hours: 54

Aim:

To introduce students the importance of water resources and concepts of fluid mechanics

Objectives:

- To make students understand the importance of water as a natural resource
- To introduce students to the principles of fluids
- To give students the basics of fluid mechanics
- To make students understand the need of using principles of fluid mechanics in real life situations

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Articulate the importance of water as a natural resource	Un, Re
2.	CO 2	Describe various principles of fluids	Un, Re
3.	CO 3	Explain the behaviour of fluids	Re, Un, Ap
4.	CO 4	Identify the flow patterns of fluids	Re, Un
5.	CO 5	Explain the mathematical expressions of fluid mechanics	Re, Un

Course Content:

Module I: Water as a Resource: Water as a natural resource, pressure on water resource – urbanization, population growth, increasing living standards, competition for water, over-consumption, climate change; Availability of freshwater in India with special reference to Kerala

10 Hours

Module II: Uses of Water: Multiple uses of water – Direct uses – drinking, bathing, cooking etc., Indirect uses – processing in industries, agriculture,

electricity; Consumptive uses – irrigation, Partial consumptive use – domestic use, institutional use, industrial use, use in thermal and nuclear power plants – Non-consumptive uses – Recreational use, Navigational use

10 Hours

Module III: Properties of fluids: Intensive property - temperature, pressure, density, viscosity, specific volume, specific gravity, surface tension; extensive property – volume, mass, size, weight and conjugate properties: enthalpy, entropy, heat capacity

10 Hours

Module IV: Fluid flow – steady and unsteady flow, uniform and non-uniform flow, one, two- and three-dimensional flow, laminar and turbulent flow

8 Hours

Module V: Fluid Mechanics: Reynold's number, Reynold's experiment, Flow in a pipe, flow in a wide duct, flow in an open channel, calculation of flow velocity, Head losses

8 Hours

Module VI: Equations in fluid dynamics: Darcy-Weisbach equation, HazenWilliam's formula, Manning's formula (No derivation).

8 Hours

References

1. David Keith (2004) Ground Water Hydrology 3 edn. Todd-Willey International. P 656
2. Asit K. Biswas (1997) Water Resources: Environmental Planning, Management, and Development McGraw-Hill P 737
3. Sharma RK (1987) Hydrology and Water Resources Engineering Dhanpat Rai 818 p
4. R. K. Sharma (1987) A Textbook of Hydrology and Water Resources Engineering Dhanpat Rai & sons 818 p
5. Er. R K Rajput (1998) A Textbook of Fluid Mechanics 6th Edn S. Chand Publishing P 1051
6. Gray N F (2010) Water Technology: An Introduction for Environmental Scientists and Engineers

SEMESTER- I
VOCATIONAL PRACTICAL
EE1172 WATER MANAGEMENT LAB - I

Total hours: 36

1. Measurement of rain fall
2. Measurement of Evaporation (Relative Humidity)
3. Measurement of atmospheric temperature
4. Record of humidity

SEMESTER II

FOUNDATION COURSE II

EE1221 COMPUTER APPLICATION FOR BIOSTATISTICS

Total Hours: 36

Aim:

To introduce students the basics of Computer applications and the basics of biostatistics

Objectives:

- To make students know the applications of computer in research
- To introduce students to various data collection and processing steps
- To make students know the various statistic that can be applied to collected data
- To make students understand the various types of statistical variability in research

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Describe the various techniques of sampling	Un, Re
2.	CO 2	Present collected data in an comprehensible form	Un, Re, Ap
3.	CO 3	Express data in various types of graphical representations	Re, Un, Ap
4.	CO 4	Perform basic statistical techniques in	Re, Un, Ap

		data	
5.	CO 5	Formulate null and alternate hypothesis on research topics	Re, Un

Course Content:

Module I: Computer applications: preliminary concepts - sampling, sampling designs - sampling techniques - sample random – systematic sampling data - data presentation – numeric –alphabetic – alphanumeric

9 Hours

Module II: Collection and representation of data: Collection and classification tabulation of data.

3 Hours

Module III: Graphical representation of data: - methods of preparation of graph – Frequency curve relative frequency map - cumulative frequency map - relative frequency map or o-give. Dot diagram -significance of graphic representation - limitations of graphic representation

6 Hours

Module IV: Measures of central tendencies - mathematical average, average of position - measures of dispersion - range-mean deviation - standard deviation - distribution patterns

5 Hours

Module V: Statistical inference and hypothesis: Tests for statistical significance: student t-test, Chi-square test, confidence level, Null and alternate hypothesis (Concept only).

4 Hours

Module VI: Types of variability-experimental variation-biological variability, real variability-experimental variability, error, subjective, objective instrumental and sampling error

9 Hours

References

1. Elements of Biostatistics -S.Prasad. ISBN 81-7133-613-2 Title code bc-33 First edition -2003 Rastogi publications, Gangotri, Shivagiroad-Meerut 250 002.
2. Methods in Biostatistics for Medical students & research works-V. K Mahajan. Jaypee Brothers Medical brothers Pvt Ltd, New Delhi- 6th edition.

3. Introduction to Biostastitics. Pranab Kumar Banerjee and S.Chand. ISBN81-219-2329-8. First edition 2004. Rajendra Raveendra Printers Pvt. Ltd., Ram Nagar, New Delhi 110 055.

SEMESTER - II

CORE COURSE - II

EE1241 ENVIRONMENTAL STUDIES

Total Hours: 72

Aim:

To introduce students to the importance of the Environment and its components

Objectives:

- To give students an understanding on the basic concepts of Environment
- To introduce students to the concept of ecosystem and the different types of it
- To introduce students to the biodiversity and the significance and uses of it
- To make students understand the various social issues related to environment

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO1	Articulate the basic concepts of Environmental Studies	Un, Re
2.	CO2	List out and describe the various Natural Resources and enumerate the conservation strategies of resources	Un, Re, Ap
3.	CO3	Explain different kinds of ecosystem	Re, Un
4.	CO4	Explain the concept of biodiversity and its type	Re, Un

Course Content:

Module I: Concepts of Environmental Studies: Multidisciplinary nature of environmental studies; Definition, scope and importance, need for public awareness

4 Hours

Module II: Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. d) Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer- pesticide problems, water logging, salinity. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources, equitable use of resources

16 Hours

Module III: Ecosystems: Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystems: a) Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

12 Hours

Module IV: Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

14 Hours

Module V: Social Issues and the Environment: From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its—problems and concerns. Case Studies; Environmental ethics: Issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies; Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest

Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

16 Hours

Module VI: Human Population and the Environment: Population growth, variation among nations; Population explosion – Family Welfare Programme; Environment and human health; Human Rights; Value Education; HIV/AIDS; Women and Child Welfare; Role of Information Technology in Environment and human health.

10 Hours

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad –380 013, India, Email:mapin@icenet.net
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
5. DeA.K., Environmental Chemistry, Wiley Eastern Ltd.
6. Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
7. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
8. Heywood, V.H &Waston, R.T. 1995. Global BiodiversityAssessment. Cambridge Univ. Press 1140p.
9. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
10. Mckinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
11. MhaskarA.K., Matter Hazardous, Techno-Science Publication (TB)
12. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
13. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
14. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.

15. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
16. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
17. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
18. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
19. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA499p

SEMESTER- II

CORE & FOUNDATION COURSE PRACTICAL

EE 1242 ENVIRONMENTAL SCIENCE LAB-II

Total Hours: 36

Computer Application for Biostatistics

1. Create a power point presentation of wild life population.
2. Graphical representation - Bar, Pie charts of flora and fauna.
3. Plotting straight lines
4. Determination of Central tendencies

Environmental Studies

1. Identification of flora and fauna – terrestrial, marine and freshwater ecosystems
2. Estimation of primary productivity – light and dark bottle method
3. Community study : quadrat and line transect method
4. Construction of food chain/ food web : terrestrial and aquatic ecosystems

SEMESTER II

VOCATIONAL COURSE II

EE1271 WATER RESOUCE MANAGEMENT

Total Hours: 54

Aim:

To introduce students to the importance of management of water resources

Objectives:

- To make students the distribution of water on earth
- To give students an understanding of impacts of human use of water
- To make students understand the various irrigation types for water resource management
- To make students aware of the importance of sustained use of water
- To make students understand and identify the means of meeting the demand of freshwater

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Describe the distribution of water on earth	Un and Re
2.	CO 2	Reflect the impact of human use of water	Un
3.	CO 3	Articulate the various types of irrigation and develop efficient irrigation methods	Re, Un and Ap
4.	CO 4	List out the various methods for meeting increasing water demand	Re, Un
5.	CO 5	Describe sustainable use of water	Re, Un

Course Content:

Module I: Water resources: Distribution of water on earth: Forms of water – Freshwater - Types – glaciers and ice caps, precipitation, surface water – lentic and lotic; ground water: Saline water

10 Hours

Module II: Effects of human use of water: landscape changes, deforestation, Pollution, ground water exploitation, Urbanisation, Agriculture

6 Hours

Module III: Irrigation: Definition, Types of irrigation and its advantages and ill effects – surface irrigation, localized irrigation, drip irrigation, sprinkler irrigation, centre pivot irrigation, free flooding/wild/inundation, perennial system, direct irrigation: Frequency of irrigation: standards of irrigation water: Irrigation efficiency

12 Hours

Module IV: Lift irrigation: definition, advantage, requirements of lift irrigation, case study of lift irrigation

6 Hours

Module V: Meeting water demand: Rainwater harvesting, diverting surface water, dams and reservoirs, transferring water between river basins, waste water reuse, desalinisation of salt water

10 Hours

Module VI: Sustainable use of water: Freshwater shortage, management of water and conservation of water resources, Urban Decision Support System (UDSS)

10 Hours

References

1. Santosh Kumar Garg (1976) Water Resources Engineering Irrigation Engineering & hydraulic Structures Khanna Publishers 1132 p
2. Loucks, Daniel P., van Beek, Eelco (2017) Water Resource Systems Planning and Management Springer
3. M. H. Ali (2010) Fundamentals of Irrigation and On-farm Water Management: Volume 1 Springer

SEMESTER- II

VOCATIONAL PRACTICAL

EE1272 WATER MANAGEMENT LAB - II

Total hours: 36

1. Determination of pH of water sample
2. Determination of Alkalinity of water sample
3. Determination of SPM load of water
4. Determination of Surface tension by drop weight method
5. Determination of Surface tension by drop number method
6. Determination of Viscosity of a sample by Ostwalds Viscometer method
7. Determination of Humidity by Psychrometer

SEMESTER – III

CORE COURSE - III
EE1341 FUNDAMENTALS OF ECOLOGY AND CURRENT ENVIRONMENTAL ISSUES

Total Hours: 54

Aim:

To impart a detailed knowledge among the students on ecology and current environmental problems

Objectives:

- To understand the basic principles and classifications of ecology
- To gain the practical knowledge on diversity indices.
- To give an idea about the causes and impacts of current environmental issues.

Course Outcomes

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Understand the basic concepts of ecology	Un
2.	CO 2	Know the structure and principles of different types of ecology	Un
3.	CO 3	Understand the basic idea of biogeochemical and nutrient cycles	Un
4.	CO 4	Apply the knowledge on diversity indices	Ap
5.	CO 5	Describe the impacts of current environmental problems	Un
6	CO6	Generate solutions for the impacts of human use of Environment	Re, Un, Ap

Course Content:

Module I: Ecology: Definition, scope and history of ecology. Basic concept of Ecology, Terminology of ecology- species, vegetation, flora, fauna, population, community, habitat Subdivisions of ecology-Autecology and Synecology. Categories of ecological factors: climatic factors-light, temperature, rainfall, humidity, atmosphere; topographic factors- altitude, direction of mountain chains and valleys, steepness and exposure of slope; edaphic factor- soil formation, soil profile, physical and chemical properties of soil; Biotic factors-different kinds of interactions between forms of life i.e. plants, animals and microorganisms.

12 Hours

Module II: Population ecology: Population characteristics: size and density, dispersion, age structure, natality, mortality, life tables. Population interactions- Intra and inter specific interactions, symbiosis, mutualism, commensalism, competition, predation and parasitism.

8 Hours

Module III: Community Ecology: characteristics of community - species diversity, growth form and structure, dominance, succession, trophic structure. Composition, structure, origin and development of community.

Trophic pyramids and food webs. Ecological succession and its classification. Competition exclusion principle and Gause's theory of niche. Wetlands and Ramsar sites

10 Hours

Module IV: Habitat ecology: Structure and classification of different ecosystems– Freshwater, Marine, forest, grassland and deserts, Biogeographic zones. Endemic and endangered species, Invasive species and control. Biogeochemical cycles and nutrient cycles: Nitrogen cycle, carbon cycle, phosphorous. cycle, sulphur cycle.

9 Hours

Module V: Applied ecology: Species diversity, community stability and disturbance, Measurement of diversity, Abundance and frequency, Basic concepts of Diversity indices- Shannon-Weiner index, Simpson Index**,** Importance value Index.

6 Hours

Module VI: Current Environmental issues: Causes and consequences of climate change and global warming, ozone layer depletion, pollution, deforestation, soil degradation, waste disposal, water scarcity, natural resource depletion, over population, epidemiological issues-water, air and vector borne diseases.

9 Hours

References

1. Odum,E.P. 1971. Fundamentals of Ecology, W.B.Saunders Company, Philadelphia
2. Sharma.P.D. (2001). Ecology and Environment, Rastogi Publications, Meerut.
3. Rana, S.V.S. (2015). Essentials of Ecology and Environmental Science, PHI Learning Private Limited, New Delhi.
4. Chapman, J. L. and Reiss, M. J.(1992). Ecology: Principles and Application, Cambridge University Press, Cambridge

SEMESTER III

CORE COURSE IV

EE1342 PAPER II ENVIRONMENTAL MANAGEMENT

Total Hours 54

Aim:

To enable the students to identify, describe, and compare core themes and principles of the subject_

Objectives:

- To teach basics of environmental management
- To make students interpret environmental risk levels to make management decisions
- To make students aware of the National Environmental Policy and other regulatory frameworks

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
6.	CO 1	Define Environment Impact Assessment (EIA)	Re
7.	CO 2	List out the major Environmental protection laws in India	Re
8.	CO 3	Explain National Environmental Policy and Regulatory Frame Work	Un
9.	CO 4	Differentiate Environment Impact Assessment (EIA) and Environmental Impact Statement (EIS)	An
10.	CO 5	Compare Sustainable development measures taken by India and other developed nations	Ev

Course Content:

Module I: Basics of Environmental Management: Definition –Basic principles of Environmental Management. Environment Impact Assessment (EIA) -Definition and aim, Principles and Concepts of EIA, Environmental inventory, Baseline data on EIA, EIA assessment methodologies, Environmental Impact Statement (EIS) and Environmental Management Plan (EMP)

9 Hours

Module II: Sustainable Development -Meaning , Concept and Need of Sustainable Development, Indicators of Sustainable Development, Policies, UN and International conferences - Rio summit, Earth Summit, Agenda 21, Johannesburg conference on sustainable development; Copenhagen summit, Sustainable Development Goals (SDGs) Models of sustainable development; Case studies – Sustainable development scenario – global and national level.

9 Hours

Module III: National Environmental Policy and Regulatory Frame Work: Constitutional and Statutory laws in India – Article 48A, Article 51A(g); National Environment Policy, 2006; Intellectual Property Rights; Public Liability Insurance Act, 1991; Biopiracy; Green funding and taxes; Green Bench; Central and State Pollution Control Boards.

9 Hours

Module IV: Environmental Laws in India - The Wildlife Protection Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest Conservation Act, 1980; The Air Act (Prevention and Control of Pollution), 1981; The Environment Protection Act, 1986; Solid Waste Management Rules, 2016

9 Hours

Module V: Environmental Economics: Nature and scope of Environmental Economics; Interrelationship with Economy and Environment

9 Hours

Module VI: Environmental Standards: Scheme of labeling environment friendly products (Ecomark); Environmental Management and ISO Certification; Environmental Management System (EMS); ISO 14000

9 Hours

References

1. Environmental laws of India. An introduction. CPR Environmental Education Centre Chennai, 2000.
2. A text book on Environmental Studies. D.K. Asthana and Meera Athana. S.Chand and Co.
3. Ecology and Sustainable Development. P.S.Ramakrishnan. NBS New Delhi, 2001.
4. Environmental laws. Gurudip Singh. Macmillan India ltd.
5. Introductory Text of Environmental policies and laws. V.K.Garg, M.S Bishnoi, C.P Malik Kalyani Publishers, New Delhi.
6. Environmental Laws, Dharmendra.S.Sengar, Prentice Hall of India Pvt.ltd, Dew Delhi, 2000.
7. Ricci, P.F., Environmental and Health Risk Assessment and Management: Principles and Practices, Springer, 2006.
8. Theobald, R.H., Environmental management, Nova Science Publishers, 2008.
9. Madu, C.N., Environmental planning and management, Imperial College Press, 2007

SEMESTER III
CORE COURSE PRACTICAL
EE1343 ENVIRONMENTAL SCIENCE LAB-III

Total Hours: 36

1. Measuring rainfall and calculation of normal rainfall
2. Recording of maximum -minimum temperature
3. Recording of humidity
4. Preparing a field map using prismatic compass
5. A Collection and submission of 5 Eco-friendly products
6. A report of visit to a factory where Pollution abatement technology is implemented
7. A report on environmental law case study in India
8. A case study of EIA

SEMESTER III

VOCATIONAL COURSE III

EE1371 PAPER (1) HYDROLOGY - I

Total Hours: 72

Aim:

To introduce students to the basics of Surface water and Ground water Hydrology

Objectives:

- To make students understand the various factors affecting occurrence and movement of ground water
- To make students aware of the importance of sustained use of ground water
- To make students understand the potential problems of saline water intrusion

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Articulate the importance of hydrological	Un and Re

		cycling and the factors affecting	
2.	CO 2	Describe formation of rain, the factors affecting and various measuring techniques	Un
3.	CO 3	Frame an outline depicting evapo-transpiration with factors mentioned	Re, Un and Ap
4.	CO 4	Describe infiltration of water, groundwater, its occurrence and movement and the factors affecting ground water	Re, Un
5.	CO 5	Articulate connections between groundwater usage and saline water intrusion	Re, Un, Ap and An

Course Content:

Module I: Surface water hydrology: Definition and importance of surface water hydrology, Hydrological cycle – description; climatic factors affecting hydrological cycle - humidity, temperature, radiation and wind.

10 Hours

Module II: Evaporation and transpiration: Evaporation – definition; factors affecting evaporation - temperature, movement of air and wind speed, surface area and humidity; Estimation of evaporation - evaporation pan method, estimation from water balance calculation; evaporation from soil surface, factors affecting soil water evaporation - soil characteristics, tillage and environmental interactions; Transpiration – definition, factors affecting transpiration - evaporative demand of surrounding atmosphere, humidity, temperature, wind and incident sunlight.

15 Hours

Module III: Precipitation: Precipitation – definition; forms of precipitation, causes of precipitation Measurement of rainfall: measurement using rain gauge - Graduated Cylindrical or Standard Rain Gauge, Tipping Bucket Rain Gauge, Optical Rain Gauge and Acoustic Rain Gauge, measurement using radars; Rainfall intensity - Light rain, moderate rain, heavy rain, violent rain; Mean and annual rainfall, Snowfall, measurement of snow fall - snow gauges: automated and snow pillow; Characteristics of precipitation in India;

15 Hours

Module IV: Infiltration and Runoff: Infiltration – Definition; infiltration rate; factors affecting infiltration rates - precipitation, soil type, soil moisture content, land cover and slope; Runoff – definition; factors affecting runoff - climatic factors and physiographic factors; Global Water Balance.

11 Hours

Module V: Ground Water Hydrology: Ground water – definition; sources of ground water - meteoric water, connate water, magmatic water and juvenile water; ground water fluctuations; factors affecting ground water fluctuations - topography, stream flow, meteorological phenomena, evapo-transpiration and urbanization;—major sources of ground water contamination.

11 Hours

Module VI: Saline Water Intrusion and Wells: Saline water intrusion – Definition; causes of surface and ground water intrusion; control of saline water intrusion; wells – definition, types of wells - open wells/ dug wells and bore wells/ tube wells.

10 Hours

References

1. Rk Sharma and Tk Sharma (2000) Text Book Of Hydrology & Water Resources Engineering, Dhanpat Rai Publications (P) Ltd
2. K. Subramanya (1994) Hydrology, Tata McGraw-Hill Education p. 392
3. N N Basak (2017) Irrigation Engineering, McGraw Hill Education; 1 edition p. 329
4. Santosh Kumar Garg (2010) Water Supply Engineering, Khanna Publishers, p. 1196
5. David Keith Todd and Larry W. Mays (2005) Groundwater Hydrology, John Wiley & Sons; 3rd edition John Wiley & Sons; p. 656.

SEMESTER III
VOCATIONAL COURSE IV
EE13712 PAPER (2) WATER QUALITY PARAMETERS AND ASSESSMENT

Total Hours: 54

Aim:

To train the students on the basic concepts of water sampling technique and analyzing the water quality parameters

Objectives:

- To give an in-depth knowledge on sampling and preservation of water sample for physical, chemical and biological analysis.
- To gain the practical knowledge on water analysis.
- To give an idea about the water quality guidelines.

Course Outcomes:

At the end of the course, the student will be able to:

Sl.No.	Course Outcome No.	Course outcome (CO)	Taxonomic Level (TL)
	CO-1	Understand the basic concepts of water and water quality parameters	Un
	CO-2	Know the principles of water sampling and preservation methods	Un
	CO-4	Understand the basic idea of drinking water quality guidelines	Un
	CO-5	Apply the knowledge on water quality monitoring	Ap

Course Content:

Module I: Physical properties of Water: Boiling Point, Melting Point, critical temperature, viscosity, Surface tension, dielectric constant, dipole moment, Heat of vaporization.

10 Hours

Module II: Water quality and Sampling: definition, importance of water quality measurement, Objectives of water quality assessment, sampling methods & collection of water samples -surface water and groundwater, Types of sampling -spot or grab samples and composite samples, sampling frequency. Types of water samplers –Van Dorn water sampler, Ruttner water sampler, Dussart-flask water sampler, Thermos-flask water sampler, pump

sampler, Niskin water sampler, Nansen water sampler, handling and preservation of water sample for physical, chemical and biological analysis.

12 Hours

Module III: Water quality parameters: physical- colour, temperature, odour, electrical conductivity, turbidity, transparency; chemical - pH, total dissolved solids, Dissolved Oxygen, Biochemical Oxygen Demand, Ca, Mg, hardness, alkalinity, acidity, Chemical Oxygen Demand, Nitrite, Nitrate, phosphate, Fluoride, chloride; bacteriological -total coliforms, faecal coliforms, E.coli and biological parameters - macrophytes, phytoplankton, chlorophyll. Tolerance limits for trace metals in drinking water- Al, B, Cd, Co, Pb, Mn, Ni. Fe, Zn, Cr, Cu, Mo, Se

12 Hours

Module IV: Analytical methods: pH, electrical conductivity, alkalinity, hardness by EDTA method, TDS, DO by Winkler method, Chloride by Titrimetry, Transparency by Seechi disc method, Coliforms by MPN method.

10 Hours

Module V: Biological Methods: Estimation of chlorophyll content, collection and preservation of phytoplankton, measurement of phytoplankton population -Sedgwick-Rafter cell method and Lackey's drop method.

8 Hours

Module VI: National and International Standards for drinking water quality: WHO, USPHS, CPCB, BIS.

2 Hours

References

1. APHA (1995). Standards methods for the examination of water and wastewater.19th Edition., American Public Health Association, Washington DC.
2. BIS (2012). Indian Standard Drinking Water-Specification (Second Revision) IS 10500 : 2012.
3. Saxena, M.M. (1998). Environmental Analysis: Air, Water and Soil. Agrobotanica, Bikaner, 184 p.
4. Trivedi, R.K. and Goel, P.K. (1986).Chemical and biological methods for water pollution studies. Environmental Publications, Karad, India, 247 p.
5. USPHS (1962). Public Health Service Drinking Water Standard (https://law.resource.org/pub/us/cfr/ibr/006/usphs.956.1962.pdf)
6. WHO (2008). Guidelines for drinking-water quality [electronic resource]:incorporating 1st and 2nd addenda, Vol.1,

Recommendations. – 3rd ed. https://www.who.int/water_sanitation_health/dwq/fulltext.pdf

S

EMESTER – III

VOCATIONAL PRACTICAL

EE1373 WATER MANAGEMENT LAB - III

Total Hours: 36

1. Determination of Chlorine percentage in a sample of bleaching powder
2. Determination of concentration of chloride ion in a sample of water sample
3. Determination dissolved oxygen in a sample of water
4. Determination of density of water

SEMESTER – IV

CORE COURSE V

EE1441 - PAPER (1) ENVIRONMENTAL BIOTECHNOLOGY AND MICROBIOLOGY

Total Hours: 90

Aim:

To develop basic understanding of the principles and applications of microbiology and biotechnology in the environment

Objectives:

- To impart knowledge on the microbes in the environment and interactions of microorganisms in the various spheres of the environment
- To understand the principles of biotechnology applications of biotechnology in waste management

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO1	Describe the different types of microbes in the environment and differentiate microbes based on their metabolic	Re

		diversity	
2.	CO2	Define the various environmental factors that influence growth and activity of microbes	Re
3.	CO3	Explain the role of microorganisms in biogeochemical cycling of nutrients	Un
4.	CO4	Outline the environmental applications of biotechnology	Re
5.	CO5	Assess the bioremediation techniques for application in waste treatment	An

Course Content:

Module I: Environmental Microbiology: Microbes in the environment – diversity and types – bacteria, archaea, fungi, protozoa and algae: Growth of microorganisms Environmental factors and microbial growth: oxygen, temperature, pH, pressure. Extremophiles – microbes in the extreme environment.

15 Hours

Module II: Microbial ecology: Microbes in water; coliforms and indicators of fecal contamination; Microbiology of soil: role in soil fertility; interactions between microbes and plants – mycorrhizae; rhizobium - nitrogen fixation; microbiology of air: prevalence and environmental factors; air-borne pathogens.

15 Hours

Module III: Metabolic diversity: Phototrophs, autotrophs, heterotrophs, chemolithotrophs, heterotrophy; Aerobic and anaerobic respiration, fermentation

Role of microbes in geochemical cycles – Carbon, Nitrogen and Sulphur cycles; Microbial interactions; Interactions between microorganisms: commensalism, mutualism, parasitism and ammensalism

15 Hours

Module IV: Biotechnology-definitions: Scope of biotechnology in agriculture, food production and nutrition. Impact of biotechnology on sustainable development and sustainable agriculture: biofertilizer and biopesticides; Microorganisms in biomass and energy production: Microbes producing protein - single cell protein; Biogas production – Methane.

15 Hours

Module V: Genetic Engineering: Brief study of gene cloning in prokaryotes, Molecular tools for genetic engineering. Recombinant DNA technology and its applications; Release of genetically engineered

microorganisms; safety and environmental risks; impact of genetically modified crops

15 Hours

Module VI: Microbes in waste treatment: treatment of solid waste – biocomposting and vermicomposting: principles, technique and applications. Microbes in waste water treatment: aerobic and anaerobic waste water treatment

Bioremediation: principles and applications; in situ and ex situ remediation processes and applications; in situ remediation of groundwater contamination and petroleum hydrocarbon contamination

15 Hours

References

1. Ananthanarayanan and Panicker. 2009. Textbook of Microbiology, University Press.
2. Bhandar,S.C & L.L. Somani. 1994. Ecology and Biology of Soil microorganisms: Agretech Publishing, Udaipur.
3. Chandrawati Jee and Shagutta. 2007. Environmental Biotechnology, APH Publishing.
4. Ignacimuthu,S.J. Biotechnology: An Introduction. Tata Mc GrawHill Publication Company Ltd.
5. Kumar,H.D. Modern Concepts of Biotechnology. Vikas Publishing House.
6. Mohapatra,P.K. 2010. Textbook of Environmental Biotechnology, I.K.International Pvt.Ltd.
7. Pelczar,M. 2001. Microbiology.
8. Pepper,I. and C.P.Gerba. 2004. Environmental Microbiology (2nd Edition). Academic Press
9. Power,C.B. & Daginawala,H.F. 1982. General Microbiology Volume I & II. Himalaya Publishing house, New Delhi.
10. Purohit,S.S. 2004. A text book of Microbiology. Student edition, Jodhpur.
11. Raina M.Maier. 2000. Environmental Microbiology, Academic Press.
12. Sharma,P.D. 1989, Microbiology Restegi& Company, Meerut.
13. Singh,R.P. & Kamal. 1989. An Introduction to Microbiology Central Book Depot, Allahabad

SEMESTER IV

CORE COURSE VI

EE1442 PAPER (2) BIOPHYSICS, BIOSTATISTICS AND COMPUTER APPLICATION

Total Hours 36

Aim:

To introduce students to the instruments used in Environmental research

Objectives:

- To introduce students to the principles and techniques of various instruments
- To give students the basics of biostatistics
- To make students understand the need of using principles of statistics in environmental research
- To make students capable of browsing the internet through relevant websites for statistical analysis

Course Outcomes:

At the end of the course, the student will be able to:

Sl No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO1	Articulate the importance of light and its measurements in environmental analysis	Un, Re
2.	CO2	Describe various instruments used in environmental analysis with their principles and application	Un, Re
3.	CO3	Perform statistical analysis of data provided	Re, Un
4.	CO4	Explain the significance of Redox Potential in environmental analysis	Re, Un
5.	CO5	Describe the use of internet and computer based tools for information and statistical analysis	Re, Un

Course Content:

Module I: Biophysics - Introduction: Importance of instruments in environmental anaysis

1 Hour

Module II: Effects of Light in environmental analysis: Beer Lambert's Law - Law, mathematical expression of the law, explanation on its application in environmental research; Absorption spectrum; Photochemistry – definition; fluorescence and phosphorescence - definition and principle; Photochemical reactions such as photosynthesis; Bioluminescence and photo degradation - definition

10 Hours

Module III: Redox potential - definition and significance in environmental research

1 Hour

Module IV: Instruments and techniques: Light microscopy - principle and application; electron microscopy - principle and application; spectrophotometry - principle, instrumentation and application; mass spectroscopy - principle, instrumentation and application; absorption spectroscopy - principle, instrumentation and application; X ray analytical methods - principle and application

10 Hours

Module V: Biostatistics: Significance of biostatistics in environmental studies, Population and sample – definitions; Sampling methods - probability/ random - simple random sampling, systematic sampling, stratified sampling multistage sampling, cluster sampling and non-random methods - convenience sampling, purposive sampling and quota sampling; Measures of dispersion - range, deviance and variation – definition with examples; Test of significance - chi square test, student t-test – definition with example and analysis of these using computer

12 Hours

Module VI: Internet: Basic idea on browsing websites for information and statistical analysis

2 Hours

References

1. David Burns (2016) An Introduction to Biophysics. Wentworth Press P. 456
2. Daniel M. (2012) Basic Biophysics for Biologists (I edn) Agrobios (India)
3. Veerakumari L. (2015) Bioinstrumentation (I edn) MJP Publishers; P. 578
4. Wayne W. Daniel and Chad L. Cross (2014) Biostatistics: Basic Concepts and Methodology for the Health Sciences (X edn) Wiley P. 954
5. Banerjee Pranab Kumar (2007) Introduction to Bio-Statistics (III edn) S Chand & Company P. 2018

6. Rao S (2012) Introduction to Biostatistics and Research Methods (V edn) PHI Learning Pvt. Ltd P. 280

7. James Gatenby (2001) Basic Internet Skills. Bernard Babani Publishing P. 160

SEMESTER IV

CORE COURSE PRACTICAL

EE1443 ENVIRONMENTAL SCIENCE LAB-IV

Total Hours: 36

1. Demonstration of Sterilisation by dry heat and wet heat (SteamAutoclaving)

2. Cultutre media preparation using PDA (Potato DextroseAgar)

3. Growth of E.Coli in liquid media.

4. Slides of specimens - Paramecium, Spirogyra, Pencillium, coliform bacteria

SEMESTER IV

VOCATIONAL COURSE V

EE1471 WATER QUALITY MANAGEMENT - I

Total hours: 72

Aim:

This course is designed to provide the proper understanding and hands on training on determining water quality and thereby achieving an ecological and chemical good status of all water bodies by means of sampling, laboratory analysis and management strategies. Preventing and controlling pollution of the water resources is a major challenge facing today. Over large parts of the world, rivers and lakes show increasing trends of water pollution.

Objectives:

- To find out the scientific guidelines that are safe limits of the physical, chemical, or biological characteristics of water and sediments which protect water for different uses.
- To reduce to control and prevent pollution
- To adopt cost effective and sustainable management practices to conserve water resources for the sustainable utilization.

Course Outcomes:

At the end of the course, the student will be able to:

SL No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Recognize the concept of water quality criteria and standards for different purposes	Re
2.	CO 2	Understand and apply the different sampling methodologies and collection equipment needed for water quality monitoring	Un
3.	CO 3	Develop the analytical ability to set up the experiments	An
4.	CO 4	Analyze the different conventional and specific water treatment processes	An
5.	CO 5	Design sound and sustainable water quality management practices under specified conditions	Cr
6.	CO 6	Apply any of these treatment strategies wherever necessary	Ap

Course Content:

Module I: Water Quality Requirement and Standards for various uses: Water quality Criteria and standards (WHO and BIS)-drinking, industrial, irrigation, aquaculture.

6 Hours

Module II: Water Quality Monitoring and Sampling: Water quality parameters, Sampling methods for streams, lakes, waste water and sediment (Grab and Composite samples) Sampling equipments: Niskin water sampler, Nansen water sampler, Dussart flask

12 Hours

Module III: Water treatment process: Conventional methods-sedimentation, coagulation, flocculation, filtration, disinfection. Chemical methods-UV rays, ionizing radiation (X-rays, gamma rays, and electron beams), iodine and bromine, ozone, potassium permanganate, silver and chlorine. Types of chlorination- Plain chlorination, Pre-chlorination, Post-chlorination, Break point chlorination, Super chlorination, De-chlorination

18 Hours

Module IV: Specific water treatment processes: Desalination. Reverse osmosis; electrodialysis; freezing method; multi flash evaporators. Water softening methods- Lime soda process, Ion-exchange process and Permutit process

12 Hours

Module V: Methods for removal of iron and manganese-oxidation/filtration, ion exchange method. Methods for removal of chromium- Chemical precipitation, adsorption and biosorption, reverse osmosis, ion exchange, Electrodialysis. Methods for Removal of dissolved gases from water – Degasification. Methods for removal of oil from water- Oil skimming. Methods for removal of Radio materials (Uranium, Radon, Polonium) from water

14 Hours

Module VI: Water quality management: Definition, Management and conservation of water resources, national and state level policies in water quality management- The National Water Policy, 2002, The Water (Prevention & Control of Pollution) Act, 1974, Water Cess Act, 1977, Environment (Protection) Act, 1986. Polluter Pays principle

10 Hours

References

1. Annanmaki, M. and Turtiainen, T. (Eds.). Treatment Techniques for Removing Natural Radionuclides from Drinking Water, STUK—Radiation and Nuclear Safety Authority, Finland.
2. https://inis.iaea.org/collection/NCLCollectionStore/_Public/32/018/32018426.pdf
3. APHA (1995). Standards methods for the examination of water and wastewater.19th Edition. American Public Health Association, Washington DC.
4. Arceivala, S.J. Asolekar, S.R. (2007): Wastewater Treatment for Pollution Control and Reuse, Tata McGraw Hill Publishing Company Ltd, New Delhi.
5. Gray, N.F. (2010). Water Technology: An Introduction for Environmental Scientists and Engineers, Butterworth-Heinemann, 3rd Edition
6. Hammer, M.J. and Jr. Hammer, M.J. (2012). Water and Waste Water Technology, Printice Hall India Pvt. Ltd.
7. Punmia, B.C., Jain, A.K. and Jain, A.K. (1995). Water Supply Engineering, Lakshmi Publications, New Delhi.

8. Trivedi, R.K., Goel, R.K. (1984) Chemical and Biological Methods of water pollution studies. Environmental publication, Karad.
9. Michael, P. Ecological Methods for field and Laboratory Investigation, Tata McGraw Hill publishing Company. New Delhi.
10. Saxena, M.M. (1998). Environmental Analysis: Air, Water and Soil. Agrobotanica, Bikaner, 184 p.

SEMESTER IV
VOCATIONAL PRACTICAL
EE1473 WATER MANAGEMENT LAB - IV

Total Hours: 36

1. Determination of BOD of a sample of water
2. Determination of COD of a water sample
3. Determination of TDS in a sample of water
4. Determination of Salinity in a sample of water
5. Determination of hardness of water

SEMESTER V

CORE COURSE VII

EE1541 PAPER (1) ENVIRONMENTAL GEOLOGY AND MINERALOGY

Total Hours: 72

Aim:

To make them learn the basic principles of geology and develop an understanding of the methods geologists use to study the Earth.

Objectives:

- Recognize the Earth as a unique, closed system and composition of earth.
- To make students understand the role of natural geologic processes operating on earth.
- To make students aware of the different rocks and minerals – the building block of earth.

Course Outcomes:

At the end of the course, the student will be able to:

Sl No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Define the scope of Environmental Geology	Re
2.	CO 2	Compare Exogenous and Endogenous processes	Un
3.	CO 3	Explain Pedogenesis and soil profiles	Un
4.	CO 4	Explain the geological processes operating on earth	An
5.	CO 5	Analysing minerals and rocks-the building block of earth	An

Course Content:

Module I Introduction to Environmental Geology: Definition and scope; Origin and Evolution of Earth- Current views on origin of earth, Geological Time Scale; Plate Tectonics – Sea floor spreading and continental drift; Forces acting on the surface of the Earth – Tectonic and Diastrophic forces.

14 hours

Module II: Processes on Earth: Exogenous (weathering, erosion, transportation, and sedimentation) and endogenous (folding, faulting and volcanism) processes operating on earth. Study of the interior of earth: Crust, mantle and core; Earth's Surface Process- Weathering of rocks – physical, chemical and biological weathering; erosion, transportation, and deposition.

14 hours

Module III: Pedogenesis: Factors affecting soil formation, factors controlling formation of soil; soil profiles

6 hours

Module IV: Geological agents: Erosion, transportation and deposition of earth's materials by water, wind and glaciers; River as a geological agent - development of river; meandering of river; drainage pattern; drainage basin; energy in streams; Rivers in India; Glaciers - Types and geological activity, Glaciers as an index of climate change.

12 hours

Module V: Minerals: Definition of mineral; Physical properties of minerals such as colour, streak, luster, hardness and specific gravity. Composition and diagnostic properties of important rock forming minerals - quartz, feldspar, calcite, biotite

12 hours

Module VI: Rocks: Petrology- Igneous, Sedimentary and Metamorphic rocks; Igneous Petrology - Brief overview of formation, structures and classification of igneous rocks. Megascopic features of Granite, Syenite, Gabbro and Basalt; Sedimentary Petrology - Brief overview of formation, structures and characteristics of sedimentary rocks. Megascopic features of Sandstone, Limestone, Shale, Breccia, Conglomerate; Metamorphic Petrology – Origin and formation of metamorphic rocks. Megascopic features of Marble, Gneiss and Schist.

14 hours

References

1. Carla Montgomery (2020). Environmental Geology (11th Edition). Mc Graw Hill. ISBN13: 9780078022951.
2. Edward. A. Keller. 2018. Introduction to Environmental Geology (5th ed.). Pearson India. 792p.
3. Jim Reichard (2020). Environmental Geology (4th Edition). Mc Graw Hill. ISBN13: 9781260368277
4. LaMoreaux James. (2019). Environmental Geology. (1st edition). springer. p 472. Print ISBN: 978-1-4939-8786-3
5. Steven Eark. 2019. Physical geology. Press Books.
6. Duggal K. N. and J. P. Soni, (1996). Elements of water resource engineering; New Age International Publisher.
7. Read, H. H. Rutley's Elements of Mineralogy. John Wiley and Sons, New York.
8. Reghunath, H.M. (1996). Hydrology – Principles, analysis and design, New Age international publisher.
9. Singh V.P (1994). Elementary Hydrology, Prentice – Hall of India.
10. Strahler, A. N. and Strahler, A.H. (1987). Physical Geography, John Wiley and Sons, New York.
11. Todd, D. K. and L.W. Mays (2005). Ground Water Hydrology, 3rd Edn. Wiley Inc.
12. Tyrell, G. W. (1978). Principles of Petrology. Chapman & Hall Ltd.
13. Mukergee,P.K, 1986. A text book of Geology.
14. Parbin Singh, S.K.Katariah & sons Engineering & General Geology, Gurunank market, New Delhi.

SEMESTER V

CORE COURSE VIII

EE1542 PAPER (2) DISASTER MANAGEMENT

Total Hours: 72

Aim:

The aim of this elective course is to improve the scientific knowledge among students about various natural and man- made disasters through the teaching of policies, programs, administrative actions and operations undertaken. This will train them to cope with the different disaster management activities like preparedness, prevention and thereby to reduce or avoid the human, physical, and economic losses suffered by individuals, by the society, and by the country at large. Also train them to reduce their personal sufferings in connection with a disaster.

Objectives:

- To make students understand the concept of disaster, perception and management of various natural disasters like flood, earthquake, landslide, cyclone, coastal erosion etc.
- To make students know the role of Remote Sensing and GIS in disaster management etc.

Course Outcomes:

At the end of the course, the student will be able to:

Sl No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Understand the basic aspects of disaster	Un
2.	CO 2	Analyse the components in disaster management cycle	An
3.	CO 3	Identify the sectors in disaster management	Un
4.	CO 4	Understand the different types of natural disasters	Un
5.	CO 5	Understand the different types of anthropogenic disasters	An

Course Content:

Module I: Basic concept of disaster: Definition of hazard, vulnerability, risk, disaster.

Causative factors of disaster; Classification of disasters

8 Hours

Module II: Disaster management: Definition, components of disaster management cycle -crisis management & risk management. Crisis management- quick response and relief, recovery, rehabilitation; Risk management- risk identification, risk assessment, risk reduction in vulnerable areas – Preparedness, prevention, mitigation; Risk transfer.

15 Hours

Module III: **Important sectors in disaster management:** Health & Medical care; Communication, Insurance, Social work, NGO's, Media, Fire service, Police and Armed forces, parliamentary service

15 Hours

Module IV: Natural disasters: flood, drought, landslide, earthquake, cyclone, tsunami - causes, perception, mitigation, and management.

12 Hours

Module V: Man-made disasters: fire, industrial pollution, biological disaster, structural failure (building & Bridges), accidents (Road, rail & Water), dams

12 Hours

Module VI: Policies: Disaster management related Acts and Policies in India.

10 Hours

References

1. Gupta and Harsh, K. 2003. Disaster Management, Universities Press (India) Pvt. Ltd..
2. Janki Andharia (2020). Disaster Studies. Springer Singapore. p462. Hardcover ISBN 978-981-329-338-0
3. Jha and Kumar, M. 2010. Natural and Anthropogenic Disasters; Vulnerability, Preparedness and Mitigation, Springer.
4. Peijun Shi (2019). Disaster Risk Science. Springer Singapore. P 753. ISBN 978-981-13-6691-8
5. Singh, K .K .&. Singh, A .K. 2010. Natural and manmade disasters: vulnerability, preparedness and mitigation, Vol(1&2), M.D. publications. Pvt. Ltd. New Delhi.
6. Strahler, A.N. and Strahler, A.H. 1973. Environmental Geoscience – Interaction between natural systems and man: -Santa Barbara, California, Hamilton Publishing.
7. Talwar, A.K. &Juneja, S. 2009. Flood Disaster Management, Commonwealth publishers, New Delhi.

SEMESTER V

CORE COURSE PRACTICAL

EE1543 ENVIRONMENTAL SCIENCE LAB-V

Total Hours: 90

1. Identification of common minerals & rocks
2. Identification of soil types - red soil, alluvial soil, black soil
3. Identification of soil texture
4. Determination of soil moisture content
5. Determination of soil pH
6. Determination of conductivity.
7. Estimation of organic carbon of soil
8. Bulk density of soil
9. Soil organic matter
10. Particle density of soil
11. Soil nutrient analysis
12. Preparation of Disaster Management Plan for Flood/ Earth quake/
13. Preparation of Disaster Management Plan for Health disaster

SEMESTER V

VOCATIONAL COURSE VI

EE1571 PAPER (1) WATER POLLUTION

Total Hours: 54 Hours

Aim:

To develop basic understanding on the different sources of water pollution and its harmful effects

Objectives:

- To impart knowledge on the water quality standards, physical, chemical and bacteriological test methods
- To understand the factors responsible for surface water, marine water pollution and organic pollution.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Will be able to describe the sources influencing water pollution and common impurities in water	Re
2.	CO 2	To understand and analyze the physical, chemical, bacteriological testing methods, water quality standards and water borne diseases	Un, An
3.	CO 3	Will be able to explain the riverine, estuarine, marine water pollution and the extent of plastic pollution	Un
4.	CO 4	Can develop knowledge on identifying the sources and type of organic pollution	Un
5.	CO 5	To understand the role of microorganisms in cleaning up and purification of water	Un

Course Contents:

Module I: **Water pollution**: General properties of water; Brief history of water pollution; Sources of water pollution; Physical pollution of water; Chemical pollution of water; Biological pollution of water.

9 Hours

Module II: **Water impurities:** Common impurities in water; testing of water; physical test; chemical test; bacteriological test.

9 Hours

Module III: Water quality: Standards of drinking water; Maintenance of purity of water; Ground water pollution, factors affecting ground water pollution, harmful effects of ground water pollution; Water borne diseases, Bio monitoring of water pollution

9 Hours

Module IV: Surface water pollution: Sources of surface water pollution; Factors affecting surface water pollution - factors affecting nutrient loss in surface water – Monitoring and control of pollution in lakes, rivers and estuaries.

9 Hours

Module V: **Sea water pollution**: Global sea water pollution - Control of pollution in seawater; role of microorganisms in cleanup operation; current scenario of plastic pollution in marine water.

9 Hours

Module VI: **Organic pollution:** Organic pollutants - synthetic detergents; eco-friendly detergents containing enzymes; eutrophication, oceanic acidification, radionuclide pollution, thermal pollution in water; pesticide pollutants. Techniques for treatment of biological wastes

9 Hours

References

1. B K Sharma, Water pollution. Goel publishing House, Meerut.
2. B C Punmia, Ashok Jain and Arun Jain, Water supply Engineering. Lakshmi Publications, New Delhi
3. P K Goel, 2006. Water pollution: Causes, Effects and Control, New age International Publishers, New Delhi
4. Anupam Rajak, 2019. Micro plastic pollution. Published by Notion Press, Chennai

SEMESTER V
VOCATIONAL COURSE VII
EE1572 PAPER (2) WATER QUALITY MANAGEMENT-II

Total Hours: 54

Aim:

The course aims to impart basic knowledge of waste water treatment process among the students and to equip the students with the skills on the management of waste water generated in industries.

Objectives:

- To give students an overview of the characteristics of waste water, waste water treatment process, disposal methods of sewage and sludge
- To make students understand sophisticated methods adopted in industries.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Understand the basic concepts of waste	Un

		water and sewerage systems	
2.	CO 2	Articulate fundamental concepts in waste water treatment process	Un
3.	CO 3	Apply concepts and design the waste water treatment methods in industries	Ap
4.	CO 4	Know the basic principles of sewage and sludge disposal methods	Un
5.	CO 5	Develop a capacity for decision making on the management of waste generated in industries	Ap

Course Content:

Module I: Waste water or sewage: Definition, nature, sources. Types- grey water, black water, yellow water, brown water. Physical, chemical and biological properties of waste water

4 Hours

Module II: Sewage characteristics: types-domestic sewage, industrial sewage, storm sewage. Major pollutants in sewage- organic material, suspended solids, plant nutrients, microbes. Sewerage systems

2 Hours

Module III: Waste water treatment: Primary treatment - screening, skimming, grit chamber, coagulation and flocculation, filtration and sedimentation tank methods. Secondary treatment -activated sludge, trickling filters, oxidation ponds. Advanced treatment: Removal of nitrogen and phosphorous from waste water. Disinfection by chlorination

12 Hours

Module IV: Natural methods of sewage disposal: Dilution method, Sewage farming method: Sanitary water management - sanitary waste, definition, Systems of sewage disposal: Dry conservancy system & water carriage system

9 Hours

Module V: Treatment and disposal of sludge: thickening and digestion, conditioning and dewatering, incineration, anaerobic digestion, drying beds, Rotary drum filters, land filling.

9 Hours

Module VI: Characteristics and treatment of industrial waste water: breweries and wineries; distilleries; paper and pulp mill; sugar mill; oil refineries, Petrochemical industries; tanneries; pharmaceutical plants; fertilizer plant; electroplating industries; textile mills.

18 Hours

References

1. Abbasi, S.A. 1998. Environmental Pollution and its Control, Cogent International, Pondicherry.
2. Basak, N.N. (2014). Environmental Engineering, Tata Mc Graw Hill publishing company.
3. Garg, S.K. (2017). Water Supply Engineering: Environmental Engineering - Vol. I. Khanna Publishers.
4. Gray, N.F. (2010). Water Technology: An Introduction for Environmental Scientists and Engineers, Butterworth-Heinemann, 3rd Edition.
5. Mahajan, S.P. (1985). Pollution Control in Process Industries, Tata McGraw-Hill Education.

SEMESTER V

VOCATIONAL PRACTICAL

EE1573 WATER MANAGEMENT LAB - V

Total Hours: 72

1. Determination of chlorine demand a sample of water
2. Determination of residual chlorine in a municipal water sample
3. Determination of moisture percentage of soil
4. Determination of PH of soil

5. GRAVIMETRIC ESTIMATION OF

a) Sulphate, oxalate

b) Barium, calcium, iron, nickel

6. Colorimetry and turbidimetry

a) Sulphide

b) Fluoride

c) Silicate

d) Ammonia

e) Sulphate

SEMESTER V

OPEN COURSE

EE1551 SOLID WASTE MANAGEMENT

Total Hours: 36

Aim:

To make students understand the concept of Solid Waste, its composition and the problems associated and the management aspects of solid wastes and plastic wastes

Objectives:

- To introduce students to the concept and composition of solid wastes
- To make students aware of the activities creating solid wastes
- To make students understand the problems caused by hazardous wastes
- To introduce students the various management techniques of solid waste in general and plastic waste in particular

Course Outcomes:

At the end of the course, the student will be able to:

Sl.No.	Course Outcome No.	Course outcome (CO)	Taxonomic Level (TL)
1.	CO-1	Define and identify the different types of solid wastes	Re
2.	CO-2	Describe the solid waste management methods	Re
3	CO-3	Explain the management of agricultural wastes	Un
4	CO-4	Outline the types of hazardous solid wastes	Re
5	CO-5	List the waste management policies	Re
6	CO-6	Explain the functioning of sanitary landfill	Re

Course Content:

Module I: Introduction: Solid wastes and its characteristics; classification of solid waste – source; factors affecting quality & quantity. Physical and chemical characteristics - collection & transportation

4 Hours

Module II: Composition: The changing nature, quantity, composition of solid wastes in urban and rural areas of India and World. (Households, Institutions, markets, Recreational places and Parks, Corporate and Business Centers, Religious Institutions, Hotels)

4 Hours

Module III: Agricultural wastes: types and sources. Disposal techniques - composting; principles of composting; factors affecting composting; Types of composting - Windrow layout

6 Hours

Module IV: Hazardous wastes: Definition, source and characteristics; Management of medical and hospital wastes, Nuclear and radioactive wastes – classification, sources and disposal; e-waste and their management

8 Hours

Module V: Management of plastic wastes: Reuse and recycling; Waste management policies; Energy recovery from solid wastes

6 Hours

Module VI: Solid waste management: source reduction - Reuse and Recycling; sanitary landfill - advantages and disadvantages of sanitary landfill. Methods of landfill - Incineration - types of incinerators - reactions involved - advantages and disadvantages of incineration.

8 Hours

References

1. Agarwal,S.K. 2005. Green Management, APH Publishing corporation, New Delhi.
2. Agarwal,S.K. 2005. Wealth from waste, APH Publishing corporation, New Delhi
3. Bhatia,S.C. 2007. Solid and Hazardous Waste Management. Atlantic Publishers and Distributors, New Delhi
4. Bide,A.D. and R.R.Sundaresan. 2001. Solid Waste Management: Collection, processing and disposal. INSDOC, New Delhi
5. Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, 2000.2. Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001
6. George Techobanoglous et al.1993. Integrated Solid Waste Management, McGraw-Hill, 1993

7. Khan,M.K. 2004. Hospital waste Management: Principles and guidelines, Kanishka Publishers, New Delhi
8. Liu,D.H.F. and R.G.Liptak. 2000. Hazardous waste and solid waste. Lewis
9. Metcalf and Eddy. 1991. Waste Water Engineering – Treatment, Disposal and Reuse. McGraw Hill International Edition, New York.
10. Manser A.G.R. and Keeling A.A.," Practical Handbook of Processing and Recycling of Municipal solid Wastes", Lewis Publishers, CRC Press, 1996

On-line Sources

1. https://www.epa.gov/hw/hazardous-waste-recycling
2. https://www.journals.elsevier.com/waste-management
3. https://www.wm.com/us

SEMESTER - VI

CORE COURSE IX

EE1641 PAPER (1) ENVIRONMENTAL POLLUTION AND CONTROL MEASURES - I

Total Hours: 54

Aim:

To introduce students to the pollution issues related to air

Objectives:

- To understand the structure of atmosphere
- To understand the various sources of air pollution and to understand the need of control of air pollution
- To introduce students to hazardous wastes and the problems associated with it
- To give students a basic knowledge regarding the air quality standards.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Explain the structure of atmosphere with the features of each layer	Un, Re
2.	CO 2	Describe the quality parameters of air and	Un, Re

		air pollution with the various units for its measurements	
3.	CO 3	Explain the sources and effects of air pollution	Re, Un
4.	CO 4	Articulate the control techniques of various kinds of air pollution	Re, Un
5.	CO 5	Explain Hazardous waste and its management strategies	Re, Un

Course Content:

Module I: Atmosphere: Structure of atmosphere - troposphere, stratosphere, mesosphere and thermosphere – the features of these layers; the natural composition of air; air quality standards

6 Hours

Module II: Air pollution: Definition, units for quantification of air pollution - Micrograms per cubic meter ($\mu g/mm^3$), parts per million (ppm), parts per billion (ppb), newly introduced units of air pollution - olf and decipol; classification of air pollutants – according to origin, according to states of matter and sources - primary and secondary pollutants, photochemical smog; gaseous and particulate pollutants; according to sources – natural and manmade, case study of air pollution – Bhopal tragedy

10 Hours

Module III: Sources of Air pollution – automobile exhausts: emission standards of automobiles in India - CO_x, NO_x and SO_x; Specific emission standards such as Bharat stages – definition, BS I, BS II and BS III; air pollution from factories: hydrocarbons, polychlorinated hydrocarbons; Indoor air pollutants – definition and sources

10 Hours

Module IV: Effects of Air pollutants: Effect of particulate pollution and different gaseous pollutant on plants, human beings and materials

6 Hours

Module V: Control of Air pollution: control of pollution from factories - different methods of emission control - using impingers, electrostatic precipitators, bag houses and wet scrubbers; control of gaseous pollutants control of pollution from automobiles

12 Hours

Module VI: Hazardous wastes: definition and classification; sources and generation of hazardous wastes; health effects and environmental impacts of hazardous wastes; management of hazardous wastes - overview of: the

hazardous Wastes - Management, Handling and Trans-boundary Movement Rules, 2008 and amendment in 2009

10 Hours

References

1. Handbook Airborne Particulate Matter Pollution Prevention and Control, World Bank Group https://www.ifc.org/
2. Gopal Dutt N.H. (2016). Environmental Pollution and control (I edn) Neelkamal Publication. P 302.
3. Vincent King (2017). Air Pollution: Causes, Impacts and Control, Larsen and Keller Education, p. 240
4. Prabhakar V.K. (2004) Pollution Monitoring and Control Hardcover, Anmol Publisher p. 280
5. Cliff VanGuilder (2011). Hazardous Waste Management: An Introduction. Mercury Learning & Information; Har/Cdr edition, p. 300
6. E-Waste Rules http://cpcb.nic.in/e-waste-rules/

SEMESTER VI

CORE COURSE X

EE1642 PAPER (2) ENVIRONMENTAL POLLUTION AND CONTROL MEASURES II

Total Hours: 36

Aim:

The course aims to give the students an insight on the major environmental pollution problems and to acquire knowledge on the sources of different types of pollution and its impacts.

Objectives:

- To understand the main causes of aquatic and noise pollution, their harmful effects.
- To equip the students with the methods of control of different types of pollution.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level

1.	CO 1	Articulate the water quality for aquatic life and the classification of industrial wastes	Un, Re
2.	CO 2	Explain the sources of soil pollution and details of pesticide pollution. Also how to control soil pollution	Un, Re
3.	CO 3	Describe the sources of noise and effect of noise pollution on human health	Re, Un
4.	CO 4	Explain on the details of types of radiations, sources of radioactive pollution, radioactive wastes and effects of radiation pollution	Re, Un
5.	CO 5	Describe thermal pollution and effects on aquatic organisms	Re, Un

Course Content:

Module I: Introduction on water pollution: Physical and chemical parameters of water pollution - standards of aquatic life. Classification of industrial wastes and its characteristics

6 Hours

Module II: Sources of Land and soil pollution: Disposal of different types of wastes on land; pesticides pollution- control of soil pollution.

6 Hours

Module III: Noise pollution: definition; measurement - decibels; effect of noise pollution on people; traffic noise pollution; industrial noise pollution. Railway noise; aircraft noise; reduction of noise; absorption of sound; Control of noise pollution

6 Hours

Module IV: Radioactive pollution: Sources of radiation; nuclear reactions; natural sources of radioactive pollution; anthropogenic sources of radiation. Radioactive waste; biological effects of radiation pollution; dangers from nuclear plants

6 Hours

Module V: Control of radiation pollution: methods of control; minimizing X-ray hazard - Hazards of Radioactive pollution - Preventive measures from radiation.

6 Hours

Module VI: Thermal Pollution: sources, effects on aquatic organisms, methods to control thermal pollution

6 Hours

References

1. A Text book on Environmental Pollution and Control. Dr .H S. Bhatia. Galgotia Publications Pvt. Ltd., Delhi.
2. Industrial Pollution. V.P.Kudesia-PragatiPrakashan, Meerut.
3. Air Pollution. V.P.Kudesia, PragathiPrakasan Meerut.
4. Water Pollution. Sharma, B.K., Goel Publishing House, Meerut.
5. Manahan S.E., Environmental Chemistry, Lewis, 1994.

SEMESTER VI

CORE COURSE PRACTICAL

EE1643 ENVIRONEMTAL SCIENCE LAB- VI

Total Hours: 72

Instrumentation (demonstration only)

1. pH meter
2. Conductivity meter
3. Turbidity meter
4. Colorimeter
5. Spectrophotometer

Experiments

1. Determination of COD
2. Analysis of anion mixture solution (2Anions) among the following – Carbonate, sulphide, Thiosulphate, Oxalate, Chloride, Nitrate, Flouride, Sulphate, Phosphate
3. Thin layer Chromatographic separation of plant pigments

SEMESTER VI

VOCATIONAL COURSE VIII

EE1671 PAPER (1) WATER ANALYSIS

Total hours: 54

Aim:

The course aims to impart basics and practical knowledge of water analysis.

Objectives:

- To enable the students to identify, describe, and compare core themes, principles and gain hands on practical experience of the subject.
- To make the students able to analyse different water samples at the end of the course.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Define Water Analysis	Re
2.	CO 2	List out the major Water Quality Parameters	Re
3.	CO 3	Explain Protocols for Water Quality testing	Un
4.	CO 4	Differentiate Methods of Analysis for each parameter tested	An
5.	CO 5	Compare different methods of Water Quality Analysis	Ev

Course Content:

Module I: Various methods of analysis: Monitoring techniques and methodology ; Determination of pH – Specific Conductance-Dissolved Oxygen, NH_3, NO_3, NO_2, Cl^-, F^-, CN^-, S^{2-}, SO_4^{2-}, PO_4^{3-}; Method to determine the pH of given sample of water by colorimetric and electrometric method; Total hardness (Ca& Mg), B, silica, metals and metalloids As, Se, Be, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ag, Zn

9 Hours

Module II: Analysis of water: Method to determine the amount of dissolved oxygen (DO) of a water sample by Winkler Method. Chemical Oxygen Demand, Biological Oxygen Demand, Total Organic carbon, phenols, pesticides, surfactants, tannin and lignin

9 Hours

Module III: Analysis of Physical qualities of water sample: Determination of Turbidity of water sample - By Jacksons Turbidimeter, Baylis Turbidimeter and Nephelometer. Method to find the odour of given water sample; Method to find the colour of given water sample; Method to find out the Suspended solids (SS), Dissolved solids (DS) and Total Solids (TS) of a water sample

9 Hours

Module IV: Analysis of cations of water sample: Method to find the carbonate, bicarbonate and hydroxide alkalinity of a water sample. Method to determine the total hardness of a water sample by standard EDTA method

9 Hours

Module V: Method to determine the concentration of chlorides of given water sample; Method to determine the chlorine demand of a water sample; Method to determine the available chlorine percentage in a given sample of bleaching powder; Determination of residual chlorine in a given sample of water by (a) Orthotoludine Test (b) Starch Iodide Test (c) DPD Test

9 Hours

Module VI: Microbial examination of water samples: Coliforms (*Escherichia coli*) and total bacteria

9 Hours

References

1. Water supply Engineering B.C.Punmia, Asok Jain & Arun Jain. Lakshmi Publications, New Delhi.
2. Water and Waste Water Technology, Mark.J.Hammer. J Hammer, Printice Hall India Pvt. Ltd.
3. Waste Water Treatment for Pollution Control and Reuse, Tata Mac Graw Hill publishing company.
4. Water Technology, N.F Gray Butter Worth, Heimann Oxford.
5. Chemical and Biological Methods of water pollution studies. R.K. Trivedi & R. K. Goel Environmental publication, Karad 1984.
6. Standard Methods for Examination of Water and Waste Water. APHA-Washington DC1985.
7. Ecological Methods for field and Laboratory Investigation, P.Michael. Tata Macgraw Hill publishing Company. New Delhi.

SEMESTER VI

VOCATIONAL COURSE IX

EE1672 PAPER (2) WATERSHED MANAGEMENT

Total Hours: 54

Aim:

The aim of the course is to introduce the students to the concept of Watershed Management by generating a basic understanding of its principles, components and socio-economic aspects. It also enables a student to analyse and appreciate the significance of WM in the conservation of land , water and soil resources.

Objectives:

- To introduce students to the basc concepts of watershed and its management
- To establish a strong understanding of the resource components in a watershed and their significance
- To make them understand the inter relationship between the components and their impact on human socio-economy
- To introduce the technology of integrated and sustainable methods of watershed management aimed at ecosystem restoration.
- To familiarize students with the introductory concepts of watershed modelling
- To make students understand the need for a holistic approach in WM and generate a general awareness on the watershed management policies in India.

Course Outcomes:

At the end of the course, the student will be able to:

S No.	Course Outcome No.	Course Outcome	Taxonomic Level
1.	CO 1	Define and Deduce the concepts and components of watershed & its management	Re
2.	CO 2	Understand the significance of land, water and soil as watershed resources	Un
3.	CO 3	Rationalize the socio-economic aspects of watershed management	Un
4.	CO 4	Comprehend the integrated and sustainable technologies for WM	Un
5.	CO 5	Outline the modelling aspects and the policies associated therein	An

Course Content:

Module I: Basic concepts of watershed management (WM): Watershed – definition - classification of watershed - sub, milli, micro and mini watershed. Basic watershed hydrology, delineation of watershed boundary.

9 Hours

Module II: Water as a resource in WM: - Watershed management for flood control, Water harvesting cum sediment detention tanks, earthen bunds, subsurface dams, Geo textiles in watershed management.

9 Hours

Module III: Land as a resource in WM: Land preparation-timely planting. Contour farming-multistoried cropping-mixed cropping-Intercropping- strip cropping; mulching-cover cropping- crop rotation, Land use changes and resource degradation in watersheds

9 Hours

Module IV: Soil as a resource in WM: Soil conservation, Vegetative hedges - barrier grass land management - agroforestery. Engineering measures - tank -vented cross bars and diversion weirs; stone pitched Contour bunds, contour trenches and embankments of drains.

9 Hours

Module V: Socio-economic aspects of WM: Agronomic measures for resource management in a watershed - choice of vegetation, Resource degradation in a watershed and its socio-economic mpact, WM and public health. Watershed Modelling**-**Introduction and concepts, An overview of watershed management policies in India

9 Hours

Module VI: Integrated and Sustainable Approaches in WM: Definition and principles Integrated water resources management, national water grid and river networking; Integrated attempts for watershed management in India. Ecosystem Restoration - Definition and guiding principles, Watershed ecology, Eco system in a watershed.

9 Hours

References

1. Allam, Gamal Ibrahim Y., Decision Support System for Integrated Watershed Management,Colorado State University, 1994.
2. American Socy. of Civil Engr., Watershed Management, American Soc. of Civil Engineers, New York, 1975.
3. Black Peter E., Watershed Hydrology, Prentice Hall, London, 1991.
4. Michael A.M., Irrigation Engineering, Vikas Publishing House, 1992.
5. Murty, J.V.S. “Watershed Management”, New Age Intl., New Delhi 1998.
6. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994 .
7. Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad, 1995.
8. Vir Singh, Raj , Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.

SEMESTER VI

VOCATIONAL PRACTICAL

EE1673 WATER MANAGEMENT LAB - VI

Total hours: 72

1. Volumetric Estimations
    a) Carbonate hardness-Hehner’s method
    b) Non- Carbonate hardness- Hehner’s method
    c) Mixture of Carbonate-Bi carbonate-warders method (N/20 HCL & std. sodium carbonate (2600 ppm)
    d) Sulphate ion in H2 SO4 (N/20 NaOH & std sodium carbonate (2600 ppm)
    e) Iodine in the solution (N/50 thiosulphate & std pot. dichromate (1000 ppm)
    f) Estimation of Ferrous iron (N/50 potassium permanganate and standard oxalic acid 1200ppm)
    g) Estimation of ferrous iron (N/50 potassium dichromate & standard Mohrs salt)
    h) Iodometric estimation of copper (demonstration only)
    i) Complexometric estimation of Zn (demonstration only)
2. Colorimetric estimations of
    i) Nitrite
    ii) Nitrate
    iii) Phosphate
    iv) total nitrogen
    v) total phosphorous
    vi) ferrous iron and total iron

SEMESTER VI

ELECTIVE COURSE

EE1661.1 RAIN WATER HARVESTING

Total Hours: 36

Aim:

To give a detailed knowledge on Rainwater harvesting systems and water recharge methods for sustainable development.

Objectives:

- To understand the basic principles and structure of rainwater harvesting systems.
- The course explains the direct and indirect methods for artificial recharge, importance of watershed management and legal provisions in rain water harvesting.

Course Outcomes:

At the end of the course, the student will be able to:

Sl.No.	Course Outcome No.	Course outcome (CO)	Taxonomic Level (TL)
1.	CO 1	Understand the principles of water harvesting and familiarize traditional water harvesting systems	Re
2.	CO 2	Know the importance and significance of Rainwater harvesting	Re
3.	CO 3	Develop an ability for problem solving skills to solve water scarcity issues	Un
4.	CO 4	Understand the legal aspects of rain water harvesting systems	Re
5.	CO 5	Apply the methods of water harvesting and conservation for sustainable development	Re

Course Content:

Module I: Principles of water harvesting and conservation: Traditional water harvesting systems in India and Kerala.

4 Hours

Module II: Introduction to Rainwater harvesting: Definition, purpose, importance and advantages. Rainwater harvesting process, collection and storage; Basic components in Rainwater harvesting - catchments, coarse

mesh, gutters, conduits, first flushing, filters and storage tank; Hydrological aspects of Rainwater harvesting.

7 Hours

Module III: Rainwater harvesting methodologies: surface runoff harvesting and roof top rain water harvesting. Concept of roof top rain water harvesting; Methods of Rooftop Rainwater Harvesting- Storage of Direct Use and Recharging groundwater aquifers-by Recharging of bore wells, Recharging of dug wells, Recharge pits, Recharge Trenches, Recharge Shafts, Percolation Tanks.

7 Hours

Module IV: Artificial recharge methods: Direct methods - Ditch and Furrows method, Bench Terracing, Contour Bunds, Contour Trenches, Gully Plugs, Nalah Bunds and Check Dams, Percolation Tanks Injection Wells or Recharge Wells, Recharge Pits and Shaft; Indirect method-induced recharge.

7 Hours

Module V: RWH methodologies: methods for rural, urban and industrial environment; Rain water harvesting for sustainable development, concept of zero run off; Applications of Rainwater harvesting with case studies, water quality of harvested rain water; The importance of watershed management in Kerala.

6 Hours

Module VI: Legal provisions in rain water harvesting in India and Kerala. Kerala Municipality Building Rules, 1999, Kerala Municipality Building (Amendment) Rules, 2004

5 Hours

References

1. Basu, M. and Xavier, S.(2016). Fundamental of environmental studies, Cambridge University Press, New Delhi
2. CGWB (2007). Manual on Artificial Recharge of Ground water. http://cgwb.gov.in/Documents/Manual-Artificial-Recharge.pdf.
3. Chatterjee, S.N. (2008). Water Resources, Conservation and Management. Atlantic Publishers, Edition edition.
4. Er. Kollegal and Meghashyam, K. (2014.). Rain Water Harvesting : A New Concept to Utilize Rainwater and Secure the Future. Published by J.M. Jaina & Brothers; 1St Edition edition.
5. Kumar, S.V. (2013). Rainwater Harvesting. LAP Lambert Academic Publishing.

6. Rooftop rain water harvesting arrangements in Kerala - Municipality Building (Amendment) Rules (2004)
7. Singh, D.K. (2012). Rain Water Harvesting. Oxford Book Company.

SEMESTER V& VI
EE 1644 PROJECT& FACTORY VISIT
AN INVESTIGATORY PROJECT REPORT

Total hour: 72

This work may be based on Environmental Science (significance for Environment) or, project based on Water quality parameters (Local, Regional, state level, or National level important issues can be the topic of interest) –To be carried out in 3rd year (Semester 5&6)

സെമസ്റ്റർ	**:**	**III**
കോഴ്സ് കോഡ്	**:**	**ML 1331**
കോംപ്ലിമെന്ററി കോഴ്സ്:		**V**
സമയക്രമം	**:**	**ആഴ്ചയിൽ 3 മണിക്കൂർ (18 ആഴ്ചയിൽ 54 മണിക്കൂർ)**
ക്രെഡിറ്റ്	**:**	**3**

പരിസ്ഥിതിപഠനം

പരിസ്ഥിതിദർശനവുമായി ബന്ധപ്പെട്ട ആശയങ്ങൾ, തത്ത്വങ്ങൾ, പ്രവണതകൾ, പ്രതിഭാസങ്ങൾ എന്നിവയെക്കുറിച്ചുള്ള അറിവുകൾ നേടുക – പ്രകൃതിസ്രോതസ്സുകളെയും അവയുമായി ബന്ധപ്പെട്ട പ്രശ്നങ്ങളെയും കുറിച്ചു മനസ്സിലാക്കുക – പരിസ്ഥിതിയുടെ ജൈവ, സാമൂഹിക, സാംസ്കാരിക, രാഷ്ട്രീയ, സാമ്പത്തിക വശങ്ങൾ, പാരിസ്ഥിതിക മേഖലയിൽ മനുഷ്യനുള്ള സ്വാധീനത്തിന്റെ പ്രത്യേകത, ഭൂമിയിൽ ജീവൻ നിലനിർത്തുന്നതിനാവശ്യമായ സാഹചര്യങ്ങൾ എന്നിവയെക്കുറിച്ചു മനസ്സിലാക്കുക – സർഗ്ഗാത്മകതലത്തിൽ, പരിസ്ഥിതിദർശനത്തിന്റെ ഭൂമികയിൽ നിന്നുകൊണ്ട് കലയെയും സാഹിത്യത്തെയും കാണുവാനും വിലയിരുത്തുവാനുമുള്ള മനോഭാവം സൃഷ്ടിക്കുക.

പഠനഫലപ്രാപ്തി

1. പരിസ്ഥിതിയുടെ സംരക്ഷണത്തെപ്പറ്റി ജാഗ്രതയുണ്ടാകുന്നു.
2. അമിതമായ ചൂഷണവും കൈയേറ്റവും കൊണ്ട് പ്രകൃതിയ്ക്കുണ്ടാകുന്ന ആഘാതത്തെപ്പറ്റി ചിന്തിക്കാനും പരിഹാരങ്ങൾ കണ്ടെത്താനും സാധിക്കുന്നു.
3. മലയാള സാഹിത്യത്തിൽ പാരിസ്ഥിതികമായ ആശങ്കകൾ പ്രതിഫലിച്ചിരിക്കുന്നതിനെപ്പറ്റി വിലയിരുത്തുന്നു.
4. പ്രകൃതിനശീകരണം, മലിനീകരണം തുടങ്ങിയ വിഷയങ്ങളിൽ ഇടപെടാനും പ്രശ്നപരിഹാര മാർഗ്ഗങ്ങൾ കൂട്ടായി ചർച്ച ചെയ്യാനും ബദൽ മാർഗ്ഗങ്ങൾ കണ്ടെത്താനും ശ്രമിക്കുന്നു.
5. പരിസ്ഥിതി വിഷയങ്ങളെക്കുറിച്ച് എഴുതാനും സംവാദങ്ങളിൽ ഏർപ്പെടാനും സന്നദ്ധമാകുന്നു.

മൊഡ്യൂൾ : ഒന്ന് (9 മണിക്കൂർ)

പഠനഫലപ്രാപ്തി

1 സ്വന്തം പരിസരത്തെ നിരീക്ഷിച്ച് പരിസ്ഥിതിയുടെ പ്രാധാന്യം കണ്ടെത്തുന്നു.

2. പരിസ്ഥിതി സൗഹൃദത്തെപ്പറ്റി ഗൗരവമായി ചിന്തിക്കുകയും ഇടപെടലുകൾ നടത്തുകയും ചെയ്യുന്നു.

പരിസ്ഥിതി–ആവാസവ്യവസ്ഥ–ജൈവമണ്ഡലം–പരിസ്ഥിതിയിലെ ഘടകങ്ങൾ–ജൈവികവും അജൈവികവുമായ ഘടകങ്ങൾ – ഭൂമി, ജലം, വായു, അന്തരീക്ഷം, ജന്തുജാലങ്ങൾ സസ്യജാലങ്ങൾ, മനുഷ്യർ–വൈവിധ്യങ്ങളും വൈരുദ്ധ്യങ്ങളും–പ്രാചീന മനുഷ്യരും പ്രകൃതിയും തമ്മിലുണ്ടായിരുന്ന ബന്ധങ്ങൾ–ആധുനിക വ്യവസായങ്ങളും നഗരവത്ക്കരണവും

കൊണ്ട് പ്രകൃതിയ്ക്കുണ്ടായ മാറ്റങ്ങൾ-അമിതമായ ഉപഭോഗത്തിന്റെ പ്രശ്നങ്ങൾ, വനനശീകരണം-വായു-ജലമലിനീകരണങ്ങൾ-പാരിസ്ഥിതിക ആഘാതങ്ങൾ-കേരളത്തിന്റെ ഭൂപ്രകൃതിയും പാരിസ്ഥിതിക ദൗർബല്യങ്ങളും-ഉപഭോഗവും സംരക്ഷണവും തമ്മിലുണ്ടാകേണ്ട സന്തുലനാവസ്ഥ - പരിസ്ഥിതിനിയമങ്ങൾ

വിശദപഠനത്തിന്

1. പരിസ്ഥിതിപഠനത്തിന്റെ വിവിധമാനങ്ങൾ - ഡോ.ജി.ബാലമോഹൻതമ്പി
   ('പരിസ്ഥിതിദർശനം' എന്ന കൃതിയിൽ നിന്ന്)
2. കാലാവസ്ഥാ വ്യതിയാനവും നമ്മളും - ഡോ.വി.ശശികുമാർ
   ('ഭൂമിയുടെ ആവരണം' എന്ന കൃതിയിൽനിന്ന്)

മൊഡ്യൂൾ : രണ്ട് (18 മണിക്കൂർ)

പഠനഫലപ്രാപ്തി

1. പരിസ്ഥിതി ദർശനവുമായി ബന്ധപ്പെട്ട ആശയങ്ങൾ മനസ്സിലാക്കുന്നു.
2. പരിസ്ഥിതി സംരക്ഷണ പ്രസ്ഥാനങ്ങളെക്കുറിച്ചും പ്രവർത്തനങ്ങളെക്കുറിച്ചും മനസ്സിലാക്കിക്കൊണ്ട് അത്തരം പ്രവർത്തനങ്ങളിൽ പങ്കെടുക്കാൻ പ്രേരണയുണ്ടാകുന്നു.

പരിസ്ഥിതി ദർശനങ്ങൾ-ഗഹന പരിസ്ഥിതിവാദം (Deep Ecology) -- സാമൂഹിക പരിസ്ഥിതി വാദം (Social Ecology) - പരിസ്ഥിതി സ്ത്രീവാദം (Eco Feminism)- പാരിസ്ഥിതിക പ്രസ്ഥാനങ്ങൾ-

ഗ്രീൻസ്, ചിപ്കോ പ്രസ്ഥാനം - ഗ്രീൻ ബെൽറ്റ് പ്രസ്ഥാനം-കേരളത്തിലെ പാരിസ്ഥിതിക സമരങ്ങൾ -ചാലിയാർ സമരം-സൈലന്റ് വാലി പ്രക്ഷോഭം-പശ്ചിമഘട്ട സരക്ഷണ പ്രവർത്തനങ്ങൾ - ഗാഡ്ഗിൽ റിപ്പോർട്ടിന്റെ പശ്ചാത്തലം-പരിസ്ഥിതി സംരക്ഷണ നിയമങ്ങൾ-ഗാന്ധിയൻ ദർശനം-റേച്ചൽ കഴ്സന്റെ നിശ്ശബ്ദവസന്തം , ഫുക്കുവോക്കയുടെ ഒറ്റ വൈക്കോൽ വിപ്ലവം എന്നീ കൃതികളുടെ സ്വാധീനം - മാറുന്ന പാരിസ്ഥിതികാവബോധം

വിശദപഠനം

1. പട്ടുപോകാത്ത ഒറ്റമരം - ആർ.വിനോദ്കുമാർ
   ('കേരളത്തിന്റെ ഹരിതജാലകം തുറന്നവർ' എന്ന കൃതിയിൽ നിന്ന്)
2. കാടിനു കാവൽ നാം തന്നെ - സുഗതകുമാരി
   ('കാടിനു കാവൽ' എന്ന കൃതിയിൽ നിന്ന്)
3. ഒരു പക്ഷിയും പാടുന്നുമില്ല - റേച്ചൽ കാഴ്സൻ
   ('നിശ്ശബ്ദവസന്തം' എന്ന കൃതിയിൽ നിന്ന്)

   വിവർത്തനം : കെ.രതിമേനോൻ

മൊഡ്യൂൾ : മൂന്ന് (27 മണിക്കൂർ)

പഠനഫലപ്രാപ്തി

1. സാഹിത്യവും പരിസ്ഥിതിദർശനവുമായുള്ള ബന്ധങ്ങൾ സൂക്ഷ്മമായി വിലയിരുത്തുന്നു.
2. ആസ്വാദനത്തോടൊപ്പം ആശയങ്ങളുടെ പ്രായോഗികതയെക്കുറിച്ച് വിമർശനാത്മകമായി പരിശോധിക്കുന്നു.

3. പാരിസ്ഥിതിക പ്രശ്നങ്ങളും ദുരന്തങ്ങളും മലയാള കഥയിലും കവിതയിലും പ്രതിഫലിച്ചിരിക്കുന്നത് മനസ്സിലാക്കുന്നു.
4. സാഹിത്യാഭിരുചിയ്ക്കനുസരിച്ച് സമകാലിക പരിസ്ഥിതി പ്രശ്നങ്ങളെ പ്രതിഫലിപ്പിക്കുന്ന രചനകൾ നടത്താൻ പ്രേരണയുണ്ടാകുന്നു.

പാരിസ്ഥിതികാവബോധം സർഗാത്മകതലത്തിൽ - മലയാള സാഹിത്യവും പാരിസ്ഥിതിക ദർശനവും - കേവലമായ പ്രകൃതിവർണ്ണനകളിൽ നിന്ന് പാരിസ്ഥിതികമായ ആശങ്കകളിലേയ്ക്ക് സാഹിത്യം മാറുന്നു. മലയാള കഥയിലും കവിതയിലും പാരിസ്ഥിതിക വിഷയങ്ങളുടെ പ്രതിഫലനം - സമാനമായ വിഷയങ്ങൾ പ്രകടമാക്കുന്ന ഇതര സാഹിത്യ കൃതികളുടെ സാമാന്യ പരിചയം - പാരിസ്ഥിതിക പ്രാധാന്യമുള്ള കൃതികളുടെ കണ്ടെത്തൽ.

വിശദപഠനം

1. കുറ്റിപ്പുറം പാലം - ഇടശ്ശേരി ഗോവിന്ദൻ നായർ
2. പുതു വെളിച്ചം - ബാലാമണിയമ്മ
3. മരണത്തിനപ്പുറം - കെ.അയ്യപ്പപ്പണിക്കർ
4. അവസാനത്തെ നദി - കെ.സച്ചിദാനന്ദൻ
5. ഭൂമിയുടെ അവകാശികൾ - വൈക്കം മുഹമ്മദ് ബഷീർ
6. മംഗള സ്വരൂപൻ - എസ്സ്.വി.വേണുഗോപൻനായർ
7. കുന്നിൻചരുവിലെ വീട് - കെ.വി.മോഹൻകുമാർ

സഹായ ഗ്രന്ഥങ്ങൾ

1. ഇക്കോ-ഫെമിനിസം, ഇക്കോ ടൂറിസം, മാർക്സിസം - എൻ.എം.പിയേഴ്സൻ
2. കഥയും പരിസ്ഥിതിയും - ജി.മധുസൂദനൻ
3. കവിതയും പരിസ്ഥിതിയും - എസ്സ്.രാജശേഖരൻ
4. കാടിനു കാവൽ - സുഗതകുമാരി
5. കേരളത്തിന്റെ ഹരിതജാലകം തുറന്നവർ - ആർ.വിനോദ്കുമാർ
6. നിശ്ശബ്ദവസന്തം-റേച്ചൽ കാഴ്സൻ - കെ.രതിമേനോൻ (വിവ:)
7. പരിസ്ഥിതിബോധവും സംസ്കാരവും - പി.പി.കെ.പൊതുവാൾ
8. പരിസ്ഥിതി സൗന്ദര്യ ശാസ്ത്രത്തിനൊരു മുഖവുര - ടി.പി.സുകുമാരൻ
9. പരിസ്ഥിതി വിജ്ഞാനം - എൻ.ബാലകൃഷ്ണൻനായർ, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
10. പ്രകൃതി, പരിസ്ഥിതി, ദാരിദ്ര്യം, ഊർജ്ജം - ആനന്ദ്, ഡി.സി.ബുക്സ്.
11. ഹരിതദർശനം ആധുനികാനന്തര കവിതയിൽ - സി.ആർ.പ്രസാദ്, സെഡ് ലൈബ്രറി, തിരുവനന്തപുരം.
12. ഹരിത നിരൂപണം മലയാളത്തിൽ - ജി.മധുസൂദനൻ, കറന്റ് ബുക്സ്, തൃശ്ശൂർ
13. കഥയും പരിസ്ഥിതിയും - ജി.മധുസൂദനൻ, കറന്റ് ബുക്സ്, തൃശ്ശൂർ
14. ഹരിത സാഹിത്യദർശനം - എം.അച്യുതൻ
15. പരിസ്ഥിതി ചിന്തകൾ - ഡോ.എം.വിജയൻപിള്ള
16. പരിസ്ഥിതിദർശനം - (എഡി.) പ്രതാപൻ തായാട്ട്, ഹരിതം ബുക്സ്.
17. ജീവന്റെ കൈയൊപ്പ് - ആഷാമേനോൻ, ഡി.സി.ബുക്സ്
18. പ്രതിരോധചിന്തകൾ - ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്
19. പരിസ്ഥിതിയുടെ രാഷ്ട്രീയം - (എഡി.) സി.റഹിം, ഫേബിയൻ ബുക്സ്

സെമസ്റ്റർ	:	**IV**
കോഴ്സ് കോഡ്	:	**ML 1431**
കോംപ്ലിമെന്ററി കോഴ്സ്:		**VII**
സമയക്രമം	:	**ആഴ്ചയിൽ 3 മണിക്കൂർ (18 ആഴ്ചയിൽ 54 മണിക്കൂർ)**
ക്രെഡിറ്റ്	:	**3**

ദളിത് സാഹിത്യം, സ്ത്രീവാദസാഹിത്യം

ദളിത് പഠനമെന്ന വിജ്ഞാനമേഖലയുടെ പശ്ചാത്തലത്തിൽ മലയാളത്തിലെ ദളിത് സാഹിത്യത്തെ തിരിച്ചറിയുക – മലയാളികളുടെ സാംസ്കാരികവൈവിധ്യം സാഹിത്യവഴിയിൽ മനസ്സിലാക്കുക – ചരിത്രത്തിന്റെ വ്യത്യസ്ത ഇടങ്ങളിൽ പാർശ്വവൽക്കരിക്കപ്പെട്ട ജനവിഭാഗങ്ങളെയും അവരുടെ സംസ്കാരത്തെയും സാഹിത്യത്തെയും കുറിച്ച് അറിയുക – മുഖ്യധാരാസംസ്കാരത്തിന്റെ സാഹചര്യങ്ങൾക്കു പുറത്ത് രൂപപ്പെട്ട സംസ്കാരത്തിന്റെ ഒരു ജനകീയധാരയെക്കുറിച്ചു ബോധ്യപ്പെടുക.

സമീപകാല സൈദ്ധാന്തികപഠനങ്ങളിൽ ഏറെ പരാമർശിക്കപ്പെടുകയും വിമർശിക്കപ്പെടുകയും ചെയ്ത 'സ്ത്രീവാദ'ത്തെ പരിചയപ്പെടുക – ലിംഗപരമായ വ്യത്യസ്തതയുടെ അടിസ്ഥാനത്തിലുള്ള വിവേചനത്തിൽ നിന്നും സ്ത്രീകൾക്കു തുല്യനീതി ഉറപ്പാക്കുക എന്ന ലക്ഷ്യത്തോടെ രൂപപ്പെടുത്തിയ ചിന്താപദ്ധതിയും പ്രവർത്തനവും എന്ന നിലയിൽ അതിനെ തിരിച്ചറിയുക – സ്ത്രീകളുടെ വൈയക്തികവും സാമൂഹികവുമായ യാഥാർത്ഥ്യത്തെ വെളിപ്പെടുത്തുകയും ലിംഗകേന്ദ്രിതമായ എല്ലാത്തരം പാർശ്വവല്ക്കരണത്തെയും ചെറുക്കുകയുമാണ് അതിന്റെ രീതിശാസ്ത്രം എന്നു മനസ്സിലാക്കുക – ഫെമിനിസത്തിന്റെ ചരിത്രവികാസത്തിന്റെയും സിദ്ധാന്തങ്ങളുടെയും പൊതു പശ്ചാത്തലത്തിൽ മലയാളത്തിലെ സ്ത്രീപക്ഷരചനകളെ പഠിക്കുക.

സംസ്കാരത്തിലെ വംശ, വർഗ്ഗ, മത, ജാതി, ലിംഗനിർണയനങ്ങളെക്കുറിച്ചുള്ള ധാരണ നവീകരിക്കുകയും മാറുന്ന ലോകത്തിന്റെ പരിതഃസ്ഥിതികളിൽ നിന്നുകൊണ്ട് ഒരു പുതിയ മാനവീയതയെക്കുറിച്ചുള്ള അവബോധം സൃഷ്ടിക്കുകയും ചെയ്യുക ഇതൊക്കെയാണ് ഈ കോഴ്സിന്റെ സവിശേഷ ലക്ഷ്യങ്ങൾ.

പഠനഫലപ്രാപ്തി

1. വംശ വർഗ്ഗലിംഗ നിർണ്ണയനങ്ങളെക്കുറിച്ച് പുതിയ ധാരണകൾ രൂപപ്പെടുന്നു.
2. മാനവീയതയെക്കുറിച്ചുള്ള പുതിയ അവബോധം സ്വായത്തമാക്കുന്നു.
3. ദളിത് സാഹിത്യപഠനത്തിലൂടെ പാർശ്വവല്ക്കരിക്കപ്പെട്ട ജനതയുടെ സാംസ്കാരിക മുന്നേറ്റത്തെയും അവരുടെ സംസ്കാരത്തെയും സാഹിത്യത്തെയും കുറിച്ച് അറിവ് നേടുന്നു.
4. ദളിത് രചനകളുടെയും വാമൊഴി വഴക്കങ്ങളുടെയും പുനർവായനയുടെ ആവശ്യകത തിരിച്ചറിയുന്നു.
5. സ്ത്രീവാദ സാഹിത്യത്തിന്റെ സൈദ്ധാന്തിക നിലപാടുകളെക്കുറിച്ച് സാമാന്യ ജ്ഞാനം നേടുന്നു.

6. മലയാളത്തിലെ സ്ത്രീവാദ സാഹിത്യത്തിന്റെ ചരിത്രം ഗ്രഹിക്കുന്നു.

7. പുരോഗമന ചിന്താഗതിയുള്ള സർഗ്ഗാത്മകസൃഷ്ടികൾ വിലയിരുത്താനും സൃഷ്ടിക്കാനും ശേഷി നേടുന്നു.

മൊഡ്യൂൾ : ഒന്ന് (27 മണിക്കൂർ)

ദളിത് സാഹിത്യം

പഠനഫലപ്രാപ്തി

1. ദളിത് ജീവിതം, പാർശ്വവല്ക്കരിക്കപ്പെട്ടവരുടെ ഭാഷ, സാഹിത്യം എന്നിവ പരിശോധിക്കുന്നു.

2. സാഹിത്യകൃതികളുടെ ഉള്ളടക്കം വിശകലനം ചെയ്ത് അവയിലെ രാഷ്ട്രീയവും പ്രത്യയശാസ്ത്രവും തിരിച്ചറിയുന്നു.

ദളിത് എന്ന പദത്തിന്റെ നിഷ്പത്തി – ഇതര സംജ്ഞകൾ – ദളിത് പദത്തിന്റെ വ്യത്യസ്ത വ്യാഖ്യാനങ്ങൾ – ദളിത്പഠനത്തിന്റെ സാമാന്യചരിത്രം – ആഫ്രിക്കൻ – അമേരിക്കൻ എഴുത്തും കറുപ്പിന്റെ സാംസ്കാരിക മുന്നേറ്റങ്ങളും – ഇന്ത്യൻ പശ്ചാത്തലം – മലയാളത്തിലെ ദളിത് സാഹിത്യം – സാമാന്യാവലോകനം – വാമൊഴി – വരമൊഴി ഭേദങ്ങൾ.

വിശദപഠനം

എ. വാമൊഴി സാഹിത്യമാതൃക :

പാക്കനാർ പാട്ട് (ആദിയില്ലല്ലോ ലന്തമില്ലല്ലോ.....)

ബി. വരമൊഴി സാഹിത്യമാതൃകകൾ :

കവിത

1.	ജാതിക്കുമ്മി (ആദ്യത്തെ 20 ഖണ്ഡങ്ങൾ)–		കെ.പി.കറുപ്പൻ
2.	കണ്ടത്തി	–	രാഘവൻ അത്തോളി
3.	സർവ്വെ ഓഫ് ഇന്ത്യ	–	എം.ബി.മനോജ്

ചെറുകഥ

1.	ഉച്ചയുറക്കത്തിലെ സ്വപ്നങ്ങൾ	–	സി.അയ്യപ്പൻ
2	കളിവീടുകൾ	–	പി.എ.ഉത്തമൻ

നോവൽ

മുക്കണി – ഡി.രാജൻ

മൊഡ്യൂൾ : രണ്ട് (27 മണിക്കൂർ)
സ്ത്രീവാദസാഹിത്യം

സ്ത്രീവാദചിന്തയുടെ ആദ്യാങ്കുരങ്ങൾ – ഇക്കാലത്തെ ഫെമിനിസ്റ്റു ചിന്തയിലെ ശ്രദ്ധേയ വ്യക്തിത്വങ്ങൾ – കൃതികൾ – സ്ത്രീവാദത്തിലെ വ്യത്യസ്ത ധാരകൾ – ഒന്നാംതരംഗ സ്ത്രീവാദം – രണ്ടാംതരംഗസ്ത്രീവാദം – മൂന്നാംതരംഗസ്ത്രീവാദം, പ്രധാന വ്യക്തിത്വങ്ങളും കൃതികളും – ശ്രദ്ധേയങ്ങളായ ഉപധാരകൾ – ഉദാരസ്ത്രീവാദം (Liberal feminism), സോഷ്യലിസ്റ്റു സ്ത്രീവാദം, മാർക്സിസ്റ്റുസ്ത്രീവാദം, മൗലികസ്ത്രീവാദം (Radical feminism), കറുത്തസ്ത്രീവാദം (Black feminism), എക്കോ ഫെമിനിസം – സ്ത്രീവാദവും സാഹിത്യവും – സ്ത്രൈണ സർഗ്ഗാത്മകതയെക്കുറിച്ചുള്ള വ്യത്യസ്ത സമീപനങ്ങൾ – ഭാഷയുടെ

ലിംഗകേന്ദ്രിത സ്വഭാവം – കേരളത്തിലെ സ്ത്രീമുന്നേറ്റങ്ങളുടെ ചരിത്രപശ്ചാത്തലം – മലയാളത്തിലെ സ്ത്രീരചനാപാരമ്പര്യങ്ങൾ – ആദ്യകാല എഴുത്തുകാരികൾ – തുടർന്നുള്ള ഘട്ടങ്ങൾ – മുഖ്യസംഭാവനകൾ.

എ. കവിത

1. സ്വാതന്ത്ര്യം ഒരു പ്രതിമയല്ല – സാവിത്രി രാജീവൻ
2. ദിനചര്യകൾ – ഗിരിജ പാതേക്കര
3. കൈക്കലത്തുണികൾ – വിജില ചിറപ്പാട്

ബി. കഥ

1. സീതാഭാവനം – കെ.സരസ്വതിയമ്മ
2. മനുഷ്യപുത്രി – ലളിതാംബിക അന്തർജ്ജനം
3. ഫാന്റം ബാത്ത് – ഷാഹിന ഇ.കെ.

സി. നോവൽ

ഒസാത്തി – ബീന (ഡി.സി.ബുക്സ്)

സഹായകഗ്രന്ഥങ്ങൾ

1. ദലിത്പഠനം : സ്വത്വം, സംസ്കാരം, സാഹിത്യം – ഡോ. പ്രദീപൻ പാമ്പിരിക്കുന്ന്, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
2. ദലിത് തിരിച്ചറിവുകൾ (എഡി:) ഡോ. അജു. കെ. നാരായണൻ, ഭൂമിമലയാളം, യു.സി. കോളേജ്, ആലുവ.
3. ദലിത്പാതകൾ : (എഡി.) ബോബി തോമസ്, സൈൻ ബുക്സ്, തിരുവനന്തപുരം.
4. ബുദ്ധനിലേക്കുള്ള ദൂരം – കെ. കെ കൊച്ച്, ഡി. സി. ബുക്സ്.
5. ദലിത് സാഹിത്യപ്രസ്ഥാനം – കെ. എം. പുരുഷോത്തമൻ, സാഹിത്യഅക്കാദമി.
6. ദലിത് സാഹിത്യം – കവിയൂർ മുരളി, കറന്റ് ബുക്സ്, കോട്ടയം.
7. ദലിത് ഭാഷ – കവിയൂർ മുരളി.
8. കീഴാളജീവിതമുദ്രകൾ – ഡോ. പി. ജി. പത്മിനി, സമയം പബ്ലിക്കേഷൻസ്.
9. ദലിത് വർത്തമാനം (എഡി.) രാജേഷ് ചിറപ്പാട്, മൈത്രി ബുക്സ്, തിരുവനന്തപുരം.
10. 500 വർഷത്തെ കേരളം – ചില അറിവടയാളങ്ങൾ – (ജന. എഡി.) ഡോ. സ്കറിയാ സക്കറിയ, താരതമ്യപഠനസംഘം, കറന്റ് ബുക്സ്, കോട്ടയം.
11. വായനയുടെ ദലിത് പാഠം – കെ. കെ. കൊച്ച്, പൂർണ്ണ പബ്ലിക്കേഷൻസ്.
12. ദലിതന്റെ നിനവും നോവും നാടൻ പാട്ടുകളിൽ – ഡോ. കുമാരൻ വയലേരി, പാപ്പിയോൺ, കോഴിക്കോട്.
13. ദലിത് സാഹിത്യം പരസ്യകല – ഡോ. വി. സി. സുപ്രിയ/ ഡോ. കെ. കെ. ശിവദാസ്, ഡോ. സന്തോഷ് മാനിച്ചേരി – മാളുബൻ പബ്ലിക്കേഷൻസ്.
14. കീഴാളന്റെ പ്രതിരോധതന്ത്രം – ഷീബ എം. കുര്യൻ.
15. കാവ്യഭാവനയുടെ സ്ത്രീപഠനങ്ങൾ – ഡോ. എ. ഷീലാകുമാരി.
16. സമ്യക്ക് – ഡോ.എം.ബി.മനോജ് (എഡിറ്റർ)

30. How can metallic character change across a period?

31. Describe clearly the link between increasing effective nuclear charge across a period and the changes in van der Waals radius.

SECTION D

Each question carries 15 marks (essay type) Answer any two questions.

32. a.Explain about the pH changes of aqueous solutions of elements in the third period as the period is crossed.
    b. Explain how these changes are directly related to the changes in effective nuclear charge across the period.
    c. Describe the metallic character of elements in a period. (5x3 marks)

33. a.Explain the role of some chemicals in household items. (8 marks)
    b.Write a short note on food adultration. (7 marks)

34. a.Write a short note on the uses and hazards of fertilisers. (8 marks)
    b.Draw the structure of carbon and sodium (shell model) (7 marks)

35. a. Draw the structures showing shapes of methane, water and carbon dioxide (8 marks)
    b.compare the bonding structures of diamond – graphite. (7marks)

UNIVERSITY OF KERALA

OPEN COURSE FOR OTHER MAJORS

2020 Adimission onwards

Semester	V
Course	Open Course
Course name	**ENVIRONMENTAL CHEMISTRY**
Course Code	CH 1551.3
Credit	2
Hours	54 hours
Lecture-Tutorial-Lab	2-0-0

CO No.	**COURSE OUTCOME** *Upon completion of this course, students*	**Cognitive Level**	**PSO No.**
1	Discuss the structure and composition of the atmosphere	U	PSO14
2	Identify,Realise and enlist the causes of pollution to water, soil and air	U	PSO14
3	Become aware of environmental issues and its effect to man and other living beings	U	PSO12
4	Review major environmental disasters and suggest controlling and preventive measures	U	PSO12
5	Discuss the laws of environmental protection	U	PSO21

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Environmental Components** Structure and composition of the, Atmosphere, hydrosphere, biosphere and Lithosphere – composition of atmosphere	**9**	**1,2,3**
2	**Water pollution** Sources, its effect and control; Sampling and measurement of water quality and their analysis, water quality standards, BOD and COD Hard water – soft water Eutrophication and restoration of lakes.	**9**	**1,2,3**
3	**Air Pollution** Types and sources of air pollution, Common Air Pollutants - Effects of air pollution; Smog – ozone layer depletion green house effect – acid rain	**9**	**1,2,3**
4	**Soil Pollution** Sources, types, effects and control of: Land pollution, Marine pollution, Thermal Pollution and Radioactive pollution. Waste separation, storage and disposal ; Waste Reduction, Recycling and Recovery of materials.Plastics and their misuses.	**9**	**1,2,3**
5	**Major environmental disasters** Major environmental disasters - mercury poisoning in Minamata, Japan, Itaiitai disease due to cadmium poisoning in Japan - Love Canal toxic waste site, Seveso disaster chemical plant explosion - Bhopal disaster - Chernobyl incident	**9**	**4**
6	**Major environmental laws:** Environment (Protection Act) – The Air (Prevention and control of pollution) Act – The water (Prevention and control of pollution) Act – The wild life protection Act – Forest conservation Act – The Ozone Depleting Substances (Regulation and Control) Rules – The Plastic Waste (Management and Handling) Rules - Rio declaration- Montreal protocol, Kyoto protocol Introduction to Green chemistry (elementary ideas only)	**9**	**5**

Reference

1. Banerji, K Sameer"Environmental Chemistry", ISBN - 9788120315761.
2. K. De "Environmental Chemistry - An introduction" New Age International (P)Ltd.,2017
3. B. K. Sharma "Air Pollution", Goel Publishing House
4. V. K. Ahluwalia "Environmental Chemistry", books.google.co.in, 2017
5. G.W. vanLoon and S. J. Duffy "Environmental Chemistry: A Global Perspective"
6. S.K.Mohanty, Environment and Pollution Laws, Universal Law Publishing Co. (P)Ltd

2020-21

20. രസകൗമുദി - ഡോ. പൂജപ്പുര കൃഷ്ണൻ നായർ.
21. ആധുനികാനന്തര സാഹിത്യസമീപനങ്ങൾ - സി. ജെ. ജോർജ്ജ് (എഡി:).
22. ഛന്ദസ്സ് നമ്മുടെ കവിതയിൽ - സച്ചിദാനന്ദൻ, മലയാളകവിതാപഠനങ്ങൾ, മാതൃഭൂമി ബുക്സ്, പുറം 83-99.
23. ദലിത് സാഹിത്യപ്രസ്ഥാനം - കെ. എം. പുരുഷോത്തമൻ.
24. ഭാരതീയേതര സാഹിത്യസിദ്ധാന്തങ്ങൾ - ഡോ. തോമസ് സ്കറിയ.

സെമസ്റ്റർ	:	**III**
കോഴ്സ് കോഡ്	:	**ML 1331**
കോംപ്ലിമെന്ററി കോഴ്സ്	:	**V**
സമയക്രമം	:	**ആഴ്ചയിൽ 3 മണിക്കൂർ (18 ആഴ്ചയിൽ 54 മണിക്കൂർ)**
ക്രെഡിറ്റ്	:	**3**

പരിസ്ഥിതി : സിദ്ധാന്തവും ആവിഷ്ക്കാരവും

പഠനോദ്ദേശ്യം

പരിസ്ഥിതിദർശനവുമായി ബന്ധപ്പെട്ട ആശയങ്ങൾ, തത്ത്വങ്ങൾ, പ്രവണതകൾ, പ്രതിഭാസങ്ങൾ എന്നിവയെക്കുറിച്ചുള്ള അറിവുകൾ നേടുക - പ്രകൃതിസ്രോതസ്സുകളെയും അവയുമായി ബന്ധപ്പെട്ട പ്രശ്നങ്ങളെയും കുറിച്ചു മനസ്സിലാക്കുക - പരിസ്ഥിതിയുടെ ജൈവ, സാമൂഹിക, സാംസ്കാരിക, രാഷ്ട്രീയ, സാമ്പത്തിക വശങ്ങൾ, പാരിസ്ഥിതിക മേഖലയിൽ മനുഷ്യനുള്ള സ്വാധീനത്തിന്റെ പ്രത്യേകത, ഭൂമിയിൽ ജീവൻ നിലനിർത്തുന്നതിനാവശ്യമായ സാഹചര്യങ്ങൾ എന്നിവയെക്കുറിച്ചു മനസ്സിലാക്കുക - സർഗ്ഗാത്മകതലത്തിൽ, പരിസ്ഥിതിദർശനത്തിന്റെ ഭൂമികയിൽ നിന്നുകൊണ്ട് കലയെയും സാഹിത്യത്തെയും കാണുവാനും വിലയിരുത്തുവാനുമുള്ള മനോഭാവം സൃഷ്ടിക്കുക.

പാഠ്യപദ്ധതി

മൊഡ്യൂൾ : ഒന്ന് (9 മണിക്കൂർ)

എ. പരിസ്ഥിതിദർശനം

പരിസ്ഥിതി - അർത്ഥവും വ്യാപ്തിയും - പരിസ്ഥിതി സമീപനങ്ങൾ - പരിസ്ഥിതി ദർശനങ്ങൾ - ഗഹനപരിസ്ഥിതിവാദം - സാമൂഹിക പരിസ്ഥിതിവാദം - പാരിസ്ഥിതിക സ്ത്രീവാദം - പാരിസ്ഥിതിക മാർക്സിസം - പാരിസ്ഥിതികപ്രസ്ഥാനങ്ങൾ - ഇവയെക്കുറിച്ചുള്ള പഠനം.

ബി. പരിസ്ഥിതിദർശനം സർഗ്ഗാത്മകതലത്തിൽ

പരിസ്ഥിതിബോധം സാമൂഹിക, സാംസ്കാരികതലങ്ങളിൽ, പരിസ്ഥിതിബോധം സർഗ്ഗാത്മകതലത്തിൽ - പാരിസ്ഥിതിക സൗന്ദര്യശാസ്ത്രം - പരിസ്ഥിതിദർശനം കലാരൂപങ്ങളിൽ - സാഹിത്യത്തിൽ - സാമാന്യപഠനം.

മൊഡ്യൂൾ : രണ്ട് (9 മണിക്കൂർ)

പരിസ്ഥിതി ദർശനം – പഠനങ്ങൾ

വിശദപഠനം :

1. പരിസ്ഥിതിസൗന്ദര്യശാസ്ത്രത്തിന് ഒരു മുഖവുര – ഡോ. ടി. പി. സുകുമാരൻ (ഈ പേരിലുള്ള ലേഖനം മാത്രം) – ബോധി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
2. സംസ്കാരവും ആവാസവ്യവസ്ഥയും – ജി. മധുസൂദനൻ (ഭാവനയുടെ ജലസ്ഥലികൾ).

മൊഡ്യൂൾ : മൂന്ന് (9 മണിക്കൂർ)

പരിസ്ഥിതിദർശനം കഥയിൽ

വിശദപഠനം

1. ആമസോൺ – അശോകൻ ചരുവിൽ
2. ഹരിതമോഹനം – സുസ്മേഷ് ചന്ദ്രോത്ത്

മൊഡ്യൂൾ : നാല് (9 മണിക്കൂർ)

പരിസ്ഥിതിദർശനം നോവലിൽ

വിശദപഠനം

ജൈവം – പി. സുരേന്ദ്രൻ

മൊഡ്യൂൾ : അഞ്ച് (9 മണിക്കൂർ)

പരിസ്ഥിതിദർശനം കവിതയിൽ

വിശദപഠനം

1. കൊച്ചിയിലെ വൃക്ഷങ്ങൾ – കെ. ജി. ശങ്കരപ്പിള്ള
2. ഭൂമിയുടെ ചടങ്ങുകൾ – സച്ചിദാനന്ദൻ
3. അതിരപ്പിള്ളിക്കാട്ടിൽ – പി. എൻ. ഗോപീകൃഷ്ണൻ
   (ഇടിക്കാലൂരി പനമ്പട്ടടി – മാതൃഭൂമി പ്രസിദ്ധീകരണം)

മൊഡ്യൂൾ : ആറ് (9 മണിക്കൂർ)

ഹരിതദർശനം നാടകത്തിലും ചലച്ചിത്രത്തിലും

വിശദപഠനം

(എ) നാടകം: കനകം വിളയുന്ന മണ്ണ് – തിക്കോടിയൻ.

(ബി) ചലച്ചിത്രം: 1. പേരറിയാത്തവർ – ഡോ. ബിജു.
2. അരജീവിതങ്ങൾക്ക് ഒരു സ്വർഗ്ഗം – എം. എ. റഹ്മാൻ.
3. ഓരോപുഴയും പറയുന്നത് – അലിഫ്ഷാ.

സഹായകഗ്രന്ഥങ്ങൾ

1. ഹരിതനിരൂപണം മലയാളത്തിൽ - (എഡി.) ജി. മധുസൂദനൻ, കറന്റ് ബുക്സ്, തൃശൂർ.
2. കഥയും പരിസ്ഥിതിയും - ജി. മധുസൂദനൻ, കറന്റ് ബുക്സ്, തൃശൂർ.
3. പരിസ്ഥിതി കവിതയ്ക്കൊരാമുഖം - പി. പി. കെ. പൊതുവാൾ, ഡി. സി. ബുക്സ്,
4. പരിസ്ഥിതിബോധവും സംസ്കാരവും - പി. പി. കെ. പൊതുവാൾ, മാതൃഭൂമി ബുക്സ്.
5. പരിസ്ഥിതിവിജ്ഞാനം - എൻ. ബാലകൃഷ്ണൻ നായർ, ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
6. പ്രകൃതി, പരിസ്ഥിതി ദാരിദ്ര്യം ഊർജ്ജം - ആനന്ദ്, ഡി. സി. ബുക്സ്.
7. ഹരിതരാഷ്ട്രീയം : ചരിത്രം സിദ്ധാന്തം പ്രയോഗം- ജോർജ് കെ. അലക്സ്, ഡി. സി. ബുക്സ്.
8. ജീവന്റെ കയ്യൊപ്പ് - ആഷാമേനോൻ: ഡി. സി. ബുക്സ്.
9. പരിസ്ഥിതി സൗന്ദര്യശാസ്ത്രത്തിന് ഒരു മുഖവുര - ഡോ. ടി. പി. സുകുമാരൻ, ബോധി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
10. കവിതയുടെ രഥോത്സവം - (എഡി.) അജയപുരം ജ്യോതിഷ്കുമാർ, ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
11. ഹരിതസാഹിത്യദർശനം - എം. അച്യുതൻ.
12. കവിതയും പരിസ്ഥിതിയും - എസ്. രാജശേഖരൻ.
13. കാലിഫോർണിയ കാടുകളിൽ - സുഗതകുമാരി.
14. ഹരിതദർശനം ആധുനികാനന്തരകവിതയിൽ - ഡോ. സി. ആർ. പ്രസാദ്.
15. പ്രതിരോധചിന്തകൾ - ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
16. മലയാള കവിതയും പരിസ്ഥിതിയും - ഡോ. ആനന്ദ് കാവാലം.
17. പടരുന്ന മഷിച്ചാലുകൾ - ഐറിസ് കൊയ്ലിയോ.
18. ഭാവനയുടെ ജലസ്ഥലികൾ - ജി. മധുസൂദനൻ.
19. പ്രകൃതി സമീപനങ്ങൾ ആദ്യകാല കവിതകളിൽ - ഡോ. സീമ ജെറോം.
20. പരിസ്ഥിതിയുടെ രാഷ്ട്രീയം - (എഡി.) സി. റഹിം, ഫേബിയൻ ബുക്സ്.

30. How can metallic character change across a period?

31. Describe clearly the link between increasing effective nuclear charge across a period and the changes in van der Waals radius.

SECTION D

Each question carries 15 marks (essay type) Answer any two questions.

32. a.Explain about the pH changes of aqueous solutions of elements in the third period as the period is crossed.
    b. Explain how these changes are directly related to the changes in effective nuclear charge across the period.
    c. Describe the metallic character of elements in a period. (5x3 marks)

33. a.Explain the role of some chemicals in household items. (8 marks)
    b.Write a short note on food adultration. (7 marks)

34. a.Write a short note on the uses and hazards of fertilisers. (8 marks)
    b.Draw the structure of carbon and sodium (shell model) (7 marks)

35. a. Draw the structures showing shapes of methane, water and carbon dioxide (8 marks)
    b.compare the bonding structures of diamond – graphite. (7marks)

UNIVERSITY OF KERALA

OPEN COURSE FOR OTHER MAJORS

2020 Adimission onwards

Semester	V
Course	Open Course
Course name	**ENVIRONMENTAL CHEMISTRY**
Course Code	CH 1551.3
Credit	2
Hours	54 hours
Lecture-Tutorial-Lab	2-0-0

CO No.	**COURSE OUTCOME** *Upon completion of this course, students*	**Cognitive Level**	**PSO No.**
1	Discuss the structure and composition of the atmosphere	U	PSO14
2	Identify,Realise and enlist the causes of pollution to water, soil and air	U	PSO14
3	Become aware of environmental issues and its effect to man and other living beings	U	PSO12
4	Review major environmental disasters and suggest controlling and preventive measures	U	PSO12
5	Discuss the laws of environmental protection	U	PSO21

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Environmental Components** Structure and composition of the, Atmosphere, hydrosphere, biosphere and Lithosphere – composition of atmosphere	**9**	**1,2,3**
2	**Water pollution** Sources, its effect and control; Sampling and measurement of water quality and their analysis, water quality standards, BOD and COD Hard water – soft water Eutrophication and restoration of lakes.	**9**	**1,2,3**
3	**Air Pollution** Types and sources of air pollution, Common Air Pollutants - Effects of air pollution; Smog – ozone layer depletion green house effect – acid rain	**9**	**1,2,3**
4	**Soil Pollution** Sources, types, effects and control of: Land pollution, Marine pollution, Thermal Pollution and Radioactive pollution. Waste separation, storage and disposal ; Waste Reduction, Recycling and Recovery of materials.Plastics and their misuses.	**9**	**1,2,3**
5	**Major environmental disasters** Major environmental disasters - mercury poisoning in Minamata, Japan, Itaiitai disease due to cadmium poisoning in Japan - Love Canal toxic waste site, Seveso disaster chemical plant explosion - Bhopal disaster - Chernobyl incident	**9**	**4**
6	**Major environmental laws:** Environment (Protection Act) – The Air (Prevention and control of pollution) Act – The water (Prevention and control of pollution) Act – The wild life protection Act – Forest conservation Act – The Ozone Depleting Substances (Regulation and Control) Rules – The Plastic Waste (Management and Handling) Rules - Rio declaration- Montreal protocol, Kyoto protocol Introduction to Green chemistry (elementary ideas only)	**9**	**5**

Reference

1. Banerji, K Sameer"Environmental Chemistry", ISBN - 9788120315761.
2. K. De "Environmental Chemistry - An introduction" New Age International (P)Ltd.,2017
3. B. K. Sharma "Air Pollution", Goel Publishing House
4. V. K. Ahluwalia "Environmental Chemistry", books.google.co.in, 2017
5. G.W. vanLoon and S. J. Duffy "Environmental Chemistry: A Global Perspective"
6. S.K.Mohanty, Environment and Pollution Laws, Universal Law Publishing Co. (P)Ltd

EC 222: ECONOMICS OF SOCIAL SECTOR AND ENVIRONMENT

(Hours per semester: 110
Hours per week: 6)

Objectives

This course is designed to enable students to: (1) Understand and apply the key economic concepts in the context of social sectors like education, environmentand healthcare, (2) Appreciate how economic factors contribute to the development and implementation of educational policies, (3) Identify the major theories governing the development of human resources, school improvement and development, (4) Recognize the important linkages between the environment and economics, (5) Be aware of the key environmental issues around the globe, and (6) Understand approaches to identify and value costs and outcomes to include in economic evaluation of the environment through benefit cost analysis.

Course Contents

Module 1: Economics of Education (20 hours)

Human Capital – Components of Human Capital – Education as an instrument for economic Growth – Demand for Education – Supply of Education – Determinants of demand for Education – Costs of Education - Private Costs and Social Costs- Benefits of Education – Direct, Indirect and Social Benefits – Wastage and Stagnation in Education – Causes and Measures-Manpower Planning-Meaning and Techniques of Forecasting.

Module 2: Economics of Health (20 hours)

Nature and Scope of Health Economics – Health Dimensions of Development – Determinants of Health – Economic Dimensions of Healthcare – Demand for and Supply of Healthcare – Healthcare Financing – Inequalities of Health – Class and Gender Perspectives – Healthcare Sector in India-Health Insurance Schemes in India-RSBY,ESIS,AABY, JBY.

Module 3: Economics of Environment and Environmental Valuation (25 hours)

Environmental Economics – Meaning and Significance – Interlinkage between economy and Environment – Material Balance Model – Law of Entropy – Environmental Kuznets' Curve

Environmental Valuation – Use Values, Non-use Values, Option Values – Approaches to Environmental Valuation – Direct Methods – Contingent Valuation Method, Trade off Games Method, Costless Choice Method, Delphi Method – Indirect Methods – Revealed Preference

Methods – Travel Cost Method, Hedonic Pricing Method, Preventive Expenditure Method, Surrogate Market Approach, Wage Differential Approach– Cost Based Methods and Other methods of Valuation – Cost Benefit Analysis.

Module 4: Environmental Policies and Issues (25 hours)

Environmental Externalities – Design of Environmental Policy – Quantity Based Instruments – Market based Instruments – Pigouvian tax and Subsidy Approach – Non-Market Instruments – Command and Control – Mixed Instruments – Marketable permits – Tradeable Pollution Permits -Bargaining Solution – Coase Theorem – Informal Regulation – Collective Action – Grass Root Movements (Chipko Movement, Save Silent Valley Movement, Narmada Bachao Andolan, Appiko Movement)– Monitoring and Enforcement – The New Model of Pollution Control – Major Environmental Policies and Legislations in India.

Global Environmental Issues – Climate Change Problems, Global Warming, Bio Diversity Loss, Acid Rain, Deforestation, Environmental Pollution.

Module 5: Economics of Natural Resource Management (20 hours)

Natural Resources – Resource Taxonomy – Theories of Optimum Use of Exhaustible and Renewable Resources – Common Property Resource Management – Tragedy of Commons.

Environment Development Trade off – Sustainable Development – Indicators of Sustainable Development – Equity and Sustainable Development – Environment and Trade in the WTO Regime – Environment and System of National Accounts – Green GDP.

Reading List

Module 1

1. Environmental Education in India (2002) Association of Indian Universities, New Delhi.
2. Schultz., T.W. (1971) Investment in human Capital, Free Press, New York
3. Joy A. Palmer, 1998, Environmental Education in 21st century, Routledge, London.
4. Kolstad, D. Charles (2010), Environmental Economics, Oxford University Press.
5. Cohn E. and T. Gaske (1989), Economics of Education, Pergamon Press, London.
6. McMohan, W.W. (1999), Education and Development: Measuring the Social Benefits, Oxford University Press.
7. Becker G.S. (1974), Human Capital (2nd Edition), National Bureau of Economic Research, New York.

SEMESTER-II

FOUNDATION COURSE

METHODOLOGY AND PERSPECTIVES IN PLANT SCIENCES

Course code : BO 1221, Number of credits : 3

Number of contact hours: 36 hrs (Lecture); 36hrs (Practical) Total= 72 hours

Distribution of Hours	Theory	Practical
Scientific Studies	08 hrs	0 hrs
Data handling in science	12 hrs	16 hrs
Microtechnique	06 hrs	08 hrs
Biophysics	10 hrs	12 hrs
Total	36 hrs	36 hrs

Aim of the course: To introduce the methodology and perspectives of Science in general so as to enable the students to systematically pursue his particular discipline in science in relation to other disciplines that come under the rubric of sciences.

Objectives:

- To familiarize the students with the fundamental characteristics of science and significance of scientific studies
- To apply scientific methods independently and familiarize instruments in biological labs
- To interpret scientific data using basic statistical methods
- To develop skills for microscopic specimen preparation.

MODULE-I

Scientific Studies **08hrs**

1. Types of knowledge: Practical, theoretical and scientific knowledge
2. Information: What is science; what is not science; laws of science; basis of scientific laws and factual truths.
3. Science as a human activity: scientific temper and empiricism, Science disciplines
4. Revolution in Science and Technology
5. Ethics in Science: Transparency and Honesty; danger of pre conceived ideas.
6. Scientific information: Depositories of scientific information, Primary, secondary and digital sources; sharing of knowledge.
7. Methods and tools in science: Steps in scientific method. Null hypothesis and alternative hypothesis. Inductive and deductive reasoning.

MODULE- II

Data handling in science **12hrs**

1. Nature and types of data - Typical examples, Data collection, Data presentation-

Classification and tabulation, diagrammatic presentation (bar & pie diagrams) and graphic presentation (Histogram, frequency polygon, frequency curve & Ogives).
2. Samples and sampling techniques.
3. Statistical treatment of data: Statistical terms and symbols. Measures of central tendencies (mean, median, mode), Measures of dispersion (range, mean deviation, variance, standard deviation, coefficient of variation), Significance tests (chi-square test).

Practicals **16hrs**

1. Workout problems on frequency distribution
2. Represent data using bar diagram and histogram
3. Measures of central tendencies (Mean, Median,Mode)
4. Workout problems on measures of dispersion (range, mean deviation, variance, standard deviation, coefficient of variation)
5. Workout problems on chi-square test.

MODULE-I11

Microtechnique **06hrs**

1. Introduction - microscopy - simple and compound – phase contrast; dark field illumination and electron microscopes (SEM and TEM).
2. Micrometry, Camera lucida
3. Sectioning - hand and microtome– rotary and sledge
4. Killing and fixation agents – Carnoy's formula, Farmers formula, F .A.A
5. Dehydration - reagents
6. Stains and staining techniques - double staining. General account; Stains: safranin, haematoxylin, acetocarmine.
7. Mounting media - D. P. X and Canadabalsam
8. Whole mounts - cytological methods: maceration, smear and squash preparation.

Practical **08hrs**

1. Familiarize stains, fixatives and mounting media
2. General awareness of Micro technique - maceration, smears &squash
3. Demonstration of microtome sectioning and hand sectioning
4. Measurement of specimens using micrometer (Demonstration only).
5. Photomicrography and Camera lucida drawings (Demonstration only).

MODULE-IV

Biophysics **10hrs**

1. Principles and applications of Colorimeter, Spectrophotometer (UV-Visible) and Centrifuge- centrifugation, types of rotors (swinging bucket, fixed angle), Density gradient and Differential centrifugation.
2. Basic knowledge of the separation methods: - Chromatography (Column chromatography, paper chromatography and TLC), Electrophoresis (PAGE and AGE).
3. Buffers -their functions in biological systems - Uses of buffers in biological research, pH meter.
4. Cryobiology – cryopreservation, freeze drying (lyophilisation) and its applications.

Practical **12hrs**

1. Separation of plant pigments by paper chromatography/TLC.
2. Preparation of buffer
3. Measurement of pH
4. Construct the absorption spectrum of any sample.

REFERENCE

1. Bailey T .J.(1995) Statistical Methods in Biology (3rd Edition) – Cambridge University Press India Pvt Ltd.
2. Bass, Joel, E et al. (2009). Methods for teaching Science as Inquiry, Allyn&Bacon
3. Blair E .J. (1987) Introduction to chemical instrumentation Mc-Graw Hill Book Company
4. Casey E. J. (1063) Biophysics – Concepts and Mechanisms Van Nostr and Reinhold Company
5. Collins H. and T Punch (1993). The Golem. What everyone should know about Science. Cambridge Univ. Press
6. Donald A. Johansen (1940) Plant Microtechnique- Mac Graw Hill Book company
7. Elizabeth Allman (2004). Mathematical Methods in Biology, Cambridge University Press India Pvt. Ltd
8. Gieryn T.F. (1999). Cultural Boundaries of Science, Univer. Chicago Press.
9. Hewitt, Paul G, Suzanne Lyons, John A, Suchocki and Jennifer Yeh (2007). Conceptual Integrated Science, Addison-Wesley
10. Jeffrey A. Lee (2010). The Scientific Endevor. Pearson Delhi
11. Khan and Khanum (1994). Fundamentals of Biostatistics, Saras Publications
12. Marcello Pagano and Kimberlee Gauvreau (2018) Principles of Biostatistics 2nd Edition CRC Press, Chapman & Hall
13. Newton RG (2000) The truth of Science, 2nd edition, Harward University Press
14. Pattabhi V & Gautham N (2011)Biophysics, Narosa publishers
15. Peter Grey (2018) Hand book of microtechnique-Mac Graw Hill Book company
16. Prasad and Prasad (1972). Out lines of Botanical Microtechnique, Emkay publish, Delhi
17. Saha I and Paul B (2016) Essentials of Bio-statistics 2nd Edition Academic Publishers
18. Stephen W. Looney (2009). Biostatistical Methods, Humana Press, Springer International Edn.
19. Veer Bala Rastogi (2008). Fundamentals of Biostatistics, Ane Books Pvt. Ltd
20. Willard H. H., J .A. Dean, L. L. Merritt and F. A. Settle (2011) Instrumental methods of analysis, CBS Publishers and Distributors N. Delhi

EXPECTED OUTCOME

- Students will be familiarized with the fundamental characteristics of Science.
- Develops an idea about involvement of science in improvement of human life.
- Create awareness of scientific approach towards life and learns the values of ethics in science.
- Develops skills to interpret scientific data using basic statistical methods.
- Create skills to prepare specimens for microscopic and gross anatomical studies and familiarize with different microscopic methods for sample analysis.
- Students become able to prepare buffers, measure pH, separate plant pigments and construct absorption spectrum of a sample.

SEMESTER-V

ENVIRONMENTAL STUDIES AND PHYTOGEOGRAPHY

Course code: BO1542

Number of credits: 4

Number of contact hours : Lecture: 90 hrs; Practical: 36 hrs; Total: 126 hrs

Distribution of Hours	Theory	Practical
Environmental Studies	**81 hrs**	**36 hrs**
Phytogeography	**09 hrs**	**00 hrs**
Total	**90 hrs**	**36 hrs**

MODULE- I **14 hrs**

1. Definition- Scope and relevance to society and human environment. Need for public awareness
2. Natural Resources - Renewable and Non renewable - Land & Soil, Water, Energy, Minerals, Food and agriculture , Forests, Plants & Wild life resources
Degradation of natural resources - Land degradation, degradation of water resources, Loss of flora and fauna
Causes – population explosion, over exploitation, deforestation, agriculture mismanagement, desertification, overgrazing, soil erosion, mining, urbanization and industrialization- change in land use, depletion of water resources
3.Conservation of Natural resources
Land and soil- afforestation, regeneration of wasteland
Water - Rain water harvesting, ground water dams
Energy - Promoting use of renewable resources-solar, hydel, tidal and wind; biodiesel, biofuels.
Forests- Reforestation, Community forestry programmes
4. Role of an individual in conservation of natural resources, sustainable life styles.

MODULE II

Ecosystems **22 hr**

1. Ecosystems - Concept, definition, structure and function; components- biotic and abiotic; energy flow
2. Food chains -Food web & ecological Pyramids, biogeochemical cycles - Carbon and Phosphorous cycle
3. Ecological succession-Definition, primary and secondary succession, climax concept, hydrosere and xerosere.
4. Plant adaptations- Morphological, anatomical& physiological adaptations of – Hydrophytes, Xerophytes, Halophytes, Epiphytes, Parasites
5. Introduction- types, characteristic features, structure and functions of the following ecosystems.

1. Forest ecosystem 2. Grassland ecosystem 3. Desert ecosystem 4. Aquatic ecosystems- Ponds, Streams, Rivers, Oceans, Estuaries (brief account only)

MODULE-III

Biodiversity and its conservation **24 hrs**

1. Introduction
2. Definition- genetic, species and ecosystem diversity.
3. Terrestrial (Tropical rain forest) and Aquatic Biomes(mangroves).
4. Hot-spots of biodiversity; India as mega-diversity nation.
5. Threats to biodiversity: land use changes & habitat destruction, poaching of wild life- hunting & export, Overuse of pesticides, invasive species.
6. IUCN, Red data Book; Extinct and Threatened species- endangered & Rare; Endemic species of Western Ghats.
7. Conservation of biodiversity: *In-situ* (National parks and Wild life sanctuaries) and *Ex-situ* conservation (botanical gardens); Biosphere Reserves & World Heritage Sites in India-Ramsar sites.
8. Global initiatives in biodiversity conservation- Stockholm Conference, Montreal Protocol, Convention on Biological diversity Regional initiatives- *Chipko* movement, A brief account on conservation efforts in Kerala- People Biodiversity Register.

MODULE-IV

Environmental pollution & Issues **21 hrs**

1. Definition causes, effects and control measures of – 1. Air pollution 2. Water pollution 3. Soil pollution 4. Marine pollution 5. Noise pollution 6. Thermal pollution 7. Nuclear hazards.
2. Solid Waste Management- waste minimization, Recycling and Reuse, Consuming environment friendly products. E-waste management.
3**.** Environmental Issues **-** Climate change, Global warming, Acid rain, Ozone layer depletion.
4. Environmental Legislations - Environment protection Act (1986); Air [prevention and control of pollution] Act (1981; Amended 1987); Water [prevention and control of pollution] Act (1974; Amended 1988); Wildlife Protection Act (1972); Forest conservation Act (1980). (Scope and relevance only)
5. Environmental Organisations –UNEP, IPCC, WWF, Central Pollution Control Board

MODULE-V

Phytogeography- concept & definition **09 hr**

Vegetation in India – Forests- tropical, temperate, sholas, sub alpine, alpine, mangroves & Grass lands.

Phytogeographical regions of India - Western and eastern Himalayas, Dessert, Western Ghats, Deccan Peninsula, Gangetic Plain, North East India, Coasts & Islands.

Practical **36 hrs**

1. Visit a local polluted site and report major pollutants.
2. Study of ecological and anatomical modifications of Xerophytes, Hydrophytes, Halophytes, Epiphytes and Parasites.
3. Observation and study of different ecosystems mentioned in the syllabus.
4. Phytogeographical regions of India- Photos/ Diagrams

REFERENCE

1. Misra SP and Pandey SN, 2009, Essential Environmental studies, Ane Books Pvt. Ltd
2. Erach Bharucha – Text book of environmental Studies for undergraduate Courses, Universities Press, University Grants Commission
3. Ahluwalia VK and Sunitha Malhotra 2009, Environmental science, Ane Books Pvt. Ltd.
4. Chapman J.L. (2006) Ecology-Principles and Application. Cambridge University Press India Pvt. Ltd
5. Chandoco.S Weaver and Clements – Plant Ecology, McGraw Hill Publications, New York.
6. Verma, P. S. and V. K. Agrawal. 2004. *Cell Biology, Genetics, Molecular Biology, Evolutionand Ecology.* S. Chand & Company Ltd., New Delhi.
7. Prithipal Singh 2007- An Introduction to Biodiversity. Ane Books Pvt. Ltd
8. Verma and Agarwal – Principles of Ecology, S. Chand and Co.
9. Ambasht R.S. – Text book of Plant Ecology, Students and Friends & Co. Varanashi.
10. Odum Eugene P – Fundamentals of Ecology, Edn. Philladephia & Saunders, Tokyo, Toppon.
11. Sharma, P.D. – Elements of Ecology (Rastogi's Company Ltd., Publications).
12. Vashista P.C – Plant Ecology Edu. Vishali Publications.
13. Periasamy, K. – Elements of Plant Ecology, (M.K. Publications).
14. The Geography of Flowering Plants - Good
15. Kumaresan B. – *Plant Ecology & Phytogeography* – Rastrogi Pub:

Semester IV

Zoology Core course III

ECOLOGY, HABITAT DESTRUCTION & DISASTER MANAGEMENT

Course code – ZO 1441

No. of credits - 3 **Total hours 54**

Course Outcomes

- Students get basic knowledge on ecosystem, food chain, food web and energy flow.
- Students acquire general awareness on pollution and their impacts.
- Imparts basic knowledge on ecosystems and their functioning.
- Students learn about various types of anthropogenic pressures on ecosystem, related degradation and management measures.
- Students get awareness of toxicants, their impacts on human health and environment and remedial measures.
- Create awareness about disasters, prevention and mitigation measures.

ECOLOGY **4 hrs**

Module I

Components of ecosystem: Environmental factors - abiotic factors, light, temperature, soil, air; biotic factors- autotrophs, phagotrophs and saprotrophs; ecosystem interaction and relationship between biotic and abiotic factors, the cybernetic nature and the stability of the system. Pond as an ecosystem (self study)

Module II **5 hrs**

Biogeochemical cycles: Basic types of biogeochemical cycles - gaseous cycle-carbon and nitrogen cycles, mention sedimentary cycles (P and S), recycling pathways and recycle index.

Limiting Factors- basic concepts- Leibig's law of minimum, Shelford's law of tolerance, combined concept of limiting factors, Light and temperature as limiting factors.

Module III **8 hrs**

Habitat Ecology: Biosphere classification- lithosphere, hydrosphere and atmosphere physical features, fauna and their adaptations of aquatic, terrestrial and marine habitats (self study).

Population ecology: Properties of population- density, natality, mortality, age distribution, biotic potential, environmental resistance and carrying capacity, population growth forms, J and S shaped curves, emigration, immigration and migration, population fluctuation. Community ecology: Definition and characters, species diversity; stratification; dominance; ecotone and edge effect; ecological indicators; community periodicity, succession.

Module IV **5hrs**

Anthropogenic impact on ecosystem: Ionizing radiation and radioisotopes, ionizing radiation and human health, radiation accidents and other exposures, disposal of radioactive wastes, pesticides like DDT, endosulfan, furadan, insect repellants , e-wastes. Monitoring of pollutants - physical, chemical and biological.

Module V **3 hrs**

Wild life conservation and management: Significance, causes of extinction, concepts of threatened species, red data book, IUCN, WWF, CITES, Green Environment and Green peace; protected areas, biosphere reserves, national parks and sanctuaries in India, forests in India, desertification, deforestation, carbon trading; importance of mangroves in coastal ecosystems-conservation and management.

Module VII **9 hrs**

Environmental biotechnology: Biotechnological methods of pollution detection, biotechnological methods in pollution management, bioremediation, biotechnology and biodegradation, genetically engineered microbes in bio-treatment of waste, eco-friendly bioproducts for environmental health, bio-piracy, bio-pesticides and bio-fertilizers, organic farming and its merits. Green chemistry - designing a Green synthesis, basic principles of Green chemistry.

Module VIII **5 hrs**

Environment Movements

Environment and health - Environment and development: Environmental Movements (Chipko, Narmada Bachao Andolan). environmental movements in Kerala (Madhav Gadgil/Kasturi Rangan Reports. Ramsar sites Wetland Reclamations and localized anti-reclamation movements) Kerala state Biodiversity Board, Biodiversity Register.

DISASTER MANAGEMENT

Module IX **8 hrs**

Disruption in Ecosystem

Natural-flood, Draught, Earth quaque, Cyclone, Tsunamis, Volcanic eruption. Anthropognic influence on erosion, climate change and pollution. Mining activities Monoclonal plantations, genetically modified plants and their impact in ecosystem. Impact of Developmental projects such as construction of dams, Hydroelectric projects Thermal power station.

Module X **7 hrs**

Disaster Management – Meaning and Definition: Definitions of Disaster, Hazard, Risks. Vulnerability, and Resilience and their relationship: Classification of disasters- Human induced and Natural; Cause of Disasters; Impact of disasters. Factors affecting Vulnerability – Economic, Political, Environmental and Social Counselling.

Assignment/Seminar

Global warming, Green House Effect, Ozone depletion Climate change, Kyoto protocol

Reference

- Beck, W. S., Liem, K. F. & Simpson, G.G. (1991). *Life: An Introduction to Biology* (3rd Ed.) Harper Collins Publishers, New York, pp 1361. ISBN : 006500009 9
- Bharucha,E. (2005). *Textbook of Environmental Studies*. Universities Press (P)Ltd. India, pp 276. ISBN 81 7371 540 8.
- Chapman, J.L., & Reiss, M.J. () *Ecology: Principles and Applications* (2d Ed.) Cambridge University Press, UK. ISBN: 0 521 00575 2.
- Charry, S.N. (2008). *Environmental Studies*. MacMillan India Ltd. ISBN: 10:0230 63531 8, 13: 987 0230 6351 9.
- Cunningham, W.P. & Cunningham, M.A. (2003). *Principles of Environmental Science inquiry and Applications.* Tata McGraw Hill Publishing Company Ltd. New Delhi. ISBN 0 07 058112 6.
- Donald Van DeVeer & Christine Pierce (). *The Environmental Ethics & Policy Book* (3rd Ed.) Wadsworth – Thomson Learning, Canada. ISBN: 0 534 56188 8.
- Emmel, T.C. (1976). Population Biology. Harper & Row Publishers, New York. ISBN 06 041904 0

Disaster Management

- http://www.mnmk.ro/documents/2008/2008-6.pdf
- Carresi,A.L, et al (2013) Disaster Management: International Lessons in Risk Reduction, Response and Recovery , Routledge, U.K.
- Agarwal, A. and Sen, S.: The Citizen's Fifth Report, Centre for Science and Environment. New Delhi 1999
- Chandna, R.C.: Environmental Awareness, Kalyani Publishers, New Delhi, 1998
- Sharma, H.S.: RathambhoreSanctuary - Dilemma of Eco-development, Concept.
- www.ifrc.org/en/what-we-do/disaster-management/
- Coppola. Damon (2011), Introduction to International Disaster Management, Elsevier 1SBN: 978-0-12-3821744
- Abbott Leon (2008). Natural Disaster, McGraw-Hill.ISBN-13: 978 0072 428650.

HABITAT DESTRUCTION AND DISASTER MANAGEMENT

- Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
- Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
- Carter, W. Nick, 1991: Disaster Management, Asian Development Bank,
- Coppola P Damon, 2007. Introduction to International Disaster Management,
- Cuny, F. 1983. Development and Disasters, Oxford University Press. Manila.
- Ahluwalia, V. K. and Malhotra, S. (2006). Environmental science. Ane Books Pvt.Ltd.
- Aravind Kumar. (2004). Text Book of Environmental Science. APH Associates,Inc.Publishers. Massachusetts.
- Atchia. M. and Tropp.S. (1995). Environmental Management, John Wiley
- Bhatia .A.1. Current trends in Global EnvironmentNew India publishing_ Agency,
- Bishop.P.L. (2000). Pollution Prevention: Fundamentals and Practice,
- Brace, C.L. (1967). The stages of Human Evolution, Prentice Hall International.CambridgeUniversity Press.33.
- Chapman J.L.and M.J.. (1999). Ecology - Principles and Applications.
- Chatterjee B. (2003). Environmental Laws: Imple mentation problems

1644Environmental Economics and Disaster Management (Core)

Module I Basic Concepts (5 Hrs)

Basic Concepts of environmental economics – economics and ecology – ecology and eco system

Module II Theory of Externalities (15 Hrs)

Market system and environment of externalities – Pareto optimum and Market failure in the presence of Externalities – Property rights and the Coase theorem

Module III Environmental Policy Tools for Analysis (20 Hrs)

Pigouvian Taxes and Effluent Charges; Tradable Permits – Environmental Valuation – Types of Economic Values – Non Market Valuation Methods – Cost Benefit Analysis – Sensitivity and Risk analysis

Module IV Global Environmental Issues (7 Hrs)

Economics of Climate Change – Agreements and Institutions - Population Growth and the Environment – Trade and Environment – Concept and Measurement of Sustainable Development

Module V Disaster Management in india (8 Hrs)

Concept and Definitions (Disaster, Hazard, Vulnerability, resilence, Risk) – Hazard and Vulnerability Profile of India – Institutional Arrangeems (Mitigation, DM Act and Policy, Plans Programmes and Legislation),Disaster management in India

Basic Readings

1. Hussain, M, Ahmed. 2000. Principles of Environmental Economics. Routledge, London and New York
2. Charles Kolstad, Intermediate Environmental Economics, Oxford University Press, 2nd edition
3. Carter, Nick 1991. Disaster Management: Disaster Manager's Handbook, Asiaan Development Bank, Manila Pilippiens.
4. Gupta Anil K, Sreeja S Nair, 2011 Environmental Knowledge for Disaster Management, NIDM, New Delhi

5. ELECTIVE

6. EC1661.1 KERALA ECONOMY

7.

8. Inst Hours-4 Number of Credit-2

9. Course Objective

10. To understand the structural changes, Sector-wise contribution and features of the Kerala Economy since the formation of the state and enable the students to have a basic understanding of the emerging trends and issues of Kerala Economy

11.

12. MODULE I: Structure of Kerala Economy

13. Development experience of Kerala: An overview: Kerala's development since the formation of the state-Features of the Economy- Structural composition – Primary, Secondary and Tertiary Sectors – changes over the years NSDP,GSDP and PCI – "Kerala Model of Development" –A comparison with the highest SDP state in India – HDI Status

14.

15. MODULE II: Demographic change: A boost to Economic change

16.

17. Demographic Aspects (birth rate, death rate, infant mortality rate, sex ratio, age distribution)- why sex ratio is in favour of women in Kerala –need for women empowerment – Aging problem- Urbanisation, Migration and Emigration-Economic and social Impacts of Migration, return migration and interstate migration - Nature and Magnitude of Urban, Rural and Educated Unemployment - Trends in Urban and Rural Poverty in Kerala- Major poverty alleviation schemes.

18.

19. MODULE III: Kerala's Economic Development : Sector-wise Analysis

20.

21. Agricultural development since 1956: Objectives of Land reforms- Measures of Land

them to apply these tools in Economics.

MODULE I: Univariate Analysis, Correlation and Regression (35 Hours)

Univariate analysis – frequency tables, Measures of central tendency, dispersion, standard deviation, coefficient of variation, Lorenz Curve, Gini Concentration ratio-Geometric mean, Harmonic mean

Correlation--Simple, Partial and Multiple correlation- Scatter diagram-Karl Pearson's coefficient of correlation-Spearman's rank correlation- probable error- uses of correlation.

Simple and multiple linear regression- Method of Least Squares-Lines of regression- Regression coefficient-Relation between regression and correlation coefficients-Uses of regression in Economics.

MODULE II: Index Numbers and Time series Analysis (30 Hours)

Time series analysis-meaning-components- Measurement of trend-graphic method, semi-average method, moving average method and method of least squares.

Index numbers-Meaning and types of Index numbers – Simple and Weighted index numbers CPI and WPI- Problems in the construction of index numbers – Tests of index numbers- Fishers ideal index numbers- factor reversal test and time reversal test – Deflating – Base shifting – Splicing – Uses of Index numbers.

MODULE III: Probability (32 Hours)

Probability- Elements of probability theory (sample space, events) –definition of Probability: Classical and Modern , Relative frequency definition and Axiomatic approach – Addition theorem– multiplication theorem – Conditional Probability –

Random variable- discrete and continuous ,Expectation,Binomial and Normal distribution.

References

1. Murray R. Spiget (1999), Probability Theory Schaum's Series.
2. Lipshutz, (2000), Theory of Probability, Schaum 's Series,
3. S P Gupta,Statistical Methods,Sultan Chand and sons

Semester V

Core VIII EC1543 Readings in Political Economy

4 Hours **4 Credits**

Module I Passages from the Classics (15 hours)

Adam smith-Division of labour, Ricardo-On Rent and Of Machinery, Marx-CMC and MCM' circuit

1.Adam smith;Wealth of Nations,Book 1 ,Chapter 1 'of the division of labour'

,Chapter 3 ' That the division of labour is limited by the extent of market'

http://www.econlib.org/library/Smith/smWN1.html#B.I, Ch.1, Of the Division of Labor

2.David Ricardo ; On the Principles of Political Economy and Taxation Chapter 2 On Rent

http://www.econlib.org/library/Ricardo/ricP1a.html

David Ricardo;On the Principles o Political Economy and Taxation, chapter 31 on Machinery

http://www.econlib.org/library/Ricardo/ricP7.html#Ch.31, On Machinery

3.Karl Marx –Capital Volume 1

Part II The Transformation of money into Capital

Chapter-4 The General formula for Capital

https://www.marxists.org/archive/marx/works/1867-c1/ch04.htm

Robert Heilbroner (1998) Wonderful World of Adamsmith

, Worldly Phlosophers, Robert Heilbroner (1998), Updated Seventh Edition

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http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

Module II Political Economy : Different Perspectives (20 hours)

This section introduces the student to different perspectives of political economy : the perspectives of Adam Smith , John Maynard Keynes

1. Robert Heilbroner (1998) Wonderful World of Adamsmith

, Worldly Phlosophers, Robert Heilbroner (1998), Updated Seventh Edition

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http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

2. The Rise and fall of money- The Mandarin Revolution (Great Depression and the Ideas of Keynes)

3.Glabraith,John Kenneth,'The age of Uncertainty'Houghton Mifflin Company,Boston,1977

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

The Savage Society of Thorestein Veblen

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

The Contradictions of Joseph Schumpeter

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

Module III Global Economic Crisis and its Aftermath (20 hours)

THE Recent Crisis in Global Capitalism : Towards Marxian Understanding

1.Vamsi Vakulabharanam, EPW Vol.44,Issue No.13,March,2009 www.epw.in/system/files/pdf/2009_44/13/The_Recent_Crisis_in_Global_Capitalism_Towards_a_Marxian_Understanding.pdf

Module IV Issues in Political Economy and Development Thinking (20 hours)

Indian Development thinking, Gender equality and Women's empowerment. Social justice through affirmative action in India.

Naila Kabeer (2005)Gender equality and Women's empowerment Development

http://nailakabeer.net/wp-content/uploads/2005/09/13552070512331332273.pdf

Ashwini Deshpande (2012), Social Justice through Affirmative Action in India

http://research.economics.unsw.edu.au/scho/WEE/papers/Ashwini%20Deshpande1.pdf

Semester V

Core IX EC1544 Economic Growth and Development

3Hours **2 Credits**

Course Objectives:

1. To ensure that students begin to understand basic concepts of Economic Growth and Development and thereby enable them to acquire multi dimensional aspects of developmental issues

2. To convey knowledge about theoretical framework of Growth and Development under different Schools of economic thought.

3. To impart knowledge about Political institutions, the role of the state in Economic Development and problems that affect state Governance.

1	EN 1121	Foundation Course 1: Writings on Contemporary Issues
2	EN 1211.1	Language Course 3: Ability Enhancement Compulsory Course- Environmental Studies and Disaster Management
3	EN 1331	Complementary Course 5: Narratives of Resistance
4	EN 1641	Core Course 11: Gender Studies

Semester I

Foundation Course 1- EN 1121 (B A/ B. Sc) and CG 1121.3 [Career Related 2 (a) Programme]

Course Title: WRITINGS ON CONTEMPORARY ISSUES

Credits: 2

Hours: 4/week (72 hrs)

Learning Objectives:

1. To sensitize students to the major issues in the society and the world.
2. To provide students with a variety of perspectives on contemporary issues.
3. To encourage them to read literary pieces critically.

Learning Outcomes:

On completion of the course, the students should be able to

1. Have an overall understanding of some of the major issues in the contemporary world
2. Respond empathetically to the issues of the society
3. Read literary texts critically

Course Description

1. Living in the Planet of the Apps by Khyrunnisa A.
2. Ageing in India: Some Social Challenges to Elderly India by Abhay B. Mane
3. India's Women: The Mixed Truth by Amartya Sen
4. Drug Abuse: Causes and Solutions by Samudranil Mukherjee
5. Artificial Intelligence by Gareth Southwell
6. Universal Declaration of Human Rights by Leah Levin
7. What Secularism is and is not by Romila Thapar
8. The Globalisation of Inequality by P. Sainath

Textbook Prescribed:

Thoughts of Our Times

Edited by Dr. C.A. Lal, Associate Professor of English, School of Distance Education, University of Kerala and Vishnu Narayanan, Assistant Professor, Institute of English, University of Kerala

Publishers: Orient Blackswan

Additional Reading

1. Janaki Lenin, *My Husband & Other Animals*

2. Mark Tully, *No Fullstops in India*

3. Shashi Tharoor, *An Era of Darkness: The British Empire in India*

4. Alexander Frater, *Chasing The Monsoon: A Modern Pilgrimage Through India*

5. Bill Bryson, *A Short History of Nearly Everything*

Web sources

1. https://storycorps.org/stories/

2.https://www.fullspate.digitalcounterrevolution.co.uk/english-articles-advanced/

3. https://www.thehindu.com/

4. https://www.theguardian.com/international

5. http://epaper.indianexpress.com/

6. https://www.nytimes.com/

7. https://www.telegraph.co.uk/

8.https://ia601601.us.archive.org/26/items/in.ernet.dli.2015.460612/2015.460612.Jawaharlal-Nehrus-Speeches-Vol-2_text.pdf

Semester II

EN 1211.1

Language Course 3: Ability Enhancement Compulsory Course – EN 1211.1 (B.A / B.Sc)

Course Title: ABILITY ENHANCEMENT COMPULSORY COURSE: ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

Credits: 5

Hours: 5/week (90 hrs)

Learning Objectives:

To enable the student:

- to engage with a wide range of issues in environmental studies and disaster management.
- to acquire a set of values for environmental protection and conservation
- to recognize the ecological basis for regional and global environmental issues
- to manage natural disasters and other emergency situations
- to develop a critical vocabulary related to environmental studies and disaster management

Learning Outcomes:

The student will be able to:

- understand environmental crises and disaster management situations
- take lead in spreading environmental values and creating awareness among the public
- understand local environmental issues better
- respond in a better way to a natural calamity or disaster
- articulate environmental concerns using appropriate vocabulary

Course Description

Module 1

Understanding the Environment

Introduction: Environment-its importance-types of ecosystems

- "Chief Seattle's Speech"
- "The Religion of Forest" (An Essay by Rabindranath Tagore)
- "Trophic Cascade" (A poem by Camille T. Dungy)

A Glossary of relevant **key concepts** with examples

Comprehension Questions

Module 2

Resources and their Conservation

Introduction: Natural Resources-biodiversity- conservation

- An extract from *The Silent Spring*(A book by Rachel Carson)
- *On Killing a Tree* (A poem by Gieve Patel)
- *The Inheritors of the Earth* (A translation of Short Story by Vaikom Muhammed Basheer)

A Glossary of related **Key Concepts** with **examples**

Comprehension **Questions**

Module 3

Environmental Pollution

Introduction: Types-Causes-Effects-Waste management-Policies and practices

- *Beat Plastic Pollution* (An article from unenvironment.org)
- "Memory of Hiroshima" (A poem by K. Satchidanandan)
- *E is for E-waste* (Ellen Banda-Aaku)

A Glossary of Related **Key Concepts** with **examples**

Comprehension **Questions**

Module 4

Disaster Management

Introduction: Natural and Man-made- health emergency- handling hazardous materials-managing personal disasters- bomb threats- disasterpreparedness-management-rehabilitation

- An introductory essay on Disaster Management
- *The Truth about the Floods* (A poem by Nissim Ezekiel)
- An extract from Chapter 1 of *Patna Blues* by Abdullah Khan (Juggernaut Books)
- A newsletter on Bhopal Gas Tragedy

- Laboratory safety manual
- 'Relief Standard Operating Procedure for Natural & Man-made disaster,' an essay.

A Glossary of related **Key Concepts** with interesting **examples**

Comprehension Questions

Project report (10 Marks)

Students are expected to prepare a project report based on any one of the activities suggested below. General guidelines will be provided for preparing the Project Report.

1. Visit to a local area to document environmental assets: River/Forest/Grassland/Hill
2. Visit to a local polluted site: Urban/Rural/Industrial/Agricultural
3. Study of simple ecosystems: Pond/River/Hill slopes
4. Mock drill organized in their college by the local disaster management agencies

SEMESTER III

FIRST DEGREE PROGRAMME IN

BA ENGLISH LANGUAGE AND LITERATURE (CBCS SYSTEM)

Complementary Course 5: EN 1331 Narratives of Resistance Number of Credits: 3 No. of Instructional Hours: 3 [Total 54 Hours]

Aim Introduce the various narratives of resistance, literary and other wise.

Objectives

1. To understand the various modes of resistance needed to subvert oppressive socio- cultural structures.
2. To provide insight into the struggles of people from around the world for identity and rights and contribute proactively to social dynamics.
3. To understand how literature acts as a vehicle for voices of dissent and protest.

Course Outcome

CO 1: Be able to identify themes of resistance in different forms and genres of literature.

CO 2: Have a sense of the various kinds of injustice related to race, ethnicity, gender etc. prevalent in society.

CO 3: Develop an idea of literature as a form of resistance to all forms of totalitarian

authority. CO 4: Understand the inter connection between various genres in manifesting

resistance

CO 5: How resistance is an undeniable presence in the everyday narratives of literary and other artistic expressions.

COURSE OUTLINE

Module I Narratives of Resistance

Nature and Function of Resistance- Heterogeneous forms of Resistance-Gender-Dalit-Race-Totalitarianism-Nation State-Holocaust- Slave Narratives-War-Resistance and Social Change

Module II Poetry/Documentary

1. Adrienne Rich- ―What Kind of Times Are These‖ https://www.poetryfoundation.org/poems/51092/what-kind-of-times-are-these
2. Denise Levertov- ―Making Peace‖

https://www.poetryfoundation.org/poems/53900/making-peace

Mahmoud Darwish-—ID Card
https://www.wrmea.org/017-november-december/id-card-by-mahmoud-darwish-a-translation-and-commentary.html

3. S.Joseph : —Between These Lines‖ https://www.poetryinternational.org/pi/poem/17768/auto/0/0/S-Joseph/Between-These- Lines/en/nocache
4. Tishani Doshi- —Girls are coming out of the Woods‖ https://www.poetryfoundation.org/poems/152744/girls-are-coming-out-of-the-woods
5. Taslima Nasreen : —Garment Girls‖ https://www.poemhunter.com/poem/garment-girls/
6. Lucille Clifton: —poem in praise of menstruation‖ https://www.poetryfoundation.org/poems/54584/poem-in-praise-of-menstruation
7. Peter Davis (Dir): *Nelson Mandela: Prisoner to President* (Apartheid Documentary 1994) https://www.youtube.com/watch?v=Rk-Lxgp9NWg

Module III Prose and Fiction

1. Assange, Julian. —Conspiracy as Governance.‖ State and Terrorist Conspiracies. 7-12 https://cryptome.org/0002/ja-conspiracies.pdf(Article)
2. Sojourner Truth: —Ain't I A Woman?‖ (Speech) https://www.nps.gov/articles/sojourner-truth.htm
3. Jacinta Kerketta And Nighat Sahiba —On The Power of Poetry And Politics of Language‖.Huffpost article by Kavitha Muralidharan (Article) https://www.huffingtonpost.in/entry/jacinta-kerketta-nighat-sahiba-kashmir-jharkhand- poems-language_in_5c41f480e4b027c3bbc14a3a?guccounter=
4. Alice Munro: —Boys and Girls‖ (Short Story) http://www.giuliotortello.it/shortstories/boys_and_girls.pdf
5. K. Saraswathi Amma: —Life, In My View‖ (Memoir) (Translation J.Devika) https://swatantryavaadini.in/2020/08/30/life-in-my-view-k-saraswathi-amma/#more-982
6. Nemat Sadat :*Carpet Weavers* (Novel) Penguin, 2019.

Recommended Reading

Brueck , Laura. *Writing Resistance: The Rhetorical Imagination of Hindi Dalit Literature.*

Columbia University Press, 2014.

Darwish, Mahmoud.*Unfortunately, It Was Paradise: Selected Poems.*University of California Press, 2013.

De Santis, Christopher C., et al. *The Collected Works of Langston Hughes: The poems, 1941- 1950.* Italy,University of Missouri Press, 2001.

8. Doshi, Tishani. *Girls Are Coming Out of the Woods*. India, Harper Col

Dutta, Mohan J. *Voices of Resistance: Communication and Social Change*. Purdue University Press. 2012.

Harlow, Barbara. *Resistance Literature*. New York, Methuen, 1987.

Hosseini, Khaled. *A Thousand Splendid Suns*.Bloomsbury Publishing,

2009.

Jo Glanville, ed. Qissat: *Short Stories by Palestinian Women*. London, Telegram, 2006.

90-94. Levertov, Denise. *Selected Poems*.United States, New Directions, 2003.

Lewis, T. (2008).―Literature as Resistance‖.*The Hudson Review*,60(4), 655–664. www.jstor.org/stable/20464787

Manṭo, Sa'ādatḤasan. *Manto*: *Selected Short Stories: Including 'Toba Tek Singh' and 'The Dog of Tithwal'*. India, Random House India, 2012

Munro, Alice. *Selected Stories*. United Kingdom, Random House, 2012.

Neruda, Pablo. *The Poetry of Pablo Neruda*.United States, Farrar, Straus and Giroux, 2015.

Nguyen, Viet Thanh. *Race and Resistance: Literature and Politics in Asian America Race and American Culture.*USA,Oxford University Press, 2002.

Rich, Adrienne. *Collected Poems: 1950-2012.* United States,W. W. Norton, 2016.

Stoltz, Pauline. *Gender, Resistance and Transnational Memories of Violent Conflicts*.Germany, Springer International Publishing, 2020.

Williams, Nerys. *Contemporary Poetry*. United Kingdom, Edinburgh University Press, 2011.

Zimmermann, Jérémie, et al. Cypherpunks: *Freedom and the Future of the Internet*. United Kingdom, OR Books, 2016.

e-resources

https://swatantryavaadini.in/

https://www.thegoodtrade.com/features/inspiring-female-poe

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On Literature and Resistance

SEMESTER VI

FIRST DEGREE PROGRAMME IN

BA ENGLISH LANGUAGE AND LITERATURE (CBCS System)

Core Course 11: EN 1641 Gender Studies

No: of Credits: 4 **No of Instructional Hours: 5 [Total: 90hours]**

Aim: Introduce and problematize gender constructs.

Objectives

1. Explore the historical variables that have contributed towards the social norms of gender and sexuality
2. Understand the significance of making gender an integral concept of social analysis
3. Develop a conceptual understanding of the field of gender studies

Course Outcome

CO 1: Recognize the patriarchal bias in the formation of history and knowledge.

CO 2: Analyse the ways in which gender, race, ethnicity class, caste and sexuality construct the social, cultural and biological experience of both men and women in all societies.

CO 3: Recognize and use the major theoretical frames of analysis in gender studies

CO 4: CO 5: Interrogate the social constructions of gender and the limiting of the same in to the male-female binary in its intersections with culture, power, sexualities and nationalities

CO 5: Examine gender issues in relation to the sustainable goals of development

COURSE OUTLINE

Module I Introduction to Gender Studies

Gender, Patriarchy- Family- Identities- Essentialism- Difference- Ideology- Intersectionality- Feminisms-Womanism-Dalit Feminism-Islamic Feminism

1. bell hooks. ―Feminist Politics:Where we Stand‖ *Feminism is for Everybody*: *Passionate Politics*. London: Pluto, 2000: pp.1-6. https://excoradfeminisms.files.wordpress.com/2010/03/bell_hooks-feminism_is_for_everybody.pdf
2. Judith Lorber. ―The Social Construction of Gender.‖ https://ieas.unideb.hu/admin/file_9695.pdf
3. Vijila Chirappad: ―Wasteland‖ (poem) https://feminisminindia.com/2018/01/11/5-dalit-women-po

ets/

Module II Gender and Sexuality

Body-Sexualities-Performativity-Heterosexuality-Sexual Orientation-Non-normative Sexualities- Desire-Heteronormativity-Homosexuality-LGBTQI-Queer-Transgender-Pride Parade- Posthuman Orientation.

1. A. Revathi. *The Truth about Me:A Hijra Life Story*(Life Narrative)
2. Margaret Atwood: ―Helen of Troy Does Countertaps‖ Dancing (poem) https://apoemaday.tumblr.com/post/181494581744/helen-of-troy-does-counterto p- dancing
3. Kalki Subramaniam: ―Breaking Binaries, Establishing Identity‖ TEDxDumas https://www.youtube.com/watch?v=_j1NzEGMNdo

Module III Gender and Culture

Culture, Modernity, Consumption, Sexual Economies, Commodity Culture

1. Nivedita Menon: ―India: Section 377: How Natural is Normal?‖ http://www.sacw.net/SexualityMinorities/nivedita01Jan2004.html
2. Maya Angelou: ―Phenomenal Woman‖ (poem) https://www.poetryfoundation.org/poems/48985/phenomenal-woman
3. Meena Kandasamy: ―Mascara‖ (poem) https://www.poemhunter.com/poem/mascara-4/

Module IV: Gender, Power and Human Rights

Power, Sexual Politics, Discourse, Sexual Citizenship, Discrimination, Human Rights, Gender Justice

1. Alice Walker: *Meridian* (Novel)
2. Mahaswetha Devi: *Draupadi* (Short Fiction)
3. Mayilamma:Chapter 13. ―Protest: The First Year‖ (Pages 55 – 59) Jyothibai PariyadathuMayilamma: *The Life of a Tribal Eco-warrior*. Orient Blackswan, 2018.

Recommended Reading

Butler, Judith. Gender Trouble: *Feminism and the Subversion of Identity*. New York: Routledge, 1990.

Cranny-Francis,Anne. Wendy Waring, Pam Stavropoulos, Joan Kirkby. *Gender Studies Terms and Debates*.Macmillan, 2017.

Delap, Lucy. *Feminisms: A Global History*. Penguin,

2020. Foucault, Michel. *History of Sexuality*.Penguin

books: 1977

Kate, Millet. *Sexual Politics*. New York: Doubleday. 1969.

Kumar, A.*The History of Doing*, New Delhi: Kali for Women,1998.

Marao, Lori, J. *Fifty-One Key Feminist Thinkers*. Taylor and Francis, 2016.

Naples, Nancy A. *Companion to Women's and Gender Studies*. Wiley, 2020. Roth, Benita. *Separate Roads to Feminism*. CUP,2004.

Sullivan, Nikki. *A Critical Introduction to Queer Theory*.NYU, 2003.

e- resources

https://kalkisubramaniam.com/

https://www.e-ir.info/2017/02/06/online-resources-feminism/

https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)30239-9/fullte xt https://plato.stanford.edu/entries/feminist-philosophy/

http://www.gender.cawater-info.net/knowledge_base/rubricator/feminism_e.htm

https://guides.lib.purdue.edu/c.php?g=352219&p=2375079

B.Com I st Semester

Core Course I: CO 1141 – ENVIRONMENTAL STUDIES

No. of instructional hours per week: 4 No. of Credits: 3

Aim of the course: To develop knowledge and understanding of the environment and enable the students to contribute towards maintaining and improving the quality of the environment.

Course objectives:

1. To enable the students to acquire basic ideas about environment and emerging issues about environmental problems.
2. To give awareness about the need and importance of environmental protection

Module I: Environmental studies – meaning – scope – importance (4hrs)

Module II: Ecology and Ecosystems, Biodiversity and its Conservation, and Natural resources –meaning of ecology – structure and function of an ecosystem – producers – consumers – decomposers– energy flow in the ecosystem – ecological succession- food chain – food webs and ecological pyramids . Ecosystem – concept– types of ecosystems – structure and functions of forest ecosystem, grass land ecosystem- desert ecosystem, aquatic ecosystem. Biodiversity and its conservation introduction- definition- genetic, species and ecosystem diversity- value of biodiversity – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of diversity – threats to diversity – conservation of diversity in situ, ex-citu. Natural resources features- air resources, forest resources, water resources, mineral resources, food resources energy resources, land resources- over exploitation of natural resources- consequences conservation of natural resources- role of an individual in conservation of natural resources
(25 Hrs)

Module III: Industry and environment - pollution – environmental pollution – soil pollution – air pollution – water pollution – thermal pollution – noise pollution – causes, effect and control measures – waste management – waste minimisation through cleaner technologies – reuse and recycling - solid waste management.(18hrs)

Module IV: Social issues and environment – Unsustainable to sustainable development – urban problems related to energy - water conservation - water harvesting - resettlement and rehabilitation of people- environment ethics-waste land reclamation-consumerism and waste products. (15 hrs)

Module V: Human Population and environment – population growth – variation amoeg nations – population explosion – environment and human health – human rights – value education – Women and child welfare. (10hrs)

Note: All students must *visit a local area to document environmental issues and prepare a brief report on the same identifying issues involved and suggesting remedies.(This will be a part of the internal marks. i.e. for EVS the internal marks = attendance – 5 marks + test paper – 5 marks + field study report – 10 marks)*

Books recommended

Misra.S.P and Pandey .S.N. *Essential Environmental Studies*, Ane Books India, New Delhi.
Kiran B. Chokkas and others.*Understanding Environment*, Sage Publications New Delhi.
Arumugam N. and Kumaresan V. *Environmental Studies*, Saras Publications, Kanyakumari.
Benny Joseph. *Environmental Studies*, Tata McGraw-Hill Publishing Co.Ltd.,New Delhi.

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SEMESTER I

Paper 4: CO 214- PLANNING AND DEVELOPMENT ADMINISTRATION

Objectives:

1. To generate an overall insight on planning process in Indian Economy
2. To make the students aware about new planning initiatives in India

Module 1 - Structure of Indian Economy- Relevance of sectors in Indian Economy; Primary, Secondary and Tertiary Sectors-National Income-Methods of Computation-Inflation effects on Indian Economy- India's current National Income in comparison with leading economies of the world-Challenges. **(15Hrs)**

Module 2: Planning mechanism in India–Economic planning-features, types-Phases of Economic Planning-Growth and Planning Models-(Briefly mention) -State Planning Board-District Planning Board **(20Hrs)**

Module 3: Fiscal Policy-Centre-State financial relationship-Resource Allocation-Finance Commission-Development and Non Development expenditure-Preparation of budgets: Centre, State and Local Self Government-Deficit financing-Plan and Non-Plan Expenditure (Case Study: Evaluation of current Budget) **(20Hrs)**

Module 4 : Policy Initiatives in the Planning Process –Niti Aayog –Structure– Objectives –Functions-Guiding Principles -Vision Statement-Recent Policy initiatives: Make in India, Jan DhanYojana, Startup India, Swatch Bharath Abhiyan, Mudra Bank, Digital India – Future development initiatives **(20Hrs)**

Module 5: Role of State and Local Self Government-Planning initiatives in Kerala-Kerala Perspective Plan –Mission-Vision-Scope-Local Self Government –Role, Functions and Programmes **(15Hrs)**

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References:

1. Agarwal A.N. and Kundanlal (1999), Economics of Development and Planning, Vikas Publishing House, NewDelhi
2. Seth.M.L. and S.P. Singh (1998), Economic Planning: Theory andPractice, S.Chand and Company Ltd., Ram Nagar, NewDelhi
3. Dhingra.I.C. and V.K.Garg (2000), Economic Development and Planning in India, Sulthan Chand Publications, NewDelhi
4. Mishra S.K. and Puri V.K (2008), 26th Edition, Indian Economy,Himalaya Publishing House Pvt. Ltd.,Mumbai-
5. Desai and Bhale Rao (1986), Economic Planning and Policy,Himalaya Publishing House,Mumbai
6. Madan Mohan Batra (1987), Planning in India: development perspective towards the 21st century, V.K. Publishing House,Mysore
7. Misra and Puri (1999), Development and Planning Theory andPractice, Himalaya Publishing House,Mumbai
8. Gerald. M. Meier, and Robert E. Baldwin,(1957) (Reprint in 1975), Economic Development- Theory, History ,Policy, Asia Publishing House,Mumbai
9. Gerald. M. Meier, James E. Rauch,(2005), Leading Issues inEconomic Development, (8th Edition) Oxford University Press,Oxford,
10. Meier .G.M. (1995), Leading Issues in Economic Development (6thedition) Oxford University Press, NewDelhi.
11. Higgins Benjamin (1963), Economic Development, Principals, Problems and Policies, Central Book Depot,Allahabad
12. Kindleberger C.P. (1977), Economic Development (III edition) McGraw Hill NewYork.
13. Adelman. I (1961), Theories of Economic Growth and Development, Stanford Universities Press,Standford.
14. Bose. A, (1975), Marxian and Post Marxian Political Economy, PenuinLondon
15. Chakrvarthy S (1982), Alternative Approaches to the Theory of Economic Growth, Oxford University Press, NewDelhi.
16. Growth. S, (1986), An Introduction to Development Economics, Allen and Unwin
17. Little IMD (1982), Economic Development : Theory Policy and International Relations, Basic Books, NewYork
18. Schumpeter J.A., (1949), The Theory of Economic Development,Harvard University Press,Cambridige.
19. Bhagavathi J and Desai, (1970), India: Planning for Industrialization,Oxford University Press,Oxford
20. Jolly. R., (1973), Third World Employment, Penguin,Oxford
21. Sen.A.K. (1962), Choice of Techniques, Basil Backwall,Oxford

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SEMESTER I

Paper 1: CO 211- BUSINESS ETHICS AND CORPORATE GOVERNANCE

Objectives:

1. To convey basic understandings on the theories of Business Ethics
2. To provide a understanding on Corporate Governance practices and the provisions of the Companies Act relating to corporate governance

Module 1: Business Ethics and Ethical Practices: Ethics – Sources- Importance - factors influencing Business Ethics – Benchmarks on code of Ethics – Ethics Committees – Training Programmes – Ethical Decision Making – Ethics in Finance - Marketing and HR **(15Hrs)**

Module 2: Organization Culture: Features – Building and Maintaining Organization Culture – Organizational Socialization – Managing cultural Diversity – Work Ethics – Work Culture – Quality of Work Life – Work Life Balance – areas Improving Work Life Balance – Strategies of Work Life Balance **(20Hrs)**

Module 3: Corporate Governance: Importance – Objectives – Basic Ingredients of Corporate Governance – Principles - Theories – Phases of development of Corporate Governance in Global and Indian Perspectives – Code of Corporate Governance – Committees on Corporate Governance (Global and Indian) **(15Hrs)**

Module 4: Corporate Social Responsibility : CSR under Companies Act 2013 – Scope – Relevance – Importance – Areas of CSR – Arguments for and against CSR – Ackerman's model of CSR – SEBI – Clause 49 of listing agreement – Evaluation of Corporate Governance of a Company – Methods – Shareholder Value – EOCE, PAT, EPS, TSR, MVA, EVA and HVA - Corporate Philanthropy – Corporate Citizenship – Social Audit **(25 Hrs)**

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Module 5: Corporate Image and Excellence : Corporate image – building corporate image – Importance – Corporate Excellence – importance – Measures to achieve corporate excellence – New initiatives on corporate excellence - Role of Chairman – Qualifications – Power – Duties and Responsibilities – Board Committees – New Directions **(15Hrs)**

References:

1. Laura P Hartman, Perspectives in Business Ethics, Mc Graw Hill International
2. George A Steiner and John F Steiner, Business , Government and Society, Mc Graw Hill International
3. SK Chakraborthy, Ethics in Management Vedantic Perspectives, Oxford University Press
4. Subhash Sharma, Management in New Age: Western Windows – Eastern Doors, New Age International Publishing , New Delhi
5. Prof (Col.) PS Bajaj, Dr. Raj Agarwal – Business Ethics an Indian Perspectives, Biztantra2006.

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UNIVERSITY OF KRALA
SYLLABUS FOR B.Sc. CHEMISTRY
FIRST DEGREE PROGRAMME
2020 Admission onwards

Semester	I
Course	Core course-I
Course name	**INORGANIC CHEMISTRY I**
Course Code	CH 1141
Credit	2
Hours	36 hours
Lecture-Tutorial-Lab	2-0-2

CO No.	**COURSE OUTCOME** *Upon completion of this course, the students*	Cognitive Level	PSO No.
1	Discuss the course of development of structure of atom.	U	PSO1
2	Apply rules for filling electrons in classifying elements into s, p,d and f blocks	A	PSO10
3	Define various scales of electronegativities and their applications	U	PSO10
4.	Define Effective nuclear charge and Slater's rules	U,A	PSO10
5	Discuss about diagonal relationship and anomalous behaviour of hydrogen and other first element in each group.	U	PSO4
6	Correlate and predict general properties of s and p block elements based on their electronic configuration.	A	PSO4
7	Realise applications of s and p block elements in sustainable and renewable energy sources.	A	PSO14
8	Define various concepts of acids and bases.	U	PSO11
9	Understand reactions in non aqueous solvents.	U	PSO11
10	Realise various causes, effects and control measures of environmental pollution.	E	PSO13
11	Review national movements for environmental protection.	U, A	PSO21

MODULE	COURSE DESCRIPTION	Hrs	CO No.
1	**Atomic Structure and Periodicity**	**9**	
1.1	Introduction to structure of atom, Rutherford and Bohr model of atom,	1	1
1.2	Dual nature of electron-de Broglie equation-matterwaves and electromagnetic waves. Experimental verification by Davis and Germer method,Heisenberg's uncertainty principle- expression and significance.	1	1
1.3	Wave mechanical concept of the atom-Schrodinger	1	1

	equation and its significance (derivation not required.)		
1.4	Quantum numbers- Pauli's Exclusion principle- Aufbau Principle- Hund's rule- Electronic configuration of atoms- classification of elements into s,p,d and f blocks-	2	1
1.5	Electronegativity- Pauling's scale, Mulliken and Allred-Rochow scale(including numerical problems),	2	4
1.6	Effective nuclear charge, Slaters rule and its applications, diagonal relationship and anomalous behavior of first element with other elements.	2	4,5
2	**Representative elements**	**9**	
2.1	General properties of s and p block elements, Hydrogen – isotopes and its applications- uses as a fuel, water gas	2	6
2.2	Physical properties- atomic radii, ionization enthalpy, electron negativity, electron affinity, Flame colouration, inert pair effect	2	6
2.3	Chemical properties- solubility and thermal stability of alkali and alkaline earth metal oxides, sulphates and hydrides	2	6
2.4	p-block elements- oxides of nitrogen and phosphorus, oxyacids of halogens	1	6
2.5	Allotropism – carbon, sulphur and phosphorus	1	6
2.6	Applications- lithium battery, cesium in photovoltaic cells, selenium in xerography and barium x-ray	1	7
3	**Acids, Bases and non- aqueous solvents**	**9**	
3.1	Arrhenius concept, Lowery –Bronsted, Lewis concepts and Lux Flood concept and its limitations,	2	8
3.2	SHAB principle and its applications,	1	8
3.3	Non – aqueous solvents: General properties- classifications- self ionization and leveling effect-	2	9
3.4	Reaction in non-aqueous solvents- protic and aprotic non-aqueous solvents- examples-solutions of metal s in liquid ammonia- self ionization of liquid ammonia-liquid SO_2, liquid HF, alkali metals in liquid ammonia.	4	9
4	**Environmental chemistry- Air, water and soil pollution**	**9**	
4.1	Air pollution- Air pollution caused by fire works, harmful effects of fire works, acid rain, green house effect, smog- classic and photochemical smog	2	10

	Ozone layer depletion, ozone hole, protection of ozone umbrella. Management of air pollution.		
4.2	Water pollution: causes- heat, industrial waste, sewage water, detergents, agricultural pollutants Treatment of industrial waste water- Activated charcoal, synthetic resins, reverse osmosis and electro dialysis Quality of drinking water- Indian Standard and WHO standard- Dissolved oxygen- BOD , COD.	3	10
4.3	Soil pollution: pesticides, fertilizers, Industrial waste, Plastic. Control of Plastic threat- importance of Plastic identification codes and Plastic recycling, use of biodegradable plastics (PGA,PLA and PHBV(mention only)	2	10
4.3	Control of pollution. Pollution Control Board – Duties and responsibilities Mention environmental movements (Plachimada,Silent valley, movement against Endosulfan, Narmada Bachavo Andolan and Chipko movement)	2	11

Text Books

1. B.R.Puri, L.R,.Sharma, K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers New Delhi,2010
2. F.A.Cotton, G. Wilkinson, Advanced Inorganic Chemistry, Wiley, India(P)Ltd
3. J.D.Lee, Concise Inorganic Chemistry,5thEdn. Wiley, India(P)Ltd.
4. A.K.De,Environmental Chemistry,New Age International(P) Ltd. New Delhi
5. A.K.Ahluwalia, Environmental Chemistry, Ane Books, India, New Delhi.

For Further Reading

1. M.C.Day and J Selbin, Theoretical Inorganic Chemistry,2nd Edn.,Reinhold Book Corp.
2. S.Prakash,G.D.Tuli, S.K Basu, R.D.Madan,Advanced Inorganic Chemistry, Vol. 1.,S Chand
3. J.E.Huheey,E.A.Keiter, R.L.Keiter, O.K.Medhi. Inorganic Chemistry, 4th Edn. Pearson, 2006
4. S.S.Dara, A Textbook of Environmental Chemistry and Pollution Control, 8th Edn. S Chand& Sons, New Delhi.
5. M.N.Greenwood, A .earnshaw, Chemistry of the Elements, 2nd Edn. Butterworth, 1997.

UNIVERSITY OF KERALA

Career Related First Degree Programme in
Environmental Science
&
Environment and Water Management

Under Choice Based Credit and Semester System
2015

kup 179(4)/2015-16

Table 1. Scheme of Instruction and Evaluation

Seme-ster	Course Code	Study component	Instructional hours / week		Credits	Evaluation		Total Credits
			Theory	Practical		CE	ESE	
I	EN 1111.3	English I	4	-	3	20%	80%	18
	1111.3	Additional Language I	3	-	3	20%	80%	
	EE 1121	Foundation Course I	3	-	3	20%	80%	
	EE 1131	Complementary Course I	3	-	3	20%	80%	
	EE 1132	Complementary Course Practical	-	2	-	20%	80%	
	EE 1141	Core Course I	3	-	3	20%	80%	
	EE 1142	Core Course Practical		2		20%	80%	
	EE 1171	Vocational Course I	3	-	3	20%	80%	
	EE 1172	Vocational Course Practical	-	2	-	20%	80%	
II	EN 1211.3	English II	4	-	3	20%	80%	24
	1211.3	Additional Language II	3	-	3	20%	80%	
	EE 1221	Foundation Course II	2	-	2	20%	80%	
	EE 1231	Complementary Course II	3	-	3	20%	80%	
	EE 1232	Complementary Course Practical		2	2	20%	80%	
	EE 1241	Core Course II	4	-	4	20%	80%	
	EE 1242	Core Course practical		2	2			
	EE 1271	Vocational Course II	3	-	3	20%	80%	
	EE 1272	Vocational Course Practical	-	2	2	20%	80%	
III	EN 1311.3	English III	5	-	3	20%	80%	19
	EE 1331	Complementary Course III	3	-	3	20%	80%	
	EE 1332	Complementary Course Practical	-	2	-	20%	80%	
	EE 1341	Core Course III	3	-	3	20%	80%	
	EE 1342	Core Course IV	3	-	3	20%	80%	
	EE 1343	Core Course Practical	-	2	-	20%	80%	
	EE 1371	Vocational Course III	4	-	4	20%	80%	
	EE 1372	Vocational Course IV	3	-	3	20%	80%	
	EE 1372	Vocational Course Practical	-	2	-	20%	80%	
IV	EN 1411.3	English IV	5	-	3	20%	80%	22
	EE 1431	Complementary Course IV	3	-	3	20%	80%	
	EE 1432	Complementary Course Practical		2	2	20%	80%	
	EE 1441	Core Course V	5	-	4	20%	80%	
	EE 1442	Core Course VI	2	-	2	20%	80%	
	EE 1443	Core Course Practical	-	2	2	20%	80%	
	EE 1471	Vocational Course V	4	-	4	20%	80%	
	EE 1472	Vocational Course Practical	-	2	2	20%	80%	

Seme-ster	Course Code	Study component	Instructional hours / week		Credits	Evaluation		Total Credits
			Theory	Practical		CE	ESE	
V	EE 1541	Core Course VII	4	-	4	20%	80%	16
	EE 1542	Core Course VIII	4	-	4	20%	80%	
	EE 1543	Core Course Practical	-	5	-	20%	80%	
	EE 1551	Open Course I	2	-	2	20%	80%	
	EE 1571	Vocational Course VI	3	-	3	20%	80%	
	EE 1572	Vocational Course VII	3	-	3	20%	80%	
	EE 1572	Vocational Course Practical	-	4	-	20%	80%	
VI	EE 1641	Core Course IX	3	-	3	20%	80%	21
	EE 1642	Core Course III	2	-	2	20%	80%	
	EE 1643	Core Course Practical	-	4	2	20%	80%	
	EE 1661.1 EE 1661.2 EE 1661.3 EE 1661.4	Elective Course I	2	-	2	20%	80%	
	EE 1671	Vocational Course VIII	3	-	3	20%	80%	
	EE 1671	Vocational Course IX	3	-	3	20%	80%	
	EE 1673	Vocational Course Practical	-	4	2	20%	80%	
	EE 1644	Project and Factory Visit	4	-	4	20%	80%	

Table showing the credits for the programme

First language-English

Semester	Working hours/week	No of Courses	No of Credits
Sem 1	4	1	3
Sem 2	4	1	3
Sem 3	5	1	3
Sem 4	5	1	3

Total No. of credits = 12

Additional language (Hindi/Malayalam)

Semester	Working/ hours	No of Courses	No of Credits
Sem 1	3	1	3
Sem2	3	1	3

Total No. of credits = 6

Complementary course (Chemistry)

Semester	Working hours/week Theory Practicals	Total Hours	No of Courses	No of credits
Sem 1	3 2+2#	7	1	3
Sem 2	3 2+2#	7	1	3
Sem 3	3 2+2#	7	1	3
Sem 4	3 2+2#	7	1+1*	3 + 4 *

 # The additional 2 hrs as per university regulation of work load for practicals if number of students exceeds 15 in a batch

**Practical Examinations will be conducted only on even semester by the university*

Total No of Credits 12+4=16

Foundation Course

Semester	Working hours/week Theory Practicals	Total Hours	No of Courses	No of credits
Sem 1	3	3	1	3
Sem 2	2 + 2 # *	6	1+1	2

 # 2 hrs as per university regulation of work load for practicals; Total No of Credits = 5

***Practical examination for foundation course**

Core Course (Environmental science)

Semester	Theory Hrs/ Week	Practical Hrs/week	Total Hrs	No of course	No of credits
Sem1	3	2 + 2#	7	1	3
Sem 2	4		4	1	4
Sem 3	6	2+2#	10	2	6
Sem 4	7	2+2#	11	2+1**	6+4**
Sem 5	8	4+4#	15	2	8
Open	3		3	1	2
Sem 6	5	4+4#	13	2+1***	5+4***
Elective	3		3	1	2

#2 hrs as per university regulation of work load for practicals

* Practical examination for foundation course and core course are conducted together as part I & II and the credit is included with core course of 2 credits

At the end of 4th semester; * At the end of 6th semester

**Practical Exam will be conducted by the university;*

Total No of credits 32+6=38

Vocational Course (Water Management)

Semester	Theory Hrs/ Week	Practical Hrs/week	Total Hrs	No of course	No of credits
Sem1	3	2+2#	7	1	3
Sem2	3	2+2#	7	1+1	3+2=5*
Sem3	7	2+2#	11	2	4+3=7
Sem4	4	2+2#	8	1+1*	4+2=6*
Sem5	6	4+4#+4+4#	22	2	3+3=6
Sem6	6	4+4#	14	2+1 *	3+3+2=8*
Project		4+4#	8	1	4

#2 hrs as per university regulation of work load for practicals

Practical Exam will beconducted by the university;

Total No of Credits 27+8=35

B.Sc Environmental Sciences & Environment and Water Management

Six semesters; One semester-18 weeks

Total No of Courses : 43

Sl.No	Study component	No.of courses	Total credit
1	Language English	4	12
2	Additional Lan(Hin/Mal)	2	6
3	Foundation course	2	5
4	Complementary course	6	16
5	Core course	13	38
6	Vocational course	12	35
7	Open Course	1	2
8	Elective courses	1	2
9	Dissertation	1	4
10	**Total**	**43**	**120**

Total No of Credits = 12+6+16+5+38+35+2+2+4=120

Semester 1

Semester	Study component	Title of course	Instructional Hrs
EN1111.3	English I	-	4x18=72
1111.3	Additional Language (Hin/Mal) I	-	3x18=54
EE1121	Foundation Course I	1. Computer Basics and Informatics	3x18=54
EE1141	Core Course I	1. Research Methodology and Perspectives of Science	3x18=54
EE1142	Core Course Practical	2. Environmental Science lab	2x18=36
EE1171	Vocational Course I	1.Water Resources and Fluid Mechanics	3x18= 54
EE1172	Vocational course Practical	2.Water Management Lab	2x18=36
EE1131	Complementary Course I	1.Theoretical Inorganic chemistry	3x18=54
EE1132	Complemetary Course Practical	2.Chemistry lab	2x18=36

Eng-4; SL-3; FC-3; CoreC-5; Vo C-5; Comp C-5; Total=25 Instructional Hrs/week

Semester II

Semester	Study component	Title of course	Instructional Hrs
EE1211.3	English II	-	4x18=72
EE1211.3	Additional Language (Hin/Mal) II	-	3x18=54
EE1221	Foundation Course	1.Computer Application for Biostatistics	2x18=36
EE1241	Core Course II	1. Environmental studies	4 x 18=72
EE 1242	Core Course practical	Environmental Science lab	2 x 18 = 36
EE1271	Vocational Course II	1.Water Resources management	3x18=54
EE1272	Vocational Course Practical	2.Water Management lab	2x18=36
EE1231	Complementary course II	1. Organic and Environmental Chemistry	3x18=54
EE1232	Complementary course Practical	2.Chemistry lab	2x18=36

Eng-4; SL-3; FC-2; Core C- 6; Vo C-5; Comp C- 5; Total=25 Instructional Hrs/week

Semester 1II

Semester	Study component	Title of course	Instructional Hrs
EE1311.1	English III	-	3x18=54
EE1341	Core Course III	1. Natural Resources and Conservation	3x18=54
EE1342	Core Course IV	2 Environmental Management	3x18=54
EE1343	Core Course Practical	3.Environmental Science lab	2x18=36
EE1371	Vocational III	1.Hydrology	4x18=72

EE1372	Vocational IV	2.Water Quality Parameters and Assessment	3x18=54
EE1373	Vocational Practical	3.Water Management lab	2x18=36
EE1331	Complementary III	1.Analytical Chemistry and Biomolecules	3x18=54
EE1332	Complementary Practical	2.Chemistry lab	2x18=36

Eng-3; CoreC-8; Vo C-9; Comp C-5; Total =25 Instructional Hrs/week

Semester 1V

Semester	Study component	Title of course	Instructional Hrs
EE1411.3	1.English IV	-	5x18=90
EE1441	Core CourseV	1.Environmental Biotechnology & Microbiology	5x18=90
EE1442	Core Course VI	2.Biophysics, Biostatistics and Computer Application	2x18=36
EE1443	Core Course Practical	3. Environmental Science lab	2x18=36
EE1471	Vocational V	1.Water Quality Management	4x18=72
EE1473	Vocational Practical	3.Water Management lab	2x18=36
EE1431	Complementary IV	1.Physical chemistry	3x18=54
EE1432	Complementary Practical	2.Chemistry lab	2x18=36

Eng-5; Core C- 9; Vo C- 6; Comp C-5; Total =25 Instructional Hrs/week

Semester V

Semester	Study component	Title of course	Instructional Hrs
EE1541	Core Course VII	1.Environmental Geology and Mineralogy	4x18=72
EE1542	Core course VIII	2.Natural Hazards and Meteorology	4x18=72
EE1543	Core Course Practicals	3.Environmental Science lab	5x18=90
EE1571	Vocational Course VI	1.Water pollution	3x18=54
EE1572	Vocational Course VII	2.Water quality Management- II	3x18=54
EE1573	Vocational course Practical	3.Water Management lab	4x18=72
EE1551	Open course	1.Solid Waste Management	2x18=36

Core C-13; Vo C-10; Open C-2; Total =25 Instructional Hrs/week

Semester VI

Semester	Study component	Title of course	Instructional Hrs
EE1641	Core course IX	1.Environmental Pollution and Control Measures-I	3x18=54

EE1642	Core course X	2 .Environmental Pollution and Control Measures-II	2x18=36
EE1643	Core Course Practical	3.Environmental Science lab	4x18=72
EE1671	Vocational Course VIII	1.Water Analysis	3x18=54
EE1672	Vocational Course IX	2Watershed Management	3x18=54
EE1673	Vocational Course practical	3.Water Management lab	4x18=72
EE1661.1 EE1641.2 EE1641.3 EE1641.4	4.Elective	a.Rain water Harvesting b.Environmental Aspects of Estuarine System c. Disaster Management d.Elementary Concepts in GIS & GPS	2x18=36
EE1644	Project	Environmental Science/ Water Management	4 x 18 = 72

Core C-9; Vo C-10; Project -4; Elective-2; Total = 25 Instructional Hrs/week

CORE COURSES

I . Research Methodology & Perspectives of Science

II. Environmental Studies

III. (1) Natural Resources and Conservation
(2) Environmental Management

IV. (1) Environmental Biotechnology and Microbiology
(2) Biophysics, Biostatistics and Computer Application

V (1) Environmental Geology and Mineralogy
(2) Natural Hazards and Meteorology

VI. (1) Environmental Pollution and Control Measures I
(2) Environmental Pollution and Control Measures II

VOCATIONAL COURSES

I. Water Resources and Fluid Mechanics

II. Water Resources Management

III (1) Hydrology
(2) Water Quality Parameters and Assessment

IV Water Quality Management -I

V (1) Water Pollution
(2) Water Quality Management-II

Semester 5 (Open Course) Solid Waste Management

VI (1) Water Analysis
(2) Watershed Management

Semester 6 (Elective Course)

a. Rain Water Harvesting
b. Environmental Aspects of Estuarine System
c. Disaster Management
d. Elementary Concepts in GIS & GPS

COMPLEMENTARYCOURSES

I . Theoretical Inorganic Chemistry

II . Organic and Environmental Chemistry

III. Analytical Chemistry and Biomolecules

IV. Physical Chemistry

FOUNDATION COURSE

I . Computer Basics & Informatics

II . Computer Application for Biostatistics

FOUNDATION COURSE

I . **Computer Basics & Informatics** 54 hrs

Computer

History and development of computers - basic knowledge of computer systems - softwares and hardwares - free softwares - M.S Word, Excel, Power point.

Computer ethics - software piracy – internet. Piracy – privacy- computer security; computer crimes - hacking and cracking. 9 hrs

Internet - managing bodies of the internet - Internet Society - Internet Service Provider - Internet application software. 9 hrs

Overview of Information Technology

Features of the modern personal computer and peripherals - Computer network. 9 hrs

Knowledge Skills

Data information and knowledge - Internet as knowledge repository - Introduction to use of IT in teaching and learning. Educational softwares. INFLIBNET - academic services. 9 hrs

Social Informatics

IT and society - overview of it's application in medicine, health care, environmental studies-defence, crime detection, communication. 9 hrs

Applications of IT in weather forecasting, education, film and media - virtual reality. 9 hrs

References

1. Cultural Boundaries of Science. T.F.Gieryn, University of Chicago press, 1999 .
2. Alexis Leon & Mathew Leons, Computers Today, Leon Vikas.
3. Alexis Leon & Mathew Leons, Computers Today, Leon Vikas. Fundamentals of Information Technology. ISBN 08125907890
4. Learning Computer Fundamentals, Khanna Book Publishers, ISBN, 818752252b
5. John Ray 10 Minute Guide to Linnx PHI, ISBN 81-203-1549-9.

II Computer Application for Biostatistics 36 hrs

Computer applications - preliminary concepts - sampling, sampling designs - sampling techniques - sample random – systematic sampling data - data presentation – numeric –alphabetic – alphanumeric. 9 hrs

Collection and representation of data - collection and classification tabulation of data.

Graphical representation of data - methods of preparation of graph - Frequency curve relative frequency map - cumulative frequency map - relative frequency map or ogive. Dot diagram -significance of graphic representation - limitations of graphic representation. 9hrs

Measures of central tendencies - mathematical average, average of position - measures of dispersion - range-mean deviation - standard deviation - distribution patterns. 9 hrs

Types of variability - experimental variation - biological variability, real variability - experimental variability, error, subjective, objective instrumental and sampling error. 9 hrs

References

1. Elements of Biostatistics -S.Prasad. ISBN 81-7133-613-2 Title code bc-33 First edition -2003 Rastogi publications, Gangotri, Shivagiroad-Meerut 250 002.
2. Methods in Biostatistics for Medical students & research works-V.K Mahajan. Jaypee Brothers Medical brothers Pvt Ltd, New Delhi- 6th edition.
3. Introduction to Biostastitics. Pranab Kumar Banerjee and S.Chand. ISBN81-219-2329-8. First edition 2004. Rajendra Raveendra Printers Pvt. Ltd., Ram Nagar, New Delhi 110 055.

FOUNDATION COURSE - PRACTICALS

Semester II Computer Application for Biostatistics

1. Create a power point presentation of wild life population.
2. Graphical representation - Bar, Pie charts of flora and fauna.
3. Plotting straight lines
4. Determination of Central tendencies

CORE COURSE

SEMESTER I Research Methodology & Perspectives of Science 54 hrs

Introduction to research Methodology

Research fundamentals and terminologies. Introduction - scientific method - meaning of research - comparison of scientific method & non scientific method - objectives of research-research methodology - types of research. 12 hrs

Defining research problems - formulation of the problem - developing the research plan. Research design – design – experimentation – evaluation - validity of experiment. 10 hrs

Statistical analysis and interpretation of data. Report writing and presentation. Writing and formatting of reports - report presentation. 8 hrs

Perspective of science

Design of an experiment – experimentation - data collection - interpretation and deduction repeatability and replication - documentation of experiments - record keeping - planning of experiment – designs - instrumental requirements - types of instrumentation - accuracy and precision. 14 hrs

Data handling in science

Significance of statistical tools in data interpretation - errors and inaccuracies. Ethics in science -scientific information - digital sources. 10 hrs

References

1. The Glen: What everyone should know about Science. H.Collins and T.Pinch, Cambridge University press, 1993.
2. Cultural Boundaries of Science. T.F.Gieryn, University of Chicago press, 1999
3. Elements of Biostatistics. S.Prasad. ISBN 81-7133-613-2. Title code bc-33 First edition -2003. Rastogi publications, Gangotri, Shivagiroad- Meerut 250 002.
4. Introduction to Biostastitics. Pranab Kumar Banerjee and S.Chand. ISBN81-219-2329-8, First edition 2004. Rajendra Raveendra Printers Pvt. Ltd. Ram Nagar, New Delhi.
5. Research methodology. Dipak Kumar. Bhatacharya Excel Books, A-5, Naraina, Phase-1, New Delhi.

SEMESTER I Core course (Practicals)

1. Sampling methods - Plant or animal community on land.
2. Population censusing methods - Total count, sampling.
3. Estimation of beetle in wheat flour.
4. Study of common flora and fauna.

II Environmental Studies 72 Hours

Unit 1 : Multidisciplinary nature of environmental studies; Definition, scope and importance, need for public awareness. (2 hrs)

Unit 2 : Natural Resources : Renewable and non-renewable resources : Natural resources and associated problems. a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources : World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. (12 hrs)

Unit 3 : Ecosystems : Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystems :-

a. Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (10 hrs)

Unit 4 : Biodiversity and its conservation : Introduction – Definition : genetic, species and ecosystem diversity.Biogeographical classification of India. Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity. (12 hrs)

Unit 5 : Environmental Pollution : Definition, cause, effects and control measures of :- a. Air pollution, b. Water pollution, c. Soil pollution, d. Marine pollution e. Noise pollution, f. Thermal pollution, g.

Nuclear hazards; Solid waste Management : Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case studies.; Disaster management : floods, earthquake, cyclone and landslides. (12 hrs)

Unit 6 : Social Issues and the Environment : From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rahabilitation of people; its problems and concerns. Case Studies; Environmental ethics : Issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies; Wasteland reclamation; Consumerism and waste products; Environment Protection Act.; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness. (12 hrs)

Unit 7 : Human Population and the Environment : Population growth, variation among nations; Population explosion – Family Welfare Programme; Environment and human health; Human Rights; Value Education; HIV/AIDS; Women and Child Welfare; Role of Information Technology in Environment and human health; Case Studies. (7 hrs

Unit 8 : Field work : Visit to a local area to document environmental assets river/ forest/grassland/hill/ mountain; Visit to a local polluted site-Urban/Rural/Industrial/Agricultural; Study of common plants, insects, birds; Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours). (5 hrs)

REFERENCES

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad –380 013, India, Email:mapin@icenet.net
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment
8. Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
10. Heywood, V.H &Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
16. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
17. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)

19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
20. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
21. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
22. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

SEMESTER II Core course (Practicals)

1. Identification of flora and fauna – terrestrial, marine and freshwater ecosystems
2. Estimation of primary productivity – light and dark bottle method
3. Community study : quadrat and line transect method
4. Construction of food chain/ food web : terrestrial and aquatic ecosystems

III Paper (1) Natural Resources and Conservation **54 hours**

Natural resources- definition and classification-Natural resources with reference to India. Renewable and non-renewable resources - Exhaustible and non- exhaustible resources; Mineral resources – distribution – production-coal fossil fuel 10 hrs

Biotic resources-forest and wild life – Biodiversity-hot spots in India-threat to biodiversity. *In situ* & *Exsitu* conservation. Soil and Land Land use pattern - Green revolution; River systems-climate and climatic regions of India. Seasons - onset and retreat of Monsoon –Drought – flood; Flood control programme. 12 hrs

Energy resources- Energy crises-Conventional and non -conventional energy -Types of energy .Fossile fuel – Hydel – Thermal – Nuclear – Solar – Wind – Biomass-Growing energy needs-Alternate energy sources. 10 hrs

Conservation- Minerals – soil- Forest- Wild life -Biotic resources – Fuel - Energy 10 hrs

Man and population, density, distribution-growth trends-sex ratio-age, Population explosion. 12 hrs

References

1. Economic and commercial geography of India T.C Sharma Coutinho, Vikas publishers- New Delhi
2. A Text book of Environmental sciences-PurohitShamiAgrawal-student Edition
3. India – ComprehensiveGeography.D.R.Khuller-Kalyani Publishers.
4. A.Text Book of Environmental studies.E.Barucha.University Press,Hydrabad.

SEM III Practicals

1. Measuring rainfall and calculation of normal rainfall.
2. Recording of maximum -minimum temperature
3. Recording of humidity.
4. Preparing a field map using prismatic compass.

SEM III Paper (2). Environmental Management **54 hrs**

Definition - Basic principles of Environmental Management. Environment Impact Assessment-Definition and aim, Principles and Concepts of EIA- EIA assessment methodologies - few case studies. 9 hrs

Concept of Sustainable Development - UN and International conferences - Rio summit Johannesburg conference on sustainable development; Copenhagen summit. 9 hrs

Environment laws and policies-Historical background of Environment laws - Environment Protection Act, Forest Conservation Act, The Wildlife protection Act, The Air Act, Water Act. 9 hrs

National Environment policies Public Interest Litigation (PIL)-List of cases like M.C.Mehtha vs Union Government of India. 9 hrs

Environment friendly products - pollution abatement technologies; concept of environmental planning - city planning. 9 hrs

Introduction to Environmental Economics.- environmental issues. 9 hrs

References

1. Environmental laws of India. An introduction. CPR Environmental Education Centre Chennai, 2000.
2. A text book on Environmental Studies. D.K.Asthana and Meera Athana. S.Chand and Co.
3. Ecology and Sustainable Development. P.S.Ramakrishnan. NBS New Delhi, 2001.
4. Environmental laws. Gurudip Singh. Macmillan India ltd.
5. Introductory Text of Environmental policies and laws. V.K.Garg, M.S Bishnoi, C.P Malik Kalyani Publishers, New Delhi.
6. Environmental Laws, Dharmendra.S.Sengar, Prentice Hall of India Pvt.ltd, Dew Delhi, 2000.

SEMESTER III Practicals

1. A Collection and submission of 5 Eco-friendly products.
2. A report of visit to a factory where Pollution abatement technology is implemented.
3. A report on environmental law case study in India.
4. A case study of EIA

SEM IV Paper 1 - Environmental Biotechnology and Microbiology (90 hours)

Biotechnology - definitions. Scope of biotechnology in agriculture, food production and nutrition. Impact of biotechnology on sustainability of the environment. Ethical and social impacts of biotehnology. Genetic Engineering - Brief study of gene cloning in prokaryotes. 12 hrs

Molecular tools for genetic engineering. Enzymes: Restriction endonucleases. Role of resrtiction endonucleases in genetic engineering. Recognition sequences, cleavage patterns. Mention of some common RE's - Eco RI, Bam I. Mention of the role of DNA ligases, Terminal transferase in genetic engineering. 12 hrs

Vectors: Role of vectors in GE. Mention of common vectors such as plasmids, bacteriophages, cosmids, artificial chromosome vectors like HAC, YAC, BAC. Host cells: Role of host cells in GE. Mention of prokaryotic hosts - *E coli*, *Bacillus subtilis*. Methods of gene transfer: Mention of transformation, conjugation, electroporation, lypofection, direct transfer. 12 hrs

Salient features of different microbial groups and their current classification - algae, fungi, bacteria, viruses, protozoa, mycoplasma and ricketsia. Microbial nutrition: Photoautotrophy, chemoaototrophy, heterotrophy. Interactions between microorganisms: commensalism, mutualism, parasitism and ammensalism. 12 hrs

Microbial interactions with plants: mycorhiza, rhizobium, actinomycetes and their interactions with legume associations and rhizosphere. Microorganisms in biomass and energy production: Microbes producing protein - single cell protein. Methane (Biogas or Gobar gas) 12 hrs

Environmental Microbiology - Different fields in environmental microbiology. Microbes and geochemical cycles - Nitrogen cycle, Sulphur cycle,.Microorganisms as geochemical agents. 12 hrs

Growth of micro organisms - cell cycle, population growth, batch culture, continuous culture. Mycelial growth. Environmental factors and microbial growth. 9 hrs

Microbes and environmental clean up - Biodegradation. Bioremediation - Need and scope. Environmental applications of bioremediation. Bioremediation technologies. Removal of toxic chemicals. 12 hrs

Epidemiology of microbial diseases of Man - Tuberculosis, Cholera, Hepatitis, AIDS, Histoplasmos, Aspergillosis, Amoebiasis and Malaria. 9 hrs

REFERENCES

1. Ecology & Environment, P.D. Sharma.
2. Enviromental Biology & Toxicology, P.D. Sharma.
3. General Microbiology Volume I & II C.B, Power & H.F. Daginawala. Himalaya Publishing house, New Delhi, 1982.
4. A text book of microbiology. Anathanarayana,S.
5. Microbiology P.D. Sharma, Restegi& Company, Meerut, 1989.
6. An Introduction to Microbiology, R.P. Singh & Kamal Central Book Depot, Allahabad 1989.
7. Ecology and Biology of Soil microorganisms: S.C. Bhandar & L.L. Somani, Agretech Publishing, Udaipur, 1994.
8. A text book of Microbiology. S.S. Purohit. Student edition, Jodhpur. 2004.
9. Biotechnology Applications and Carriers. MeenakshiMunshi, S.K. Sopory, Viva Book Pvt Ltd.
10. Basic Biotechnology. Rev.Fr. Dr. Ignacimuthu, S. J, Tata Mc Graw_Hill Publication Company Ltd.
11. Modern Concepts of Biotechnology. H.D. Kumar, Vikas Publishing House.
12. Biochemisry. U. Sathyanarayana.

SEMESTER IV PRACTICALS Paper -I

1. Demonstration of Sterilisation by dry heat and wet heat(Steam Autoclaving)
2. Cultutre media preparation using PDA (Potato Dextrose Agar)
3. Growth of *E.Coli* in liquid media.
4. Slides of specimens - Paramecium, Spirogyra, Pencillium, coliform bacteria.

SEMESTER IV Paper(2) Biophysics, Biostatistics and Computer Application 36 hrs

Biophysics

Light observation effect effect-Beer and Lambert's law.Absorption spectrum, Redox potential-Laws of photochemistry. Fluorenscence, phosphorescence and other photochemical reaction. 9 hrs

Principle and applications of light and electron microscopy, Spectrophotometry, mass spectrometry Absorption spectroscopy, X-ray analytical methods. 9 hrs

Biostatistics Various sampling methods, Measures of dispersion Test of significance, Chi square test and t-test statistical analysis using computer. 9 hrs

Internet browsing and websites for statistical analysis (Basic idea only). 9 hrs

References

1. Molecular structure and spectroscopy G.Arul Das, Prentice Hall 2007
2. Bio Physics-Principle and Techniques, -2005M.A Subramoniam .MPJ Publishers Chennai.
3. A.Text book of Spectroscopy.Banwell

SEMESTER V Paper (1) Environmental Geology and Mineralogy 72 hrs

Introduction to Geology - Environmental Geology - Definition and scope - Geological agents-Exogenous, and endogenous geological agents. Current views on origin of earth. 12 hrs

The classification of rocks based on their origin; concept of rock cycle; weathering. River as a geological agent; development of river. Rivers in India. 12 hrs

Streams - Drainage basin - Drainage pattern; energy in streams; factors controlling formation of soil; soil profiles. 12 hrs

Glaciers - Types and geological activity - wind -geological activity of wind. Meteorology -elements and factors of climate-influence weather and climate in agriculture; heat island - effect of climate change in ecosystem. 12 hrs

Crystals and minerals - Physical properties of minerals such as colour, streak lustre, hardness and specific gravity. Composition and diagnostic properties of minerals – Quartz, feldspar, talc gypsum, galena, beryl, corundum. 12 hrs

Nature and genetic relationship with igneous rocks-Textures of igneous rocks Megascopic features of the following rock types - granite, syenite, gabbro, basalt. 12 hrs

A brief study of the origin of sediments and sediment rocks. Feature of the following sedimentary rocks - sand stones. 12 hrs

References

1. Text book of Engineering, Geology,N. Chenna Kesaulu 1993 JNTU College of Engineering, Macmillan India limited.
2. Atmospheric Science and Environment, G.N.Ghosh. ISBN 81-7764-043-7-(C) 2000, Allied publishers Ltd.
3. A text book of Geology. Mukergee,P.K, 1986.
4. Engineering & General Geology, Parbinsingh,S.K.Katariah & sons, Gurunank market New Delhi.

SEMESTER V PRACTICALS Paper -II

1. Identification of common minerals & rocks
2. Identification of soil types - red soil, alluvial soil, black soil
3. Determination of soil moisture content.
4. Determination of soil pH
5. Determination of conductivity.
6. Estimation of organic carbon of soil

SEMESTERV Paper (2) Natural Hazards and Meteorology 72 hrs

Basic concept and definition of natural hazard and disaster - earth quake - distribution and causes; volcanoes - types and causes of volcanic eruptions. 12 hrs

Introduction to landslides, (Tsunami), cyclones, floods, hurricane, tornadoes, drought, fire; Causes, mitigation and management. 12 hrs

Anthropogenic disasters : chemical, industrial hazards, nuclear power plants, occupational hazards; hazards due to dam break. Mitigation measures. 12 hrs

Differences between natural disaster and artificial disasters. Environmental health hazard and risk management; Risk identification and assessment – prevention and mitigation. 12 hrs

Meteorology - elementary concept of climate, weather and climate. Clouds – types and classification; wind – forces affecting wind; types of wind and measurement; precipitation – measurement of precipitation; micrometereology 12 hrs

Climate change in agriculture; urban climatology; drivers of climate change – green house gases; effect of climate change on ecosystems, factors affecting climate. 12 hrs

References

1. A text book of Geology -Mukergee ,P.K 1986
2. Rutley's elements of MinerologyCBS.Publishers.New Delhi
3. Physical geography.StablerA.N.and Strahler,A,.H.1987
4. Principles of Petrology,TyrrelG.W.1948

SEMESTER VI. Paper (1) Environmental Pollution and Control Measures–I (54 hrs)

Air pollution - basic definitions and requirements - structure of atmosphere - composition of air, primary and secondary pollutants - unit for quantification of air pollution. Classification of air pollutants. 12 hrs

Automobiles exhaust - Emission standards - COx, NOx, SOx. Indoor air pollution. Effect of pollutants on plants and human beings. 9 hrs

From Factories - hydrocarbons, polychlorinated hydrocarbons; photochemical smog. 6 hrs

Control of air pollution - from factories-Automobile Exhaust-Automobile emission standards- Specific emission standards; Bharath Stages -I,II,III. Measures to check Industrial pollution. 9 hrs

Sources of correction - Control of particulate - removal of particulate matter. Control strategies - control of specific gaseous pollutants - Air Quality standards. 6 hrs

Hazardous Wastes – definition; dentification & classification - Generation of hazardous wastes - Management of hazardous wastes. Health and environmental effects of hazardous wastes-treatment methods. 12 hrs

References

1. A text book on Environmental Pollution and Control, Dr .H S. Bhatia, Galgotia Publications Private Ltd-5, Ansari road, Darya Ganj, Delhi-110 002.
2. Industrial Pollution, V.P.Kudesia, Pragati Prakashan, Meerut 250 001.
3. Air pollution, V.P.Kudesia, Pragathi Prakasan Meerut 250 001.

SEMESTER VI Paper (2) Environmental Pollution and Control Measures -II 36 hrs

Parameters of water pollution - standards of aquatic life. Classification of industrial wastes. 6 hrs

Land and soil pollution - Disposal on land - pesticides pollution- control of soil pollution. 6 hrs

Noise pollution – definition; measurement - decibels; effect of noise pollution on people; traffic noise pollution; industrial noise pollution. 6 hrs

Railway noise; aircraft noise; reduction of noise; absorption of sound. Control of noise pollution.6 hrs

Radioactive pollution - Kinds of radiation; nuclear reactions; natural sources of radioactive pollution; anthropogenic sources of radiation. Radioactive waste; biological effects of radiation pollution; dangers from nuclear plants. 6 hrs

Control from radiation - methods of control; minimizing X-ray hazard - Hazards of Radioactive pollution - Preventive measures from radiation. 6 hrs

References

1. A text book on Environmental pollution and Control. Dr .H S. Bhatia. Galgotia Publications private limited-5,Ansari road, Darya Ganj, Delhi-110 002.
2. Industrial Pollution. V.P.Kudesia-Pragati Prakashan, Meerut 250 001.
3. Air pollution. V.P.Kudesia, Pragathi Prakasan Meerut 250 001.

SEMESTER VI PRACTICALS Paper -I

INSTRUMENTATION (Demonstration)

1. pH meter
2. Conductivity meter
3. Turbidity meter
4. Colorimeter
5. Spectrophotometer

SEMESTER VI PRACTICALS Paper -II

1. Determination of COD
2. Analysis of anion mixture solution (2 Anions)among the following – Carbonate, sulphide, Thiosulphate, Oxalate, Chloride, Nitrate, Flouride, Sulphate, Phosphate
3. Thin layer Chromatographic separation of plant pigments.

Semester 6 (Elective)

a. Rain water Harvesting 3x18=54 hrs
b . Environmental Aspects of Estuarine System
c. Disaster management
d. Elementary concepts in GIS & GPS

Semester 5 (Open**) Solid Waste management** **54 hrs**

Solid wastes and its characteristics; classification of solid waste – source; factors affecting quality & quantity. Physical and chemical characteristics - collection & transportation. 9 hrs

Solid wastes from households, institutions, commercial establishment, public amenities; demolition sites; construction sites; mining & quarrying; sewage treatment plants. Types of solid wastes – municipal; agriculture; biomedical; hazardous; radioactive wastes. 9 hrs

Waste Management - global perspective - source reduction - Reuse and recycling. Disposal techniques - composting; principles of composting; factors affecting composting. Types of composting - Windrow layout and management. 9 hrs

Methane recovery; sanitary landfill - advantages and disadvantages of sanitary landfill. Methods of landfill. Incineration - types of incinerators - reactions involved - advantages and disadvantages of incineration. 9 hrs

Estimation of moisture content; determination of combustible matter; determination of calorific value; reactions involved. Functional elements of solid waste management. Disposal system with or without recoveries. 9 hrs

Summary of method of collection - transfer station; Vehicle and equipment for secondary collection. Ethical aspects of waste management; Pubic participation Law provisions. 9 hrs

References

A text book on Environmental pollution and Control. Dr .H S. Bhatia, Galgotia Publications private limited-5, Ansari road, Darya Ganj, Delhi-110 002.

Semester 6 (Elective)

a. Rain water Harvesting **36 hrs**

Rain water harvesting- Rainwater collection for drinking purpose; domestic rain water collection-community rain water collection. 6 hrs

Artificial recharge; methods of artificial recharge; roof water harvesting-surface water harvesting; dug cum borewells. 6 hrs

Mini artificial aquifer systems; borewell and hand pumps; artificial recharge in roads and colonies. Recycling and treating- methodology land use planning in watershed. 6 hrs

Rain water harvesting for sustainable development - water related sustainability issues in cities-Depletion of ground water table- concept of zero run off. Urban RWH practices. 6 hrs

The importance of watershed management in Kerala - Rain water harvesting in Institutional buildings. 6 hrs

Legal provisions in rain water harvesting in India and Kerala. 6 hrs

References

1. A.Keldho .T.I Sustainable watershed management strategies in semi arid regions of India .II Bombay email.eldho@civiliitb.ac.in.
2. KRG Rainwater Harvesting Foundation.

Semester 6 (Elective) **36 hrs**

b .Environmental Aspects of Estuarine System

The Estuary- definition - Physical features- salinity, temperature, circulation and mixing processes- Major and minor elements- chemical speciation in estuarine waters- Suspended matter in estuaries- adsorption and desorption processes- Sediment transport and sedimentation- Sediment- water interaction and the geochemistry of interstitial waters. 12 hrs

Nutrients, dissolved gases, and general biogeochemistry in estuaries- Biotic aspects of the chemistry of estuaries - Carbon dioxide - calcium carbonate system in estuaries. 12 hrs

Inorganic pollutants, particularly heavy metals in estuaries - Chlorinated hydrocarbons in estuaries- Oil pollution of the marine environment - with an emphasis on estuarine studies - Recovery and decontamination of estuaries. 12 hrs

References

1. Chemistry and Biogeochemistry of Estuaries. Edited by Eric Olausson and Ingemar Cato- John Wiley and Sons - New York.

2. Estuaries: monitoring and modeling the physical system. By Jack Hardisty. Blackwell Publishing.350 main street maldenMA 02148-5020, USA
3. Biogeochemistry of Estuaries, Thomas S. Bianchi. Department of Oceanography, Texas A&M University. Oxford University Press, 2007
4. Practical handbook of estuarine and marine pollution.

By Michael J. Kennish CRC press marine science series (For Oil Pollution and halogenated hydrocarbons)

Semester 6 (Elective)

d. Elementary concepts in GIS & GPS **36 hrs**

Map language – introduction; map as model; spatial elements terminology; classification of maps; map scale; map projection; grouping of map projection; commonly used map projections - Computer in map production; linkage of GIS to Remote Sensing. 9 hrs

Remote sensing; basic principles – Introduction; electromagnetic remote sensing process; nature of electromagnetic radiation. Electromagnetic spectrum; Energy interaction with earth's surface materials. 9 hrs

Fundamentals of GIS - roots of GIS; over view of information system; contribution; disciplines; GIS definition and terminology – Topology – Models - GIS queries - GIS architechture -Components of a GIS. 9 hrs

GIS Work Flow - functional elements of GIS - fundamentals of operations of GIS - theoretical frame work for GIS. GIS categories - level/scales of measurement. Nature of remote sensing-Remote sensing systems - Image display system. 9 hrs.

References

1. A Text book of Remote Sensing and Geographic Information Systems. M. Anji Reddy BS Publications 4-4-309,Giriraj Lane, sulthan Bazar, Hyderabad 500 095.
2. Remote sensing - Models and methods for image processing. Robert A. Schowengerdt-academic Press525 B street, suite 1900, San Diego,California-92101-4495.USA.

Semester 6 (Elective)
Disaster management **36 hrs**

Natural disasters **:** Introduction to - earthquake, volcanic eruptions, landslides, flash flood (Tsunami), major flood, storm surge, hurricane, tornadoes, drought 9 hrs

Anthropogenic disasters - disasters due to chemical, industrial, nuclear, domestic, dam break. 9 hrs

Pre-disaster, during disaster, post disaster; possibility of disaster - warning system - preparedness relief operations - National, State level, Local level – Agencies; concepts in remote sensing, GIS, GPS – applications. Rehabilitations - immediate, first stage, permanent. 9 hrs

Disaster assessment - casualty assessment; ecosystem damage - assessment. Introduction to disaster management. Management plan - preparedness, vulnerability of disaster, safety measures Role of NGO's - International, National, Regional (UN, Red Cross Army, Paramilitary NCC,NSS) 9 hrs

References

1. R.B.Singh (Ed) Environmental Geography, Heritage Publishers New Delhi,1990.
2. Savinder Singh Environmental Geography, PrayagPustak Bhawan, 1997.
3. Kates,B.I& White, G.F The Environment as Hazards, Oxford, New York, 1978.

4. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000.
5. H.K. Gupta (Ed) Disaster Management, Universities Press, India, 2003.
6. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo, 1994.
7. Dr. Satender , Disaster Management in Hills, Concept Publishing Co., New Delhi, 2003
8. A.S. Arya Action Plan For Earthquake, Disaster, Mitigation. In:V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994.
9. R.K. Bhandani An overview on Natural & Manmade Disaster & their Reduction, CSIR, New Delhi.
10. M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster Management,IIPA, New Delhi, 2001.

VOCATIONAL COURSES

SEMESTER I. Water Resources and Fluid Mechanics 36 hrs

Water as a resource material - multiple uses of water.-consumptive uses- irrigation; Partial consumptive uses-public water supply - Fire demand - Industrial uses - thermal uses. 9 hrs

Nuclear power generation - non consumptive uses - hydropower generation - inland navigation water resources – rivers, ponds, lakes. 9 hrs

Introduction to fluid mechanics - properties of fluids – density – viscosity - surface tension- types of flow - laminar flow - turbulent flow. 9 hrs

Reinhold's Number. Reynold's experiment - flow of water in open channels - pipes, calculation of flow velocity. Head losses – Dary-Weisbach equation; Hazen William's formula; Manning's formula (No derivation). 9 hrs

Reference

1. Ground Water Hydrology. David Keith Todd-Willey International.
2. Water resources Asit.K. Biswas Tata Macgraw Hill publishingcompany Ltd.
3 Hydrology and water resources. Sharma .RK .Dhanapathrai & Sons.
4 Water Technology N.F Gray 2nd Edition. Butterworth Haimann Publication.
5. AText book on Fluid Mechanics. R.K.Rajput.S.Chand & Company, New Delhi.

Practical

SEM- I

1. Measurement of rain fall
2. Measurement of Evaporation(Relative Humidity)
3. Measurement of atmospheric temperature
4. Record of humidity

SEMESTER II. Water Resources Management 54 hrs

Wate resources : types – surface water, ground water, water availability and uses. Water requirement for various uses - Industrial uses – aquaculture - recreational uses; Irrigational uses - definition of irrigation – necessity – benefits; ill effects - systems. 12 hrs

Lift irrigation – advantages – disadvantages-flow irrigation – Inundation – irrigation. Perennial system of irrigation.Direct irrigation-storage irrigation. 12 hrs

Surface irrigation methods - wild (uncontrolled) flooding method - furrow method - countour farming. Sub surface irrigation method - sprinkler irrigation - drip irrigation. Frequency of irrigation-standard of irrigation water. Irrigation efficiency. 12 hrs

Freshwater shortage; impact of climate on freshwater resources; management and conservation 6 hours

Reference

1. Irrigation Engineering, N.N.Basak.

2. Irrigation Water Power & Water resources Engineering, K.R.Arora Anand Publishers and distributors.

SEMESTER- II Practicals

1. Determination of pH of water sample
2. Determination of Alkalinity of water sample
3. Determination of SPM load of water.
4. Determination of Surface tension by drop weight method.
5. Determination of Surface tension by drop number method
6. Determination of Viscosity of a sample by Ostwalds Viscometer method
7. Determination of Humidity by Psychrometer.

SEMESTER III Paper (1)
Hydrology - I 72 hrs

Surface water hydrology

Hydrology (surface water); definition ; importance. Hydrologic cycle; climatic factors influencing hydraulic cycle – humidity, temperature, radiation, wind. Precipitation - condition for occurrence of precipitation. 9 hrs

Measurement of rainfall - different types of rain gauge; rainfall measurement by radar; errors in measurement; estimation of missing rainfall data; average rainfall over an area. Mean and annual rainfall; measurement of snow fall. 9 hrs

Characteristics of precipitations of India. Evaporators; factors affecting evaporation - Estimation of evaporation - evaporation pan method - Evaporation from soil surface. 9 hrs

Transpiration - Factors affecting infiltration rates. Infiltration rate; infiltration capacity; Infiltration indices; runoff; estimation of runoff; hydrograph; global water balance; water losses-inter basin transfer.

Ground water hydrology

Hydrology - ground water hydrology; occurrence of ground water; different types; Aquitard- Aquifuge - ground water collecting systems – wells. 9 hrs

Types of wells-collection – conveyance and distribution-general study-Ground water movement-Darcy's law (No derivation required); Ground water and well hydraulics. 9 hrs

Ground water and environmental influence-ground water level fluctuation due to stream flow-Evapo - transpiration; urbanization - ground water pollution by municipal, industrial, agriculture, domestic sources. 9 hrs

Saline water intrusion - Investigation of Ground water (Outline study only). Surface and ground water intrusion. Various types of underground sources. Infiltration galleries - Infiltration wells -Spring wells - open wells or dug wells - tube wells - different types. 9 hrs

Reference

1. Hydrology & Water Resources. Sharma R.K .Dhanapath Rai & Sons.
2. Engineering Hydrology Subramonian.K Tata Macgraw Hill publishing company ltd.
3.. Irrigation Engineering-N.N.Basak.
4. Water Supply Engineering. Santosh Kumar Garg. Khanna Publishers.
5. Water Resources Asit. K Biswas, Tata Macgraw Hill publishing company ltd.
6. Ground Water Hydrology, David Keeth, Todd-Willy international.
7. Ground Water by Ramakrishnan.

SEMESTER III Paper (2) Water Quality Parameters and Assessment 54 hrs

Water quality parameters - USPHS Scale and WHO scale, sampling; preservation. Water as a solvent. Collection of water sample. Analysis of natural and waste water sampling procedures. Main quality characteristics of water a) Alkalinity b)Hardness c) Total solids. 18 hrs

Physical properties of water- like BP, MP, critical temperature, viscosity, Surface tension, dielectric constant, dipole moment, Heat of vaporization; tolerance limits for trace metals in drinking water (Al, B, Cd, Co, Pb, Mn, Ni, Fe, Zn, Cr, Cu, Mo, Se, Sc). 16 hrs

International standards for Drinking water - pH, BOD, COD, B, As, Cd, Cr, NH_3, Fe, Cl, Hg, Mg, total hardness, pesticides, *E. Coli*, TDS; International standards for drinking water prescribed by WHO. 12 hrs

Water pollution - types of water pollution; Sources of water pollution; Harmful effects of water pollution - Strategies for water pollution control. 8 hrs

Reference

1. Environmental pollution -Management & Control for sustainable development. R. K. Khitoliya S. Chand & Company, Ram Nagar, New Delhi.
2. Laboratory Manual For Environmental Chemistry. SunithaHooda, Samanjeet Kaur. S. Chand & Company Ram Nagar New Delhi.
3. Water pollution. B.K.Sharma, Goel publishing House Meerut.

SEMESTER - III Practicals

1. Determination of Chlorine percentage in a sample of bleaching powder.
2. Determination of concentration of chloride ion in a sample of water sample
3. Determination dissolved oxygen in a sample of water.
4. Determination of density of water

SEMESTER IV Paper (2) Water quality Management -I 72 hrs

Water quality requirement and standards for various uses - drinking, industrial, irrigation aquaculture, cooling, recreation. 9hrs

Quality of water from different sources - water quality monitoring, sampling methods for waste water; stream and lake water, sediment. 9 hrs

Sampling equipments :Niskin water sampler, Nansen water sampler, Dussart flask. 9hrs

Water treatment processes; conventional process – sedimentation, coagulation, flocculation, filtration, disinfection. 9 hrs

Physical and chemical methods, UV rays, iodine and bromine – ozone – potassium permanganate – silver and chlorine. Different forms of chlorination. 9 hrs

Water softening - hardness and measurement of hardness - effects of hardness - removal of hardness. 9 hrs

Specific water treatment; removal of iron, manganese, chromium; Desalination. Reverse osmosis; electrodialysis; freezing method; multi flash evaporators 9 hrs

Fluoridation and de-fluoridation. Removal of dissolved gases from water - removal of oil - removal of radiomaterials. 9 hrs

Reference

1. Water supply Engineering B.C.Punmia, Asok Jain & Arun Jain. Lakshmi Publications, New Delhi.
2. Water and Waste Water Technology, Mark.J.Hammer. J Hammer, Printice Hall India Pvt. Ltd.
3. Waste Water Treatment for Pollution Control and Reuse, Tata Macgraw Hill publishing company.
4. Water Technology, N.F Gray Butter Worth, Heimann Oxford.
5. Chemical and Biological Methods of water pollution studies. R.K. Trivedi & R. K. Goel Environmental publication, Karad 1984.
6. Standard Methods for Examination of Water and Waste Water. APHA-Washington DC1985.
7. Ecological Methods for field and Laboratory Investigation, P.Michael. Tata Macgraw Hill publishing Company. New Delhi.

SEMESTER IV Practicals

1. Determination of BOD of a sample of water.
2. Determination of COD of a water sample
3. Determination of TDS in a sample of water.
4. Determination of Salinity in a sample of water
5. Determination of hardness of water

SEMESTER V Paper (1) Water Pollution 54 hrs

Sources of water pollution; physical pollution of water; chemical pollution of water; biological pollution of water. 9 hrs

Common impurities in water; testing of water; physical test; chemical test; bacteriological test. 9 hrs

Standards of drinking water. Water bone diseases; Maintenance of purity of water. Ground water pollution, factors affecting ground water pollution, harmful effects of ground water pollution. 9 hrs

Surface water pollution; Factors affecting surface water pollution - factors affecting nutrient loss in surface water - lake water pollution. 9 hrs

River water pollution - global river water pollution - sea water pollution-marine pollution. Control of pollution in seawater; role of microorganisms in cleanup operation. 9 hrs

Organic pollutants - synthetic detergents; ecofriendly detergents containing enzymes; eutrophication thermal pollution in water; esticide pollutants. 9 hrs

Reference

1. Water pollution. B.K.Sharma, Goel publishing House Meerut.

2. Water supply Engineering B.C.Punmia,Asok Jain & Arun Jain, Lakshmi Publications, New Delhi.

SEMESTER V Paper (2) Water quality management-II **54 hrs**

Quality and characterization of domestic waste water - physical Chemical and Biological Properties of waste water. Determination of COD, BOD. 9 hrs

Natural methods of sewage disposal : Dilution method, Sewage farming method, Self purification theory; Sanitary water management - sanitary waste; Definition-importance, historical back ground. Systems of sewage disposal. Dry conservancy system & water carriage system. 9 hrs

Sewage sickness - primary and secondary treatment - conventional and low cost - advanced waste water treatment including nitrogen and phosphorous removal - miscellaneous treatment of sewage 9 hrs

Oxidation pond – cesspool - septic tank - soak pit. Waste water disposal and reuse. Characteristics and treatment of industrial waste water : breweries and wineries; distilleries; paper and pulp mill; sugar mill; oil refineries. 9 hrs

Petrochemical industries; tanneries; pharmaceutical plants; fertiliser plant; electroplating industries; textile mills. 9 hrs

Treatment and disposal of sludge : thickening and digestion; conditioning and dewatering-incineration - ultimate disposal. 9 hrs

References

1. A Text book of Hydrology and Water Resources. R.K.Sharma. Dhanapath Rai & Sons.
2. Water Supply Engineering - Santosh Kumar, Garg-Khanna Publishers.
3. Environmental Engineering-N.N.Basak, Tata Macgraw Hill publishing company.
4. Pollution control in process industries-S.P.Mahajan.
5. WaterTechnology. N.F.Gray, Butter worth Heinmanm Publications.

SEMESTER - V Paper –I Practicals

1. Determination of chlorine demand a sample of water.
2. Determination of residual chlorine in a municipal water sample.
3. Determination of moisture percentage of soil.
4. Determination of PH of soil.

SEMESTER - V Paper –II Practicals

1. Gravimetric estimation of-
   a) Sulphate, oxalate
   b) Barium, Calcium, Iron, Nickel
2. Colorimetry & turbidimetry
   a) Sulphide, fluoride, silicate, ammonia & sulphate

SEMESTER -VI Paper -I WATER ANALYSIS 54 hrs

Various methods of analysis; Monitoring techniques and methodology ; Determination of pH - Specific conductance - Dissolved Oxygen, NH_3, NO_3^- & NO_2^-, Cl^-, F^-, CN^-, S^{-2}, SO_4^{-2}, PO_4^{-3}. 6 hrs

Total hardness (Ca& Mg), B, silica, metals and metalloids As, Se, Be, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ag, Zn. 6hrs

Chemical Oxygen Demand, Biological Oxygen Demand, Total Organic carbon, phenols, pesticides, surfactants, tannin and lignin. Microbial examination : Coliforms (*Escherichia coli*) and total bacteria. 6 hrs

Laboratory analysis of water sample; Determination of Turbidity of water sample - By Jacksons Turbidimeter, Baylis Turbidimeter and Nephelometers. Method to find the odour of a given water sample. 6 hrs

Method to find the colour of a given water sample. Method to determine the pH of given sample of water by colorimetric and electrometric method. 6 hrs

Method to find the carbonate, bicarbonate and hydroxide alkalinity of a water sample. Method to determine the concentration of chlorides of a given water sample. 6 hrs

Method to determine the total hardness of a water sample by standard EDTA method. Determination of residual chlorine in a given sample of water by (a) Orthotoludine Test; (b) Starch Iodide Test; (c) DPD Test 6 hrs

Method to determine the chlorine demand of a water sample; Method to determine the available chlorine percentage in a given sample of bleaching powder. 6 hrs

Method to determine the amountof dissolved oxygen (DO) of a water sample by Winkler Method; Method to find out the Suspended solids (SS), Dissolved solids(DS) and Total Solids (TS) of a water sample. 6 hrs

SEMESTER -VI Paper -(2) Watershed Management 54 hrs

Watershed – definition - classification of watershed - sub, milli, micro and mini watershed. Hydrology of watershed. 6 Hrs

Eco system in a watershed - Land use changes and resource degradation in watersheds-Agronomic measures for resource management in a watershed - choice of vegetation. 6 hrs

Land preparation - timely planting. Contour farming - multistoried cropping-mixed cropping-Inter cropping - strip cropping; mulching-cover cropping- crop rotation. 6 hrs

Vegetative hedges - barrier grass land management - agroforestery. Engineering measures - tank - vented cross bars and diversion weirs; stone pitched 6 hrs

Contour bunds, contour trenches and embankments of drains. 6 hrs

Water harvesting cum sediment detention tanks, earthen bunds, subsurface dams. 6 hrs

Watershed management for flood control. Geo textiles in watershed management. 6 hrs

Soil conservation; national water grid and river networking; initial attempts for watershed management in India. 6 hrs

An outline study of watershed management in Western Ghats Development Programme. 6hrs

SEMESTER VI Paper I Practicals

1. Volumetric Estimations

   a) Carbonate hardness-Hehner's method

   b) Non- Carbonate hardness- Hehner's method

   c) Mixture of Carbonate-Bi carbonate-warders method (N/20 HCL & std. sodium carbonate (2600 ppm)

   d) Sulphate ion in $H_2 SO_4$ (N/20 NaOH & std sodium carbonate(2600 ppm)

   e) Iodine in the solution (N/50 thiosulphate & std pot. dichromate (1000 ppm))

SEM -VI Paper II Practicals

f) Colorimetric estimations of

i.	nitrite	ii.	nitrate	iii.	phosphate	iv.	total nitrogen
v.	total phosphorous	vi.	sulphide	vii.	ammonia	viii.	silicate
ix.	fluoride	x.	ferrous iron and total iron.				

Project :-An investigatory Project report. This work may be based on Environmental Science (significance forEnvironment) or, project based on Water quality parameters (Local, Regional,state level, or National level important issues can be the topic of interest)

COMPLEMENTARY COURSES

I	Theoretical Inorganic chemistry	3x18=54 hrs
II	Organic and Environmental chemistry	3x18=54hrs
III	Biomolecules and Analytical chemistry	3x18=54 hrs
IV	Physical chemistry	3x18=54 hours

COMPLEMENTARY COURSES (Auxiliary Chemistry)

Semester-I Theoretical and Inorganic Chemistry **54 hours**

Module-1: Atomic Structure 9 Hrs

Atomic spectrum of Hydrogen - different series, , Bohr theory - postulates - statement of Bohr energy equation - derivation of spectral frequency from Bohr equation. Schrodinger wave equation (no derivation mention only) concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule - Pauli's principle, Hund's rule, stability of filled and half filled orbitals

Module - II Radio Activity and Nuclear Chemistry **9 Hrs**

Radio active equilibrium (qualitative only). Detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter - units of radio activity - Curie and Rutherford - Radio Carbon dating , Rock dating, Neutron activation analysis Applications in agriculture and medicine. A brief study of the biological effects of radiation such as pathological and genetic damage, Dosimetry - Units - rad, gray and roentgen. Nuclear Chemistry - stability of Nucleus - n/p ratio, artificial transmutation and radio activity, mass defect, binding energy, atomic fission and fusion.

Module III - Chemical bonding **9 Hrs**

Energetics of bond formation - Types of Chemical bonds - Energetics of ionic bond formation - Lattice energy - Born Haber Cycle - partial covalent nature of ionic bond - Fajan's rules , polarity of covalent bond

its relation with electronegativity - electro negativity scales - PaulingsScalefactors influencing polarity, dipolemoment-its relation to geometry.

Module IV - Chemical bonding II **9 hrs**

Hydrogen bond - inter and intra molecular - its consequences on boiling point -volatility and solubility. Hybridisation and structure of molecules - SP, SP^2, SP^3, dSP^2, dSP^3, SP^3d^2, and SP^3d^3hybridisation with examples. Explanation of bond angle in water and ammonia VSEPR theory, geometry of molecules with bond pairs of electrons only, geometry of molecules containing bond pairs and lone pairs of electrons, limitations. A brief review of molecular orbital approach, LCAO method -bond order, bond distance and stability of O_2,O_2^{2+},O_2^{2-},NO,NO+,COand HF.

Module V- Metallurgy **9 hrs**

General principles of occurrence and extraction of metals - purification, roasting, calcination and smelting, reduction to metal,different method with examples, refining of metals- electrolytic and zone refining. Van - Arkel method. Metallurgy of titanium, thorium and uranium.

Module VI- Coordination Chemistry **9 hrs**

Types of ligands, Werner's coordination theory, Valence bond theory of bonding in octahedral and tetrahedral complexes, Drawbacks of valence bond theory crystal field theory of octahedral and tetrahedral complexes, examples - high and low spin complexes, magnetic properties ,application in qualitative and quantitative analysis.

Semester II Organic and Environmental Chemistry **(54 hours)**

Module I - Introduction to organic reaction mechanisms **9hrs**

Types of reactions - substitution, addition, elimination and rearrangement reactions. Electrophilic and nucleophilic reagents - concept of inductive effect, hyper conjugative effect and resonance effect - reaction intermediates - carbocations, carbanions, carbenes, and free radicals - their formation, stability and configuration.

Module II - Stereochemistry **9hrs**

Optical isomerism- chirality, racemisation and resolution- relative and absolute configuration- DL and RS notations- asymmetric synthesis- optical isomerism due to restricted rotation- geometrical isomerism- EZ- nomenclature- conformation of ethane, propane, butane and cyclo hexane - Axial and equatorial bonds in cyclo hexane.

Module III - Polymer Chemistry **9 hrs**

Classification of polymers based on origin, structure, synthesis, and molecular forces. Commercially important polymers: structure and application of polyethylene, polystyrene, polyhaloolefines, Nylon-6, Nylon-66, Melamine, Terylene, Bakelite, Natural and synthetic rubber, vulcanization, inorganic polymer-silicones.

Module IV - Carbohydrates **9 hrs**

Classification- Configuration of glyceraldehydes, erythrose, threose, ribose, arabinose,glucose,fructose and mannose- properties of glucose and fructose-inter conversion of glucose and fructose- Industrial uses of cellulose- of macromolecules.

ModuleV - Environmental Chemistry **9 hrs**

Air Pollution: Types of pollutants in air- carbon monoxide, carbon dioxide, Nitrogen oxides, Sulphur dioxides, hydrogen sulphide, Cl_2, CFC, particulate matter, metals, fly ash, asbestos, hydrocarbons- source

and influence. Acid rain, Green house Gases, Green house effect, ozone layer and its depletion- Sulphatic, phosphatic, nitrogenous, chloride fertilizers-pollution due to long term use of fertilizers. Pesticides like chlorinated hydrocarbons, carbamates, organophosphorous compounds, organometallics, inorganic compounds- Non biodegradable pesticides - Environmental impact of pesticides. Detergents - cationic, anionic and non ionic-water pollution by detergents.

Module VI - Organometallic compounds **9 hrs**

Definition and classification - preparation, properties and applications of Grignard reagents, Ferrocene. Biological and environmental aspects. Applications in medicine, agriculture and horticulture - antitumour drugs.

Semester III Analytical Chemistry and Biomolecules **(54 hours)**

Module I - Spectroscopy I **9 hrs**

Regions of electromagnetic spectrum- interaction of radiation with matter-Various types of molecular spectra- Microwave spectroscopy- spectra of diatomic molecules-selection rule-frequency of separation of spectral line- determination of bond length- Infra red spectra-selection rule-frequency of separation- calculation of bond length.

Module II - Spectroscopy II **9 hrs**

Raman spectroscopy: Stoke's and antistoke's lines - Quantum theory of Raman spectra-advantage and disadvantage -complementary nature of Raman and IR spectra- Mutual exclusion principle.

Module III - Instrumental methods of analysis **9hrs**

Principle, Instrumentation and applications of : Atomic Absorption Spectroscopy- Flame photometry-Nephelometry and turbidimetry- colorimetry- spectrophotometry.

Module IV - Analytical Chemistry **9 hrs**

Solubility product- common ion effect- their applications in qualitative analysis- principles of volumetric analysis- primary standard-standard solution-normality and molarity -theory of acid base indicators-redox indicators-theory of complexometric titration. Accuracy and precision-classification of errors-detection and correction of determinate errors.

Module V - Chromatography **9 hrs**

Outline study of adsorption and partition chromatography-column, paper, thin layer, ion exchange , and gas chromatography- Rf value - relative merits of different techniques- separation of amino acids from mixtures.

Module VI- Bioinorganic compounds **9 hrs**

Metalloporphyrins - photosynthesis and respiration- haemoglobin – myoglobin - mechanism of O_2-CO_2 transportation - nitrogen fixation-carbon fixation - carbon cycle - biochemistry of iron toxicity and nutrition-essential and trace elements of biological systems

Semester IV Physical Chemistry **54 hrs**

Module I- Colloids **9hrs**

Properties of colloids-Tyndall effect-Ultra microscope-Brownian movement-electrophoresis-electroosmosis-sedimentation and streaming potentials- origin of charge and stability of colloids-zeta potential-Hardy Schulz rule- protective colloids-gold number- emulsions-gels-application of colloids-clarification of water-Cottrell precipitator-delta formation-medicines-sewage disposal-emulsification and cleansing action of soaps and detergents.

Module II- Electrochemistry **9 hrs**

Conductance- specific, equivalent and molar conductance-measurement using conductivity meter-variation with dilution - conductometric titration- principle-merits- strong acid-strong base titration & weak acid - strong base titration.

Electrochemical cell- cell potential and electrode potential- standard electrode potential -electro chemical series-SHE -measurement of electrode potential- Nernst equation for electrode potential(No derivation)-Calomel electrode, pH electrodes-Glass electrode, Quinhydrone electrode- fuel cell.

Module III- Binary liquid systems **9 hrs**

Completely miscible liquid pairs, vapour pressure - composition curves, boiling point- composition curves, fractional distillation, Azeotropic mixtures, critical solution temperature, Conjugate layers, phenol-water system. Theory of steam distillation, distribution law, limitations of distribution law, application of distribution law solvent extraction.

Module IV- Thermodynamics **9 hrs**

First law - intrinsic energy and enthalpy - work done during reversible isothermal expansion-second law of thermodynamics-entropy and free energy - concept of spontaneity and reversibility, Gibb's Helmholtz equation - derivation of relation between heat of reaction at constant pressure and constant volume - Hess's law - bond energy and bond dissociation energy -measurement based on Hess's law - Third law of thermodynamics.

Module V- Equilibrium **9 hrs**

Chemical equilibrium - relation between Kp and Kc-Vant Hoff's isotherm equation and isochoric equation- relation connecting equilibrium constant and degree of dissociation for the following systems: $2NH_3$ $N_2 + 3H_2$, PCl_5 $PCl_3 + Cl_2$ - degree of dissociation- determination from density measurement- Le Chatelier principle and its applications. Concept of acid and bases-ionic product of water- pH, pOH ,pKw- ionization constants of weak acids and bases- Buffer solution- Henderson equation-calculation of pH of solutions.

Module VI- Chemical Kinetics, Catalysis and Photochemistry **9hrs**

Order and molecularity, derivation of rate equation for zero, first and second order reactions (same initial concentrations) - determination of order of reactions—effect of temperature on rate of reactions-concept of activation energy-illustration of exothermic and endothermic reactions based on it- Arrhenius equation-determination of Arrhenius parameters -intermediate compound formation theory and adsorption theory of catalytic reactions.

Practicals

Semester I & II- Qualitative Analysis **72 hrs**

1) Reactions of anions - carbonate, sulphide, sulphate, thiosulphate, oxalate, nitrite, nitrate, chloride, phosphate, fluoride (No exam)
2) Identification by flame colouration : Lithium, sodium, potassium, barium, calcium, strontium(No exam)
3) Reactions of cations: Ag^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Al^{3+}, Fe^{2+}, Fe^{3+}, Zn^{2+}, Mn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH_4^+
4) Analysis of solution containing mixture of two cations- at least 10 mixtures (Avoid same group)

Semester III & IV- Quantitative Analysis **72 hrs**

I. **Volumetric Analysis**

a) Acidimetry and alkalimetry

1) Estimation of NaOH using Na_2CO_3
2) Estimation of KOH using Na_2CO_3
3) Estimation of K_2CO_3 using Na_2CO_3
4) Estimation of H_2SO_4 using oxalic acid
5) Estimation of HNO_3 using oxalic acid

b) Permanganometry
1) Estimation of Fe^{2+} using oxalic acid
2) Estimation of sod.oxalate using Mohr's salt
3) Estimation of Fe^{2+} using oxalic acid
4) Estimation of Mohr's salt using oxalic acid

c) Dichrometry
1) Estimation of Fe^{2+} using internal indicator
2) Estimation of Fe^{2+} using external indicator

d) Iodometry and Iodimetry
1) Estimation of iodine
2) Estimation of copper

e) Complexometry
1) Estimation of Zinc
2) Estimation of Mg

II Gravimetric Analysis (No Exam)

1) Estimation of water of hydration in barium chloride crystals
2) Estimation of barium in barium chloride solution

References

1) Atomic structure and chemical bonding with introduction to molecular spectroscopy, Manas Chanda.
2) Concise Inorganic Chemistry,J.D.Lee
3) Elements of Nuclear Chemistry, Arnikar
4) EnvironmentalChemistry,A.K De.
5) Essentials of Physical Chemistry, Bahl,Tuli and ArunBahl.
6) A. I. Vogel, "Text book of Qualitative Analysis"
7) A. I. Vogel, "Text book of Quantitative Inorganic Analysis".
8) A. K. Srivasthava and P. C. Jain, "Chemical Analysis".
9) Coordination Chemistry : Bosolo and Johnson.
10) Coordination Chemistry : S. F. A. Kettle.
11) Instrumental Methods of Analysis,B.K Sharma.

UNIVERSITY OF KERALA

Career Related First Degree Programme in Environmental Science

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Environment and Water Management

Under Choice Based Credit and Semester System

2015

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സെമസ്റ്റർ	**:**	**IV**
കോഴ്സ് കോഡ്	**:**	**ML 1431**
കോംപ്ലിമെന്ററി കോഴ്സ്	**:**	**VII**
സമയക്രമം	**:**	**ആഴ്ചയിൽ 3 മണിക്കൂർ (18 ആഴ്ചയിൽ 54 മണിക്കൂർ)**
ക്രെഡിറ്റ്	**:**	**3**

ദലിതെഴുത്ത്, പെണ്ണെഴുത്ത്: സിദ്ധാന്തവും ആവിഷ്ക്കാരവും

പഠനോദ്ദേശ്യം:

ദലിത് പഠനമെന്ന വിജ്ഞാനമേഖലയുടെ പശ്ചാത്തലത്തിൽ മലയാളത്തിലെ ദലിത് സാഹിത്യത്തെ തിരിച്ചറിയുക - മലയാളികളുടെ സാംസ്കാരികവൈവിധ്യം സാഹിത്യ വഴിയിൽ മനസ്സിലാക്കുക - ചരിത്രത്തിന്റെ വ്യത്യസ്ത ഇടങ്ങളിൽ പാർശ്വവൽക്കരിക്ക പ്പെട്ട ജനവിഭാഗങ്ങളെയും അവരുടെ സംസ്കാരത്തെയും സാഹിത്യത്തെയും കുറിച്ച് അറിയുക - മുഖ്യധാരാസംസ്കാരത്തിന്റെ സാഹചര്യങ്ങൾക്കു പുറത്ത് രൂപപ്പെട്ട സംസ് കാരത്തിന്റെ ഒരു ജനകീയധാരയെക്കുറിച്ചു ബോധ്യപ്പെടുക.

സമീപകാല സൈദ്ധാന്തികപഠനങ്ങളിൽ ഏറെ പരാമർശിക്കപ്പെടുകയും വിമർശിക്ക പ്പെടുകയുംചെയ്ത 'സ്ത്രീവാദ'ത്തെ പരിചയപ്പെടുക - ലിംഗപരമായ വ്യത്യസ്തത യുടെ അടിസ്ഥാനത്തിലുള്ള വിവേചനത്തിൽ നിന്നും സ്ത്രീകൾക്കു തുല്യനീതി ഉറപ്പാ ക്കുക എന്ന ലക്ഷ്യത്തോടെ രൂപപ്പെടുത്തിയ ചിന്താപദ്ധതിയും പ്രവർത്തനവും എന്ന നിലയിൽ അതിനെ തിരിച്ചറിയുക - സ്ത്രീകളുടെ വൈയക്തികവും സാമൂഹികവുമായ യാഥാർത്ഥ്യത്തെ വെളിപ്പെടുത്തുകയും ലിംഗകേന്ദ്രിതമായ എല്ലാത്തരം പാർശ്വവല്ക്ക രണത്തെയും ചെറുക്കുകയുമാണ് അതിന്റെ രീതിശാസ്ത്രം എന്നു മനസ്സിലാക്കുക - ഫെമിനിസത്തിന്റെ ചരിത്രവികാസത്തിന്റെയും സിദ്ധാന്തങ്ങളുടെയും പൊതു പശ്ചാ ത്തലത്തിൽ മലയാളത്തിലെ സ്ത്രീപക്ഷരചനകളെ പഠിക്കുക.

സംസ്കാരത്തിലെ വംശ, വർഗ്ഗ, മത, ജാതി, ലിംഗനിർണയനങ്ങളെക്കുറിച്ചുള്ള ധാരണ നവീകരിക്കുകയും മാറുന്ന ലോകത്തിന്റെ പരിതഃസ്ഥിതികളിൽ നിന്നുകൊണ്ട് ഒരു പുതിയ മാനവീയതയെക്കുറിച്ചുള്ള അവബോധം സൃഷ്ടിക്കുകയും ചെയ്യുക എന്നതാണ് ഈ കോഴ്സിന്റെ സവിശേഷ ലക്ഷ്യം.

രീതിശാസ്ത്രം

ഈ കോഴ്സിന്റെ പഠനത്തിനു രണ്ടുതലങ്ങളുണ്ട്. ഒന്ന്: സിദ്ധാന്തതലം. രണ്ട്: ആവിഷ്ക്കാരതലം. സിദ്ധാന്തതലത്തിൽ ദലിതെഴുത്തിനും പെണ്ണെഴുത്തിനും ആസ്പദമായ അവസ്ഥകളെയും സിദ്ധാന്തങ്ങളെയും സാമാന്യമായി പരിചയപ്പെടു ത്തുന്നു. ആവിഷ്ക്കാരതലത്തിൽ ദലിതെഴുത്ത്, പെണ്ണെഴുത്ത് മാതൃകകൾ പരിചയ പ്പെടുത്തുകയും വിശദപഠനം ഏതാനും രചനകളിലായി പരിമിതപ്പെടുത്തുകയും ചെയ്യുന്നു.

പാഠ്യപദ്ധതി

മൊഡ്യൂൾ : ഒന്ന് (9 മണിക്കൂർ)

ദലിതെഴുത്ത്

ദലിത് എന്ന പദത്തിന്റെ നിഷ്പത്തി - ഇതര സംജ്ഞകൾ - ദലിത് പദത്തിന്റെ വ്യത്യസ്ത വ്യാഖ്യാനങ്ങൾ - ദലിത്പഠനത്തിന്റെ സാമാന്യചരിത്രം - ആഫ്രിക്കൻ - അമേരിക്കൻ എഴുത്തും കറുപ്പിന്റെ സാംസ്കാരിക മുന്നേറ്റങ്ങളും - ഇന്ത്യൻ പശ്ചാത്തലം - മലയാളത്തിലെ ദലിത് സാഹിത്യം - സാമാന്യ അവലോകനം - വാമൊഴി - വരമൊഴി ഭേദങ്ങൾ.

മൊഡ്യൂൾ : രണ്ട് (18 മണിക്കൂർ)

എ. വാമൊഴി സാഹിത്യമാതൃക :

പാലുവം പെണ്ണിനെത്തേടി (നാടൻപാട്ട്)

ബി. വരമൊഴി സാഹിത്യമാതൃകകൾ :

I കവിത

1. എന്റെ വംശത്തെപ്പറ്റി.... - പൊയ്കയിൽ അപ്പച്ചൻ
2. അമ്മ ഒരു കാല്പനിക കവിത - വിജില ചിറപ്പാട്.
3. കറുത്ത കല്ല് - എസ്. ജോസഫ്

II ചെറുകഥ

1. നിരവത്ത് കയ്യാണി - സി. അയ്യപ്പൻ
2. നിസ്സഹായരുടെ നിലവിളി - നാരായൻ

III നോവൽ

എരി - പ്രദീപൻ പാമ്പിരിക്കുന്ന്

സഹായകഗ്രന്ഥങ്ങൾ

1. ദലിത്പഠനം : സ്വത്വം, സംസ്കാരം, സാഹിത്യം - ഡോ. പ്രദീപൻ പാമ്പിരിക്കുന്ന്, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
2. ദലിത് തിരിച്ചറിവുകൾ (എഡി:) ഡോ. അജു. കെ. നാരായണൻ, ഭൂമിമലയാളം, യു.സി. കോളേജ്, ആലുവ.
3. ദലിത്പാതകൾ : (എഡി.) ബോബി തോമസ്, സൈൻ ബുക്സ്, തിരുവനന്തപുരം.
4. ബുദ്ധനിലേക്കുള്ള ദൂരം - കെ. കെ കൊച്ച്, ഡി. സി. ബുക്സ്.
5. ദലിത് സാഹിത്യപ്രസ്ഥാനം - കെ. എം. പുരുഷോത്തമൻ, സാഹിത്യഅക്കാദമി.
6. ദലിത് സാഹിത്യം - കവിയൂർ മുരളി, കറന്റ് ബുക്സ്, കോട്ടയം.
7. ദലിത് ഭാഷ - കവിയൂർ മുരളി.
8. കീഴാളജീവിതമുദ്രകൾ - ഡോ. പി. ജി. പത്മിനി, സമയം പബ്ലിക്കേഷൻസ്.
9. ദലിത് വർത്തമാനം (എഡി.) രാജേഷ് ചിറപ്പാട്, മൈത്രി ബുക്സ്, തിരുവനന്തപുരം.
10. 500 വർഷത്തെ കേരളം - ചില അറിവടയാളങ്ങൾ - (ജന. എഡി.) ഡോ. സ്കറിയാ സക്കറിയ, താരതമ്യപഠനസംഘം, കറന്റ് ബുക്സ്, കോട്ടയം.

11. വായനയുടെ ദലിത് പാഠം - കെ. കെ. കൊച്ച്, പൂർണ്ണ പബ്ലിക്കേഷൻസ്.
12. ദലിതന്റെ നിനവും നോവും നാടൻ പാട്ടുകളിൽ - ഡോ. കുമാരൻ വയലേരി, പാപ്പിയോൺ, കോഴിക്കോട്.
13. ദലിത് സാഹിത്യം പരസ്യകല - ഡോ. വി. സി. സുപ്രിയ/ ഡോ. കെ. കെ. ശിവദാസ്, ഡോ. സന്തോഷ് മാനിച്ചേരി - മാളുബൻ പബ്ലിക്കേഷൻസ്.
14. കീഴാളന്റെ പ്രതിരോധതന്ത്രം - ഷീബ എം. കുര്യൻ.
15. കാവ്യഭാവനയുടെ സ്ത്രീപഠനങ്ങൾ - ഡോ. എ. ഷീലാകുമാരി.

മൊഡ്യൂൾ : മൂന്ന് (9 മണിക്കൂർ)

പെണ്ണെഴുത്ത്

സ്ത്രീവാദചിന്തയുടെ ആദ്യാങ്കുരങ്ങൾ - ഇക്കാലത്തെ ഫെമിനിസ്റ്റു ചിന്തയിലെ ശ്രദ്ധേയ വ്യക്തിത്വങ്ങൾ - കൃതികൾ - സ്ത്രീവാദത്തിലെ വ്യത്യസ്ത ധാരകൾ - ഒന്നാംതരംഗ സ്ത്രീവാദം - രണ്ടാംതരംഗസ്ത്രീവാദം - മൂന്നാംതരംഗസ്ത്രീവാദം, പ്രധാന വ്യക്തിത്വങ്ങളും കൃതികളും - ശ്രദ്ധേയങ്ങളായ ഉപധാരകൾ - ഉദാരസ്ത്രീവാദം (Liberal feminism), സോഷ്യലിസ്റ്റു സ്ത്രീവാദം, മാർക്സിസ്റ്റുസ്ത്രീവാദം, മൗലിക സ്ത്രീവാദം (Radical feminism), കറുത്തസ്ത്രീവാദം (Black feminism), എക്കോ ഫെമിനിസം - സ്ത്രീവാദവും സാഹിത്യവും - സ്ത്രൈണ സർഗ്ഗാത്മകതയെക്കുറിച്ചുള്ള വ്യത്യസ്ത സമീപനങ്ങൾ - ഭാഷയുടെ ലിംഗകേന്ദ്രിത സ്വഭാവം - ഇവയെക്കുറിച്ചുള്ള സാമാന്യപഠനം - കേരളത്തിലെ സ്ത്രീമുന്നേറ്റങ്ങളുടെ ചരിത്രപശ്ചാത്തലം - മലയാളത്തിലെ സ്ത്രീരചനാപാരമ്പര്യങ്ങൾ - ആദ്യകാല എഴുത്തുകാരികൾ - തുടർന്നുള്ള ഘട്ടങ്ങൾ - മുഖ്യസംഭാവനകൾ.

മൊഡ്യൂൾ : നാല് (18 മണിക്കൂർ)

പെണ്ണെഴുത്ത് : മലയാള മാതൃകകൾ

എ. കവിത

1. കെട്ടിയിട്ട കോലാട് - കമലാദാസ് (വിവ. സച്ചിദാനന്ദൻ)
   (ഈ പേരിലുള്ള കവിത മാത്രം)
2. പ്രതിഷ്ഠ - സാവിത്രിരാജീവൻ
3. പെണ്ണുങ്ങൾ കാണാത്ത പാതിരാനേരങ്ങൾ - വി. എം. ഗിരിജ
   (ഈ പേരിലുള്ള കവിത മാത്രം)

ബി. കഥ

1. പരാജിത - രാജലക്ഷ്മി
2. വനദുർഗ്ഗ - സാറാജോസഫ്
3. ഇത്തവണ രാധ - പ്രിയ. എ. എസ്.

സി. ആത്മകഥ

നഷ്ടബോധങ്ങളില്ലാതെ (ആത്മകഥ) - ദേവകി നിലയങ്ങോട്

സഹായകഗ്രന്ഥങ്ങൾ

1. ഫെമിനിസം : ചരിത്രപരമായ ഒരന്വേഷണം - ഡോ. എം. ലീലാവതി, ചിന്ത, പബ്ലിഷേഴ്സ്.
2. ഫെമിനിസം - വാല്യം 1, 2 (എഡി.) ഡോ. ജാൻസി ജയിംസ്, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
3. കേരളത്തിലെ സ്ത്രീമുന്നേറ്റങ്ങളുടെ ചരിത്രം - സി. എസ്. ചന്ദ്രിക, സാഹിത്യ അക്കാദമി.
4. ആദ്യകാല സ്ത്രീകഥകൾ - (എഡി.) ഡോ. എം. എം. ബഷീർ, ലിപി പബ്ലി ക്കേഷൻസ്.
5. സ്ത്രീവാദം - ജെ. ദേവിക, ഡി. സി. ബുക്സ്.
6. സ്ത്രീരചനാദർശനം : ഒരു അവലോകനം - പ്രശാന്ത് കുമാർ. എൻ., എൻ.ബി. എസ്. കോട്ടയം.
7. സ്ത്രീസ്വത്വാവിഷ്ക്കാരം മലയാളത്തിൽ - ഡോ. എം. ലീലാവതി, സാഹിത്യ അക്കാഡമി, തൃശൂർ.
8. സ്ത്രീവിമോചനം : ചരിത്രം, സിദ്ധാന്തം, പഠനം - എ. കെ. രാമകൃഷ്ണൻ/ കെ. എം. വേണുഗോപാലൻ, നയനാബുക്സ്, പയ്യന്നൂർ.
9. ആധുനിക മലയാളകവിതയിലെ സ്ത്രീപക്ഷ സമീപനങ്ങൾ - പി. ഗീത, ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
10. ഇക്കൊഫെമിനിസം, ഇക്കോടൂറിസം, മാർക്സിസം - എൻ. എം. പിയേഴ്സൺ, കറന്റ് ബുക്സ്, കോട്ടയം.
11. മുടിത്തെയ്യങ്ങൾ - സച്ചിദാനന്ദൻ ('പാപത്തറ' എന്ന സമാഹാരത്തിന്റെ ആമുഖ പഠനം).
12. പ്രത്യവമർശം - ബാലചന്ദ്രൻ വടക്കേടത്ത്, കറന്റ് ബുക്സ്, കോട്ടയം.
13. കുലസ്ത്രീകളും ചന്തപ്പെണ്ണുങ്ങളും ഉണ്ടായത് - (എഡി.) ജെ. ദേവിക.

2019-20

20. രസകൗമുദി - ഡോ. പൂജപ്പുര കൃഷ്ണൻ നായർ.
21. ആധുനികാനന്തര സാഹിത്യസമീപനങ്ങൾ - സി. ജെ. ജോർജ്ജ് (എഡി:).
22. ഛന്ദസ്സ് നമ്മുടെ കവിതയിൽ - സച്ചിദാനന്ദൻ, മലയാളകവിതാപഠനങ്ങൾ, മാതൃഭൂമി ബുക്സ്, പുറം 83-99.
23. ദലിത് സാഹിത്യപ്രസ്ഥാനം - കെ. എം. പുരുഷോത്തമൻ.
24. ഭാരതീയേതര സാഹിത്യസിദ്ധാന്തങ്ങൾ - ഡോ. തോമസ് സ്കറിയ.

സെമസ്റ്റർ	:	**III**
കോഴ്സ് കോഡ്	:	**ML 1331**
കോംപ്ലിമെന്ററി കോഴ്സ്	:	**V**
സമയക്രമം	:	**ആഴ്ചയിൽ 3 മണിക്കൂർ (18 ആഴ്ചയിൽ 54 മണിക്കൂർ)**
ക്രെഡിറ്റ്	:	**3**

പരിസ്ഥിതി : സിദ്ധാന്തവും ആവിഷ്ക്കാരവും

പഠനോദ്ദേശ്യം

പരിസ്ഥിതിദർശനവുമായി ബന്ധപ്പെട്ട ആശയങ്ങൾ, തത്ത്വങ്ങൾ, പ്രവണതകൾ, പ്രതിഭാസങ്ങൾ എന്നിവയെക്കുറിച്ചുള്ള അറിവുകൾ നേടുക - പ്രകൃതിസ്രോതസ്സുകളെയും അവയുമായി ബന്ധപ്പെട്ട പ്രശ്നങ്ങളെയും കുറിച്ചു മനസ്സിലാക്കുക - പരിസ്ഥിതിയുടെ ജൈവ, സാമൂഹിക, സാംസ്കാരിക, രാഷ്ട്രീയ, സാമ്പത്തിക വശങ്ങൾ, പാരിസ്ഥിതിക മേഖലയിൽ മനുഷ്യനുള്ള സ്വാധീനത്തിന്റെ പ്രത്യേകത, ഭൂമിയിൽ ജീവൻ നിലനിർത്തുന്നതിനാവശ്യമായ സാഹചര്യങ്ങൾ എന്നിവയെക്കുറിച്ചു മനസ്സിലാക്കുക - സർഗ്ഗാത്മകതലത്തിൽ, പരിസ്ഥിതിദർശനത്തിന്റെ ഭൂമികയിൽ നിന്നുകൊണ്ട് കലയെയും സാഹിത്യത്തെയും കാണുവാനും വിലയിരുത്തുവാനുമുള്ള മനോഭാവം സൃഷ്ടിക്കുക.

പാഠ്യപദ്ധതി

മൊഡ്യൂൾ : ഒന്ന് (9 മണിക്കൂർ)

എ. പരിസ്ഥിതിദർശനം

പരിസ്ഥിതി - അർത്ഥവും വ്യാപ്തിയും - പരിസ്ഥിതി സമീപനങ്ങൾ - പരിസ്ഥിതി ദർശനങ്ങൾ - ഗഹനപരിസ്ഥിതിവാദം - സാമൂഹിക പരിസ്ഥിതിവാദം - പാരിസ്ഥിതിക സ്ത്രീവാദം - പാരിസ്ഥിതിക മാർക്സിസം - പാരിസ്ഥിതികപ്രസ്ഥാനങ്ങൾ - ഇവയെക്കുറിച്ചുള്ള പഠനം.

ബി. പരിസ്ഥിതിദർശനം സർഗ്ഗാത്മകതലത്തിൽ

പരിസ്ഥിതിബോധം സാമൂഹിക, സാംസ്കാരികതലങ്ങളിൽ, പരിസ്ഥിതിബോധം സർഗ്ഗാത്മകതലത്തിൽ - പാരിസ്ഥിതിക സൗന്ദര്യശാസ്ത്രം - പരിസ്ഥിതിദർശനം കലാരൂപങ്ങളിൽ - സാഹിത്യത്തിൽ - സാമാന്യപഠനം.

മൊഡ്യൂൾ : രണ്ട് (9 മണിക്കൂർ)

പരിസ്ഥിതി ദർശനം – പഠനങ്ങൾ

വിശദപഠനം :

1. പരിസ്ഥിതിസൗന്ദര്യശാസ്ത്രത്തിന് ഒരു മുഖവുര – ഡോ. ടി. പി. സുകുമാരൻ (ഈ പേരിലുള്ള ലേഖനം മാത്രം) – ബോധി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
2. സംസ്കാരവും ആവാസവ്യവസ്ഥയും – ജി. മധുസൂദനൻ (ഭാവനയുടെ ജലസ്ഥലികൾ).

മൊഡ്യൂൾ : മൂന്ന് (9 മണിക്കൂർ)

പരിസ്ഥിതിദർശനം കഥയിൽ

വിശദപഠനം

1. ആമസോൺ – അശോകൻ ചരുവിൽ
2. ഹരിതമോഹനം – സുസ്മേഷ് ചന്ദ്രോത്ത്

മൊഡ്യൂൾ : നാല് (9 മണിക്കൂർ)

പരിസ്ഥിതിദർശനം നോവലിൽ

വിശദപഠനം

ജൈവം – പി. സുരേന്ദ്രൻ

മൊഡ്യൂൾ : അഞ്ച് (9 മണിക്കൂർ)

പരിസ്ഥിതിദർശനം കവിതയിൽ

വിശദപഠനം

1. കൊച്ചിയിലെ വൃക്ഷങ്ങൾ – കെ. ജി. ശങ്കരപ്പിള്ള
2. ഭൂമിയുടെ ചടങ്ങുകൾ – സച്ചിദാനന്ദൻ
3. അതിരപ്പിള്ളിക്കാട്ടിൽ – പി. എൻ. ഗോപീകൃഷ്ണൻ
   (ഇടിക്കാലൂരി പനമ്പട്ടടി – മാതൃഭൂമി പ്രസിദ്ധീകരണം)

മൊഡ്യൂൾ : ആറ് (9 മണിക്കൂർ)

ഹരിതദർശനം നാടകത്തിലും ചലച്ചിത്രത്തിലും

വിശദപഠനം

(എ) നാടകം: കനകം വിളയുന്ന മണ്ണ് – തിക്കോടിയൻ.

(ബി) ചലച്ചിത്രം: 1. പേരറിയാത്തവർ – ഡോ. ബിജു.
2. അരജീവിതങ്ങൾക്ക് ഒരു സ്വർഗ്ഗം – എം. എ. റഹ്മാൻ.
3. ഓരോപുഴയും പറയുന്നത് – അലിഫ്ഷാ.

സഹായകഗ്രന്ഥങ്ങൾ

1. ഹരിതനിരൂപണം മലയാളത്തിൽ - (എഡി.) ജി. മധുസൂദനൻ, കറന്റ് ബുക്സ്, തൃശൂർ.
2. കഥയും പരിസ്ഥിതിയും - ജി. മധുസൂദനൻ, കറന്റ് ബുക്സ്, തൃശൂർ.
3. പരിസ്ഥിതി കവിതയ്ക്കൊരാമുഖം - പി. പി. കെ. പൊതുവാൾ, ഡി. സി. ബുക്സ്,
4. പരിസ്ഥിതിബോധവും സംസ്കാരവും - പി. പി. കെ. പൊതുവാൾ, മാതൃഭൂമി ബുക്സ്.
5. പരിസ്ഥിതിവിജ്ഞാനം - എൻ. ബാലകൃഷ്ണൻ നായർ, ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
6. പ്രകൃതി, പരിസ്ഥിതി ദാരിദ്ര്യം ഊർജ്ജം - ആനന്ദ്, ഡി. സി. ബുക്സ്.
7. ഹരിതരാഷ്ട്രീയം : ചരിത്രം സിദ്ധാന്തം പ്രയോഗം- ജോർജ് കെ. അലക്സ്, ഡി. സി. ബുക്സ്.
8. ജീവന്റെ കയ്യൊപ്പ് - ആഷാമേനോൻ: ഡി. സി. ബുക്സ്.
9. പരിസ്ഥിതി സൗന്ദര്യശാസ്ത്രത്തിന് ഒരു മുഖവുര - ഡോ. ടി. പി. സുകുമാരൻ, ബോധി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
10. കവിതയുടെ രഥോത്സവം - (എഡി.) അജയപുരം ജ്യോതിഷ്കുമാർ, ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
11. ഹരിതസാഹിത്യദർശനം - എം. അച്യുതൻ.
12. കവിതയും പരിസ്ഥിതിയും - എസ്. രാജശേഖരൻ.
13. കാലിഫോർണിയ കാടുകളിൽ - സുഗതകുമാരി.
14. ഹരിതദർശനം ആധുനികാനന്തരകവിതയിൽ - ഡോ. സി. ആർ. പ്രസാദ്.
15. പ്രതിരോധചിന്തകൾ - ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
16. മലയാള കവിതയും പരിസ്ഥിതിയും - ഡോ. ആനന്ദ് കാവാലം.
17. പടരുന്ന മഷിച്ചാലുകൾ - ഐറിസ് കൊയ്ലിയോ.
18. ഭാവനയുടെ ജലസ്ഥലികൾ - ജി. മധുസൂദനൻ.
19. പ്രകൃതി സമീപനങ്ങൾ ആദ്യകാല കവിതകളിൽ - ഡോ. സീമ ജെറോം.
20. പരിസ്ഥിതിയുടെ രാഷ്ട്രീയം - (എഡി.) സി. റഹിം, ഫേബിയൻ ബുക്സ്.

EC 222: ECONOMICS OF SOCIAL SECTOR AND ENVIRONMENT

(Hours per semester: 110
Hours per week: 6)

Objectives

This course is designed to enable students to: (1) Understand and apply the key economic concepts in the context of social sectors like education, environmentand healthcare, (2) Appreciate how economic factors contribute to the development and implementation of educational policies, (3) Identify the major theories governing the development of human resources, school improvement and development, (4) Recognize the important linkages between the environment and economics, (5) Be aware of the key environmental issues around the globe, and (6) Understand approaches to identify and value costs and outcomes to include in economic evaluation of the environment through benefit cost analysis.

Course Contents

Module 1: Economics of Education (20 hours)

Human Capital – Components of Human Capital – Education as an instrument for economic Growth – Demand for Education – Supply of Education – Determinants of demand for Education – Costs of Education - Private Costs and Social Costs- Benefits of Education – Direct, Indirect and Social Benefits – Wastage and Stagnation in Education – Causes and Measures-Manpower Planning-Meaning and Techniques of Forecasting.

Module 2: Economics of Health (20 hours)

Nature and Scope of Health Economics – Health Dimensions of Development – Determinants of Health – Economic Dimensions of Healthcare – Demand for and Supply of Healthcare – Healthcare Financing – Inequalities of Health – Class and Gender Perspectives – Healthcare Sector in India-Health Insurance Schemes in India-RSBY,ESIS,AABY, JBY.

Module 3: Economics of Environment and Environmental Valuation (25 hours)

Environmental Economics – Meaning and Significance – Interlinkage between economy and Environment – Material Balance Model – Law of Entropy – Environmental Kuznets' Curve

Environmental Valuation – Use Values, Non-use Values, Option Values – Approaches to Environmental Valuation – Direct Methods – Contingent Valuation Method, Trade off Games Method, Costless Choice Method, Delphi Method – Indirect Methods – Revealed Preference

Methods – Travel Cost Method, Hedonic Pricing Method, Preventive Expenditure Method, Surrogate Market Approach, Wage Differential Approach– Cost Based Methods and Other methods of Valuation – Cost Benefit Analysis.

Module 4: Environmental Policies and Issues (25 hours)

Environmental Externalities – Design of Environmental Policy – Quantity Based Instruments – Market based Instruments – Pigouvian tax and Subsidy Approach – Non-Market Instruments – Command and Control – Mixed Instruments – Marketable permits – Tradeable Pollution Permits -Bargaining Solution – Coase Theorem – Informal Regulation – Collective Action – Grass Root Movements (Chipko Movement, Save Silent Valley Movement, Narmada Bachao Andolan, Appiko Movement)– Monitoring and Enforcement – The New Model of Pollution Control – Major Environmental Policies and Legislations in India.

Global Environmental Issues – Climate Change Problems, Global Warming, Bio Diversity Loss, Acid Rain, Deforestation, Environmental Pollution.

Module 5: Economics of Natural Resource Management (20 hours)

Natural Resources – Resource Taxonomy – Theories of Optimum Use of Exhaustible and Renewable Resources – Common Property Resource Management – Tragedy of Commons.

Environment Development Trade off – Sustainable Development – Indicators of Sustainable Development – Equity and Sustainable Development – Environment and Trade in the WTO Regime – Environment and System of National Accounts – Green GDP.

Reading List

Module 1

1. Environmental Education in India (2002) Association of Indian Universities, New Delhi.
2. Schultz., T.W. (1971) Investment in human Capital, Free Press, New York
3. Joy A. Palmer, 1998, Environmental Education in 21st century, Routledge, London.
4. Kolstad, D. Charles (2010), Environmental Economics, Oxford University Press.
5. Cohn E. and T. Gaske (1989), Economics of Education, Pergamon Press, London.
6. McMohan, W.W. (1999), Education and Development: Measuring the Social Benefits, Oxford University Press.
7. Becker G.S. (1974), Human Capital (2nd Edition), National Bureau of Economic Research, New York.

SEMESTER-II

FOUNDATION COURSE

METHODOLOGY AND PERSPECTIVES IN PLANT SCIENCES

Course code : BO 1221, Number of credits : 3

Number of contact hours: 36 hrs (Lecture); 36hrs (Practical) Total= 72 hours

Distribution of Hours	Theory	Practical
Scientific Studies	08 hrs	0 hrs
Data handling in science	12 hrs	16 hrs
Microtechnique	06 hrs	08 hrs
Biophysics	10 hrs	12 hrs
Total	36 hrs	36 hrs

Aim of the course: To introduce the methodology and perspectives of Science in general so as to enable the students to systematically pursue his particular discipline in science in relation to other disciplines that come under the rubric of sciences.

Objectives:

- To familiarize the students with the fundamental characteristics of science and significance of scientific studies
- To apply scientific methods independently and familiarize instruments in biological labs
- To interpret scientific data using basic statistical methods
- To develop skills for microscopic specimen preparation.

MODULE-I

Scientific Studies **08hrs**

1. Types of knowledge: Practical, theoretical and scientific knowledge
2. Information: What is science; what is not science; laws of science; basis of scientific laws and factual truths.
3. Science as a human activity: scientific temper and empiricism, Science disciplines
4. Revolution in Science and Technology
5. Ethics in Science: Transparency and Honesty; danger of pre conceived ideas.
6. Scientific information: Depositories of scientific information, Primary, secondary and digital sources; sharing of knowledge.
7. Methods and tools in science: Steps in scientific method. Null hypothesis and alternative hypothesis. Inductive and deductive reasoning.

MODULE- II

Data handling in science **12hrs**

1. Nature and types of data - Typical examples, Data collection, Data presentation-

Classification and tabulation, diagrammatic presentation (bar & pie diagrams) and graphic presentation (Histogram, frequency polygon, frequency curve & Ogives).
2. Samples and sampling techniques.
3. Statistical treatment of data: Statistical terms and symbols. Measures of central tendencies (mean, median, mode), Measures of dispersion (range, mean deviation, variance, standard deviation, coefficient of variation), Significance tests (chi-square test).

Practicals **16hrs**

1. Workout problems on frequency distribution
2. Represent data using bar diagram and histogram
3. Measures of central tendencies (Mean, Median,Mode)
4. Workout problems on measures of dispersion (range, mean deviation, variance, standard deviation, coefficient of variation)
5. Workout problems on chi-square test.

MODULE-I11

Microtechnique **06hrs**

1. Introduction - microscopy - simple and compound – phase contrast; dark field illumination and electron microscopes (SEM and TEM).
2. Micrometry, Camera lucida
3. Sectioning - hand and microtome– rotary and sledge
4. Killing and fixation agents – Carnoy's formula, Farmers formula, F .A.A
5. Dehydration - reagents
6. Stains and staining techniques - double staining. General account; Stains: safranin, haematoxylin, acetocarmine.
7. Mounting media - D. P. X and Canadabalsam
8. Whole mounts - cytological methods: maceration, smear and squash preparation.

Practical **08hrs**

1. Familiarize stains, fixatives and mounting media
2. General awareness of Micro technique - maceration, smears &squash
3. Demonstration of microtome sectioning and hand sectioning
4. Measurement of specimens using micrometer (Demonstration only).
5. Photomicrography and Camera lucida drawings (Demonstration only).

MODULE-IV

Biophysics **10hrs**

1. Principles and applications of Colorimeter, Spectrophotometer (UV-Visible) and Centrifuge- centrifugation, types of rotors (swinging bucket, fixed angle), Density gradient and Differential centrifugation.
2. Basic knowledge of the separation methods: - Chromatography (Column chromatography, paper chromatography and TLC), Electrophoresis (PAGE and AGE).
3. Buffers -their functions in biological systems - Uses of buffers in biological research, pH meter.
4. Cryobiology – cryopreservation, freeze drying (lyophilisation) and its applications.

Practical **12hrs**

1. Separation of plant pigments by paper chromatography/TLC.
2. Preparation of buffer
3. Measurement of pH
4. Construct the absorption spectrum of any sample.

REFERENCE

1. Bailey T .J.(1995) Statistical Methods in Biology (3rd Edition) – Cambridge University Press India Pvt Ltd.
2. Bass, Joel, E et al. (2009). Methods for teaching Science as Inquiry, Allyn&Bacon
3. Blair E .J. (1987) Introduction to chemical instrumentation Mc-Graw Hill Book Company
4. Casey E. J. (1063) Biophysics – Concepts and Mechanisms Van Nostr and Reinhold Company
5. Collins H. and T Punch (1993). The Golem. What everyone should know about Science. Cambridge Univ. Press
6. Donald A. Johansen (1940) Plant Microtechnique- Mac Graw Hill Book company
7. Elizabeth Allman (2004). Mathematical Methods in Biology, Cambridge University Press India Pvt. Ltd
8. Gieryn T.F. (1999). Cultural Boundaries of Science, Univer. Chicago Press.
9. Hewitt, Paul G, Suzanne Lyons, John A, Suchocki and Jennifer Yeh (2007). Conceptual Integrated Science, Addison-Wesley
10. Jeffrey A. Lee (2010). The Scientific Endevor. Pearson Delhi
11. Khan and Khanum (1994). Fundamentals of Biostatistics, Saras Publications
12. Marcello Pagano and Kimberlee Gauvreau (2018) Principles of Biostatistics 2nd Edition CRC Press, Chapman & Hall
13. Newton RG (2000) The truth of Science, 2nd edition, Harward University Press
14. Pattabhi V & Gautham N (2011)Biophysics, Narosa publishers
15. Peter Grey (2018) Hand book of microtechnique-Mac Graw Hill Book company
16. Prasad and Prasad (1972). Out lines of Botanical Microtechnique, Emkay publish, Delhi
17. Saha I and Paul B (2016) Essentials of Bio-statistics 2nd Edition Academic Publishers
18. Stephen W. Looney (2009). Biostatistical Methods, Humana Press, Springer International Edn.
19. Veer Bala Rastogi (2008). Fundamentals of Biostatistics, Ane Books Pvt. Ltd
20. Willard H. H., J .A. Dean, L. L. Merritt and F. A. Settle (2011) Instrumental methods of analysis, CBS Publishers and Distributors N. Delhi

EXPECTED OUTCOME

- Students will be familiarized with the fundamental characteristics of Science.
- Develops an idea about involvement of science in improvement of human life.
- Create awareness of scientific approach towards life and learns the values of ethics in science.
- Develops skills to interpret scientific data using basic statistical methods.
- Create skills to prepare specimens for microscopic and gross anatomical studies and familiarize with different microscopic methods for sample analysis.
- Students become able to prepare buffers, measure pH, separate plant pigments and construct absorption spectrum of a sample.

SEMESTER-V

ENVIRONMENTAL STUDIES AND PHYTOGEOGRAPHY

Course code: BO1542

Number of credits: 4

Number of contact hours : Lecture: 90 hrs; Practical: 36 hrs; Total: 126 hrs

Distribution of Hours	Theory	Practical
Environmental Studies	**81 hrs**	**36 hrs**
Phytogeography	**09 hrs**	**00 hrs**
Total	**90 hrs**	**36 hrs**

MODULE- I **14 hrs**

1. Definition- Scope and relevance to society and human environment. Need for public awareness
2. Natural Resources - Renewable and Non renewable - Land & Soil, Water, Energy, Minerals, Food and agriculture , Forests, Plants & Wild life resources
Degradation of natural resources - Land degradation, degradation of water resources, Loss of flora and fauna
Causes – population explosion, over exploitation, deforestation, agriculture mismanagement, desertification, overgrazing, soil erosion, mining, urbanization and industrialization- change in land use, depletion of water resources
3.Conservation of Natural resources
Land and soil- afforestation, regeneration of wasteland
Water - Rain water harvesting, ground water dams
Energy - Promoting use of renewable resources-solar, hydel, tidal and wind; biodiesel, biofuels.
Forests- Reforestation, Community forestry programmes
4. Role of an individual in conservation of natural resources, sustainable life styles.

MODULE II

Ecosystems **22 hr**

1. Ecosystems - Concept, definition, structure and function; components- biotic and abiotic; energy flow
2. Food chains -Food web & ecological Pyramids, biogeochemical cycles - Carbon and Phosphorous cycle
3. Ecological succession-Definition, primary and secondary succession, climax concept, hydrosere and xerosere.
4. Plant adaptations- Morphological, anatomical& physiological adaptations of – Hydrophytes, Xerophytes, Halophytes, Epiphytes, Parasites
5. Introduction- types, characteristic features, structure and functions of the following ecosystems.

1. Forest ecosystem 2. Grassland ecosystem 3. Desert ecosystem 4. Aquatic ecosystems- Ponds, Streams, Rivers, Oceans, Estuaries (brief account only)

MODULE-III

Biodiversity and its conservation **24 hrs**

1. Introduction
2. Definition- genetic, species and ecosystem diversity.
3. Terrestrial (Tropical rain forest) and Aquatic Biomes(mangroves).
4. Hot-spots of biodiversity; India as mega-diversity nation.
5. Threats to biodiversity: land use changes & habitat destruction, poaching of wild life- hunting & export, Overuse of pesticides, invasive species.
6. IUCN, Red data Book; Extinct and Threatened species- endangered & Rare; Endemic species of Western Ghats.
7. Conservation of biodiversity: *In-situ* (National parks and Wild life sanctuaries) and *Ex-situ* conservation (botanical gardens); Biosphere Reserves & World Heritage Sites in India-Ramsar sites.
8. Global initiatives in biodiversity conservation- Stockholm Conference, Montreal Protocol, Convention on Biological diversity Regional initiatives- *Chipko* movement, A brief account on conservation efforts in Kerala- People Biodiversity Register.

MODULE-IV

Environmental pollution & Issues **21 hrs**

1. Definition causes, effects and control measures of – 1. Air pollution 2. Water pollution 3. Soil pollution 4. Marine pollution 5. Noise pollution 6. Thermal pollution 7. Nuclear hazards.
2. Solid Waste Management- waste minimization, Recycling and Reuse, Consuming environment friendly products. E-waste management.
3**.** Environmental Issues **-** Climate change, Global warming, Acid rain, Ozone layer depletion.
4. Environmental Legislations - Environment protection Act (1986); Air [prevention and control of pollution] Act (1981; Amended 1987); Water [prevention and control of pollution] Act (1974; Amended 1988); Wildlife Protection Act (1972); Forest conservation Act (1980). (Scope and relevance only)
5. Environmental Organisations –UNEP, IPCC, WWF, Central Pollution Control Board

MODULE-V

Phytogeography- concept & definition **09 hr**

Vegetation in India – Forests- tropical, temperate, sholas, sub alpine, alpine, mangroves & Grass lands.

Phytogeographical regions of India - Western and eastern Himalayas, Dessert, Western Ghats, Deccan Peninsula, Gangetic Plain, North East India, Coasts & Islands.

Practical **36 hrs**

1. Visit a local polluted site and report major pollutants.
2. Study of ecological and anatomical modifications of Xerophytes, Hydrophytes, Halophytes, Epiphytes and Parasites.
3. Observation and study of different ecosystems mentioned in the syllabus.
4. Phytogeographical regions of India- Photos/ Diagrams

REFERENCE

1. Misra SP and Pandey SN, 2009, Essential Environmental studies, Ane Books Pvt. Ltd
2. Erach Bharucha – Text book of environmental Studies for undergraduate Courses, Universities Press, University Grants Commission
3. Ahluwalia VK and Sunitha Malhotra 2009, Environmental science, Ane Books Pvt. Ltd.
4. Chapman J.L. (2006) Ecology-Principles and Application. Cambridge University Press India Pvt. Ltd
5. Chandoco.S Weaver and Clements – Plant Ecology, McGraw Hill Publications, New York.
6. Verma, P. S. and V. K. Agrawal. 2004. *Cell Biology, Genetics, Molecular Biology, Evolutionand Ecology.* S. Chand & Company Ltd., New Delhi.
7. Prithipal Singh 2007- An Introduction to Biodiversity. Ane Books Pvt. Ltd
8. Verma and Agarwal – Principles of Ecology, S. Chand and Co.
9. Ambasht R.S. – Text book of Plant Ecology, Students and Friends & Co. Varanashi.
10. Odum Eugene P – Fundamentals of Ecology, Edn. Philladephia & Saunders, Tokyo, Toppon.
11. Sharma, P.D. – Elements of Ecology (Rastogi's Company Ltd., Publications).
12. Vashista P.C – Plant Ecology Edu. Vishali Publications.
13. Periasamy, K. – Elements of Plant Ecology, (M.K. Publications).
14. The Geography of Flowering Plants - Good
15. Kumaresan B. – *Plant Ecology & Phytogeography* – Rastrogi Pub:

Semester IV

Zoology Core course III

ECOLOGY, HABITAT DESTRUCTION & DISASTER MANAGEMENT

Course code – ZO 1441

No. of credits - 3 **Total hours 54**

Course Outcomes

- Students get basic knowledge on ecosystem, food chain, food web and energy flow.
- Students acquire general awareness on pollution and their impacts.
- Imparts basic knowledge on ecosystems and their functioning.
- Students learn about various types of anthropogenic pressures on ecosystem, related degradation and management measures.
- Students get awareness of toxicants, their impacts on human health and environment and remedial measures.
- Create awareness about disasters, prevention and mitigation measures.

ECOLOGY **4 hrs**

Module I

Components of ecosystem: Environmental factors - abiotic factors, light, temperature, soil, air; biotic factors- autotrophs, phagotrophs and saprotrophs; ecosystem interaction and relationship between biotic and abiotic factors, the cybernetic nature and the stability of the system. Pond as an ecosystem (self study)

Module II **5 hrs**

Biogeochemical cycles: Basic types of biogeochemical cycles - gaseous cycle-carbon and nitrogen cycles, mention sedimentary cycles (P and S), recycling pathways and recycle index.

Limiting Factors- basic concepts- Leibig's law of minimum, Shelford's law of tolerance, combined concept of limiting factors, Light and temperature as limiting factors.

Module III **8 hrs**

Habitat Ecology: Biosphere classification- lithosphere, hydrosphere and atmosphere physical features, fauna and their adaptations of aquatic, terrestrial and marine habitats (self study).

Population ecology: Properties of population- density, natality, mortality, age distribution, biotic potential, environmental resistance and carrying capacity, population growth forms, J and S shaped curves, emigration, immigration and migration, population fluctuation. Community ecology: Definition and characters, species diversity; stratification; dominance; ecotone and edge effect; ecological indicators; community periodicity, succession.

Module IV **5hrs**

Anthropogenic impact on ecosystem: Ionizing radiation and radioisotopes, ionizing radiation and human health, radiation accidents and other exposures, disposal of radioactive wastes, pesticides like DDT, endosulfan, furadan, insect repellants , e-wastes. Monitoring of pollutants - physical, chemical and biological.

Module V **3 hrs**

Wild life conservation and management: Significance, causes of extinction, concepts of threatened species, red data book, IUCN, WWF, CITES, Green Environment and Green peace; protected areas, biosphere reserves, national parks and sanctuaries in India, forests in India, desertification, deforestation, carbon trading; importance of mangroves in coastal ecosystems-conservation and management.

Module VII **9 hrs**

Environmental biotechnology: Biotechnological methods of pollution detection, biotechnological methods in pollution management, bioremediation, biotechnology and biodegradation, genetically engineered microbes in bio-treatment of waste, eco-friendly bioproducts for environmental health, bio-piracy, bio-pesticides and bio-fertilizers, organic farming and its merits. Green chemistry - designing a Green synthesis, basic principles of Green chemistry.

Module VIII **5 hrs**

Environment Movements

Environment and health - Environment and development: Environmental Movements (Chipko, Narmada Bachao Andolan). environmental movements in Kerala (Madhav Gadgil/Kasturi Rangan Reports. Ramsar sites Wetland Reclamations and localized anti-reclamation movements) Kerala state Biodiversity Board, Biodiversity Register.

DISASTER MANAGEMENT

Module IX **8 hrs**

Disruption in Ecosystem

Natural-flood, Draught, Earth quaque, Cyclone, Tsunamis, Volcanic eruption. Anthropognic influence on erosion, climate change and pollution. Mining activities Monoclonal plantations, genetically modified plants and their impact in ecosystem. Impact of Developmental projects such as construction of dams, Hydroelectric projects Thermal power station.

Module X **7 hrs**

Disaster Management – Meaning and Definition: Definitions of Disaster, Hazard, Risks. Vulnerability, and Resilience and their relationship: Classification of disasters- Human induced and Natural; Cause of Disasters; Impact of disasters. Factors affecting Vulnerability – Economic, Political, Environmental and Social Counselling.

Assignment/Seminar

Global warming, Green House Effect, Ozone depletion Climate change, Kyoto protocol

Reference

- Beck, W. S., Liem, K. F. & Simpson, G.G. (1991). *Life: An Introduction to Biology* (3rd Ed.) Harper Collins Publishers, New York, pp 1361. ISBN : 006500009 9
- Bharucha,E. (2005). *Textbook of Environmental Studies*. Universities Press (P)Ltd. India, pp 276. ISBN 81 7371 540 8.
- Chapman, J.L., & Reiss, M.J. () *Ecology: Principles and Applications* (2d Ed.) Cambridge University Press, UK. ISBN: 0 521 00575 2.
- Charry, S.N. (2008). *Environmental Studies*. MacMillan India Ltd. ISBN: 10:0230 63531 8, 13: 987 0230 6351 9.
- Cunningham, W.P. & Cunningham, M.A. (2003). *Principles of Environmental Science inquiry and Applications.* Tata McGraw Hill Publishing Company Ltd. New Delhi. ISBN 0 07 058112 6.
- Donald Van DeVeer & Christine Pierce (). *The Environmental Ethics & Policy Book* (3rd Ed.) Wadsworth – Thomson Learning, Canada. ISBN: 0 534 56188 8.
- Emmel, T.C. (1976). Population Biology. Harper & Row Publishers, New York. ISBN 06 041904 0

Disaster Management

- http://www.mnmk.ro/documents/2008/2008-6.pdf
- Carresi,A.L, et al (2013) Disaster Management: International Lessons in Risk Reduction, Response and Recovery , Routledge, U.K.
- Agarwal, A. and Sen, S.: The Citizen's Fifth Report, Centre for Science and Environment. New Delhi 1999
- Chandna, R.C.: Environmental Awareness, Kalyani Publishers, New Delhi, 1998
- Sharma, H.S.: RathambhoreSanctuary - Dilemma of Eco-development, Concept.
- www.ifrc.org/en/what-we-do/disaster-management/
- Coppola. Damon (2011), Introduction to International Disaster Management, Elsevier 1SBN: 978-0-12-3821744
- Abbott Leon (2008). Natural Disaster, McGraw-Hill.ISBN-13: 978 0072 428650.

HABITAT DESTRUCTION AND DISASTER MANAGEMENT

- Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
- Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
- Carter, W. Nick, 1991: Disaster Management, Asian Development Bank,
- Coppola P Damon, 2007. Introduction to International Disaster Management,
- Cuny, F. 1983. Development and Disasters, Oxford University Press. Manila.
- Ahluwalia, V. K. and Malhotra, S. (2006). Environmental science. Ane Books Pvt.Ltd.
- Aravind Kumar. (2004). Text Book of Environmental Science. APH Associates,Inc.Publishers. Massachusetts.
- Atchia. M. and Tropp.S. (1995). Environmental Management, John Wiley
- Bhatia .A.1. Current trends in Global EnvironmentNew India publishing_ Agency,
- Bishop.P.L. (2000). Pollution Prevention: Fundamentals and Practice,
- Brace, C.L. (1967). The stages of Human Evolution, Prentice Hall International.CambridgeUniversity Press.33.
- Chapman J.L.and M.J.. (1999). Ecology - Principles and Applications.
- Chatterjee B. (2003). Environmental Laws: Imple mentation problems

1644Environmental Economics and Disaster Management (Core)

Module I Basic Concepts (5 Hrs)

Basic Concepts of environmental economics – economics and ecology – ecology and eco system

Module II Theory of Externalities (15 Hrs)

Market system and environment of externalities – Pareto optimum and Market failure in the presence of Externalities – Property rights and the Coase theorem

Module III Environmental Policy Tools for Analysis (20 Hrs)

Pigouvian Taxes and Effluent Charges; Tradable Permits – Environmental Valuation – Types of Economic Values – Non Market Valuation Methods – Cost Benefit Analysis – Sensitivity and Risk analysis

Module IV Global Environmental Issues (7 Hrs)

Economics of Climate Change – Agreements and Institutions - Population Growth and the Environment – Trade and Environment – Concept and Measurement of Sustainable Development

Module V Disaster Management in india (8 Hrs)

Concept and Definitions (Disaster, Hazard, Vulnerability, resilence, Risk) – Hazard and Vulnerability Profile of India – Institutional Arrangeems (Mitigation, DM Act and Policy, Plans Programmes and Legislation),Disaster management in India

Basic Readings

1. Hussain, M, Ahmed. 2000. Principles of Environmental Economics. Routledge, London and New York
2. Charles Kolstad, Intermediate Environmental Economics, Oxford University Press, 2nd edition
3. Carter, Nick 1991. Disaster Management: Disaster Manager's Handbook, Asiaan Development Bank, Manila Pilippiens.
4. Gupta Anil K, Sreeja S Nair, 2011 Environmental Knowledge for Disaster Management, NIDM, New Delhi

5. ELECTIVE

6. EC1661.1 KERALA ECONOMY

7.

8. Inst Hours-4 Number of Credit-2

9. Course Objective

10. To understand the structural changes, Sector-wise contribution and features of the Kerala Economy since the formation of the state and enable the students to have a basic understanding of the emerging trends and issues of Kerala Economy

11.

12. MODULE I: Structure of Kerala Economy

13. Development experience of Kerala: An overview: Kerala's development since the formation of the state-Features of the Economy- Structural composition – Primary, Secondary and Tertiary Sectors – changes over the years NSDP,GSDP and PCI – "Kerala Model of Development" –A comparison with the highest SDP state in India – HDI Status

14.

15. MODULE II: Demographic change: A boost to Economic change

16.

17. Demographic Aspects (birth rate, death rate, infant mortality rate, sex ratio, age distribution)- why sex ratio is in favour of women in Kerala –need for women empowerment – Aging problem- Urbanisation, Migration and Emigration-Economic and social Impacts of Migration, return migration and interstate migration - Nature and Magnitude of Urban, Rural and Educated Unemployment - Trends in Urban and Rural Poverty in Kerala- Major poverty alleviation schemes.

18.

19. MODULE III: Kerala's Economic Development : Sector-wise Analysis

20.

21. Agricultural development since 1956: Objectives of Land reforms- Measures of Land

them to apply these tools in Economics.

MODULE I: Univariate Analysis, Correlation and Regression (35 Hours)

Univariate analysis – frequency tables, Measures of central tendency, dispersion, standard deviation, coefficient of variation, Lorenz Curve, Gini Concentration ratio-Geometric mean, Harmonic mean

Correlation--Simple, Partial and Multiple correlation- Scatter diagram-Karl Pearson's coefficient of correlation-Spearman's rank correlation- probable error- uses of correlation.

Simple and multiple linear regression- Method of Least Squares-Lines of regression- Regression coefficient-Relation between regression and correlation coefficients-Uses of regression in Economics.

MODULE II: Index Numbers and Time series Analysis (30 Hours)

Time series analysis-meaning-components- Measurement of trend-graphic method, semi-average method, moving average method and method of least squares.

Index numbers-Meaning and types of Index numbers – Simple and Weighted index numbers CPI and WPI- Problems in the construction of index numbers – Tests of index numbers- Fishers ideal index numbers- factor reversal test and time reversal test – Deflating – Base shifting – Splicing – Uses of Index numbers.

MODULE III: Probability (32 Hours)

Probability- Elements of probability theory (sample space, events) –definition of Probability: Classical and Modern , Relative frequency definition and Axiomatic approach – Addition theorem– multiplication theorem – Conditional Probability –

Random variable- discrete and continuous ,Expectation,Binomial and Normal distribution.

References

1. Murray R. Spiget (1999), Probability Theory Schaum's Series.
2. Lipshutz, (2000), Theory of Probability, Schaum 's Series,
3. S P Gupta,Statistical Methods,Sultan Chand and sons

Semester V

Core VIII EC1543 Readings in Political Economy

4 Hours **4 Credits**

Module I Passages from the Classics (15 hours)

Adam smith-Division of labour, Ricardo-On Rent and Of Machinery, Marx-CMC and MCM' circuit

1.Adam smith;Wealth of Nations,Book 1 ,Chapter 1 'of the division of labour'

,Chapter 3 ' That the division of labour is limited by the extent of market'

http://www.econlib.org/library/Smith/smWN1.html#B.I, Ch.1, Of the Division of Labor

2.David Ricardo ; On the Principles of Political Economy and Taxation Chapter 2 On Rent

http://www.econlib.org/library/Ricardo/ricP1a.html

David Ricardo;On the Principles o Political Economy and Taxation, chapter 31 on Machinery

http://www.econlib.org/library/Ricardo/ricP7.html#Ch.31, On Machinery

3.Karl Marx –Capital Volume 1

Part II The Transformation of money into Capital

Chapter-4 The General formula for Capital

https://www.marxists.org/archive/marx/works/1867-c1/ch04.htm

Robert Heilbroner (1998) Wonderful World of Adamsmith

, Worldly Phlosophers, Robert Heilbroner (1998), Updated Seventh Edition

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http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

Module II Political Economy : Different Perspectives (20 hours)

This section introduces the student to different perspectives of political economy : the perspectives of Adam Smith , John Maynard Keynes

1. Robert Heilbroner (1998) Wonderful World of Adamsmith

, Worldly Phlosophers, Robert Heilbroner (1998), Updated Seventh Edition

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http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

2. The Rise and fall of money- The Mandarin Revolution (Great Depression and the Ideas of Keynes)

3.Glabraith,John Kenneth,'The age of Uncertainty'Houghton Mifflin Company,Boston,1977

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

The Savage Society of Thorestein Veblen

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

The Contradictions of Joseph Schumpeter

http://starbooksfeaa.weebly.com/uploads/5/4/8/6/54869709/the_wordly_philosophers.pdf

Module III Global Economic Crisis and its Aftermath (20 hours)

THE Recent Crisis in Global Capitalism : Towards Marxian Understanding

1.Vamsi Vakulabharanam, EPW Vol.44,Issue No.13,March,2009 www.epw.in/system/files/pdf/2009_44/13/The_Recent_Crisis_in_Global_Capitalism_Towards_a_Marxian_Understanding.pdf

Module IV Issues in Political Economy and Development Thinking (20 hours)

Indian Development thinking, Gender equality and Women's empowerment. Social justice through affirmative action in India.

Naila Kabeer (2005)Gender equality and Women's empowerment Development

http://nailakabeer.net/wp-content/uploads/2005/09/13552070512331332273.pdf

Ashwini Deshpande (2012), Social Justice through Affirmative Action in India

http://research.economics.unsw.edu.au/scho/WEE/papers/Ashwini%20Deshpande1.pdf

Semester V

Core IX EC1544 Economic Growth and Development

3Hours **2 Credits**

Course Objectives:

1. To ensure that students begin to understand basic concepts of Economic Growth and Development and thereby enable them to acquire multi dimensional aspects of developmental issues

2. To convey knowledge about theoretical framework of Growth and Development under different Schools of economic thought.

3. To impart knowledge about Political institutions, the role of the state in Economic Development and problems that affect state Governance.

Course Material

Modules 1-3

Core Reading: *English Language Skills for Communication I*

Module 4

Core Reading: *Dramatic Moments: A Book of One Act Plays*. Orient Black Swan, 2013

The following one act plays are prescribed:

H.H.Munro	*The Death Trap*
Philip Moeller	*Helena's Husband*
Serafin and Joaquin Alvarez Qunitero	*Sunny Morning: A Comedy of Madrid*
Margaret Wood	*Day of Atonement*

For further Reading

Marks Jonathan. *English Pronunciation in Use*. New Delhi: CUP, 2007.

Lynch, Tony. *Study Listening*. New Delhi. CUP, 2008.

Kenneth, Anderson, Tony Lynch, Joan Mac Lean. *Study Speaking*. New Delhi: CUP, 2008.

Reference

Jones, Daniel. *English Pronouncing Dictionary 17the edition*. New Delhi: CUP, 2009.4

SEMESTER I

FIRST DEGREE PROGRAMME IN ENGLISH (CBCS System)

Foundation Course I for BA/BSc - WRITINGS ON CONTEMPORARY ISSUES: EN 1121

No. of credits: 2 **No. of instructional hours: 4 per week (Total 72 hrs.)**

AIMS

1. To sensitize students to the major issues in the society and the world.
2. To encourage them to read literary pieces critically.

OBJECTIVES

On completion of the course, the students should be able to

1. have an overall understanding of some of the major issues in the contemporary world.
2. respond empathetically to the issues of the society.
3. read literary texts critically.

COURSE OUTLINE

Module I: Globalization and its Consequences

Essays: (1) "The Globalized World" – Avinash Jha.

(2) "Globalization and Education: Third World Experience" – Amit Bhaduri.

Poem: "Unending Love" - Rabindranath Tagore

Module II: Environmental Issues

Essay: "Forests and Settlements" - Romila Thapar Poems: (1) "God's Grandeur" - G.M.Hopkins (2) "The World is too Much with Us" - Wordsworth

Module III: Human Rights

Essay: "Thinking about Human Rights" - Manisha Priyam, Krishna Menon & Madhulika Banerjee,
Poem: "London" - William Blake
Fiction: *Untouchable* [an extract] – Mulk Raj Anand

Module IV: The Gender Question

Essays: "Gender, Culture and History" – Manisha Priyam, Krishna Menon & Madhulika Banerjee, Fiction: "The Elder Sister" – M. T. Vasudevan Nair

COURSE MATERIAL

Modules 1 - 4

Core reading: *Meeting the World: Writings on Contemporary Issues*. Pearson, 2013.

Semester II

First Degree Programme in English (CBCS System)

Common for B.A/B Sc [EN1211.1] & 2(a) [CG1271]

No. of Credits: 4

No. of instructional hours: 6 per week (Total 90 hrs)

ENVIRONMENTAL STUDIES

Module 1

Environmental studies: Definition, Need, Scope and Importance, Need for public awareness. Natural resources- Forest resources, water resources, mineral resources, food resources, energy resources, land resources- over exploitation, case studies.

Module 2

Eco-system- structure and function, producers, consumers and decomposers energy flow in the ecosystem, ecological succession, forest ecosystem, grassland ecosystem, desert ecosystem and aquatic ecosystem. Biodiversity and its value and conservation, hot spots of biodiversity, India as a mega-diversity nation, endangered and endemic species of India, conversation of bio-diversity. In-situ and Ex-situ conversation of bio-diversity. Sustainable use of forest – water- land -resources –Human population and its impact on environment.

Module 3

Pollution: air, water, soil and marine, noise, thermal and nuclear hazards. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management. Social issues and the Environment: from unsustainable to sustainable development, water conversation-rain water harvesting; global warming; consumerism and waste products: various acts to protect the environment; Environment protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and Control of pollution) Act; Wild Life Protection Act; Forest Conversation Act:

Module 4

Human population and Environment: Population explosion, Family Welfare Programmes, Environment and human health; human rights, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health.

Field work and Project- Visit to ecologically polluted spots: Study of nature: study of forest, insects, animals, birds and plants. Project Report on the basis of field work about 15 pages.

Total Marks: 100 **Written Exam: 60 Marks**

Internal Assessment: 15 Marks (Attendance- 5 marks+ 10 test paper)

Field work and project: 25 Marks

Books for Reference:

Adams, W.M. Future Nature: A Vision for Conservation. London: Earthscan, 2003.

Arnold, David and Ramachandra Guha, ed. Nature, Culture and Imperialism:Essays on the Environmental History of South Asia. New Delhi: Oxford UPM 2001.

Bahuguna, Sunderlal. "Environment and Education". The Cultural Dimension of Ecology. Ed. Kapila Vatsyayan. New Delhi: D.K. Printworld. 1998.

Crson, Rachel. Silent Spring. Boston: Houghton Mifflin, 1962.

Guha, Ramachandra- Environmentalism: A Global History,New Delhi: Oxford UP, 2000.

Hayward, Tim. Ecological Thought: An Introduction: Cambridge; polity, 1994.

Merchant, Crolyn. The Death of Nature. New York: Harper, 1990.

Gleick H.P. 1993. Water in Crisis, Pacific Institute for Studies in development Environment and security. Stockholm Env Institute. OUP 473 p.

Heywood V and Watson R.E. 1995. Global biodiversity Assessment. CUP 1140p

Odum FP. 1971. Fundamentals of Ecology. W.B Saunders Co. USA 574p

Rao. M. N and Dutta A.K. 1987. Waste Water Treatmentt. Oxford and IBH Publ Co Pvt.

Wagner K.D. 1998. Environmental Management. WB Saunders Co. Philadelphia, USA. 499p.

SEMESTER II

FIRST DEGREE PROGRAMME (CBCS System)

MODERN ENGLISH GRAMMAR AND USAGE

Common for BA/BSc: EN 1212.1, BCom: 1211.2 & Career related 2(a):1211.3

(2012 Admission onwards)

No. of credits: 3 **No. of instructional hours: 4 per week (Total 72 hrs.)**

AIMS: 1. To help students have a good understanding of modern English grammar.

2. To enable them produce grammatically and idiomatically correct language.
3. To help them improve their verbal communication skills.
4. To help them minimise mother tongue influence.

SEMESTER VI

FIRST DEGREE PROGRAMME (CBCS System)

Common for

ENGLISH LANGUAGE AND LITERATURE - Core Course XIV: EN 1644
&
CAREER-RELATED FIRST DEGREE PROGRAMME (CBCS) - Group 2 (a) IN ENGLISH & COMMUNICATIVE ENGLISH - Core Course XI - CG 1642

WOMEN'S WRITING

No. of Instructional hours : 4 per week (Total: 72 hrs) – for EN 1644
: 5 per week (Total: 90 hrs) - for CG 1642

No. of Credits : 3 [EN 1644 & CG 1642]

Aims:

1. To introduce students to the development of women's writing in various countries.
2. To familiarize them with the diverse concerns addressed by feminism.
3. To motivate them to critically analyse literary works from a feminist perspective.

Objectives: On completion of the course, the students should be able to

1. The students will have an awareness of class, race and gender as social constructs and about how they influence women's lives.
2. The students will have acquired the skill to understand feminism as a social movement and a critical tool.
3. They will be able to explore the plurality of female experiences.
4. They will be equipped with analytical, critical and creative skills to interrogate the biases in the construction of gender and patriarchal norms.

COURSE OUTLINE

Module 1: Essays
Module 2: Poetry
Module 3: Short Fiction
Module 4: Drama

COURSE MATERIAL

Module 1: Essays **[Detailed study]**

1. Virginia Woolf: "Shakespeare and his Sister" (Excerpt from *A Room of One's Own*)
2. Alice Walker: "In Search of our Mothers' Gardens" (From *In Search of Our Mother's Gardens*)
3. Jasbir Jain: Indian Feminisms: The Nature of Questioning and the Search for Space in

Indian Women's writing. (From *Writing Women Across Cultures*

Module 2: Poetry. **[Detailed study]**

1. Elizabeth Barrett Browning : **"**A Musical Instrument"
2. Marianne Moore : "Poetry"
3. Adrienne Rich : "Aunt Jennifer's Tigers"
4. Sylvia Plath : "Lady Lazarus"
5. Margaret Atwood : "Spelling"
6. Kishwar Naheed : "I am not That Woman"
7. Suniti NamJoshi : "The Grass Blade"
8. Nikki Giovanni : "Woman"

Module 3: Short Fiction **[Non-detailed study]**

1. Katherine Mansfield : "The Fly"
2. Shashi Deshpande : "A Wall is Safer"
3. Sara Joseph : "Inside Every Woman Writer"
4. Amy Tan : "Rules of the Game"

Module 4: Drama **[Non-detailed study]**

1. Sheila Walsh : "Molly and James"
2. Mamta G Sagar : "The Swing of Desire"

Core text:

Modules 1 – 4: Dr Sobhana Kurien, ed. *Breaking the Silence: An Anthology of Women's Literature*. ANE Books.

Books for reference:

Beauvoir, Simone de. *The Second Sex*. UK: Hammond Worth, 1972.
Davis, Angela. *Women, Race and Class*. New York: Random, 1981.
Devi, Mahasweta. *Breast Stories*. Calcutta: Seagull, 1998.
Gilbert, Sandra and Susan Gubar. *The Mad Woman in the Attic: The Woman Writer*. Yale UP, 1978.
Goodman, Lisbeth ed. *Literature and Gender*. New York: Routeledge, 1996.
Green, Gayle and Copelia Kahn. *Making a Difference: Feminist Literary Criticism*. New York: Routeledge.
Humm, Maggie ed. *Feminisms: A Reader*. New York: Wheat Sheaf, 1992.
Jain, Jasbir ed. *Women in Patriarchy: Cross Cultural Readings.* New Delhi: Rawat, 2005
Millett, Kate. *Sexual Politics*. New York: Equinox-Avon, 1971.
Rich, Adrienne. *Of Woman Born*. New York: Norton.
Roudiex, Leos S. ed. *Desire in Language*. New York: Columbia UP, 1975.
Showalter, Elaine. *A Literature of their Own*.
Spacks, Patricia Mayor. *The Female Imagination*. New York: Avon, 1976.
Tharu, Susie and K Lalitha. *Women Writing in India Vol I & II*. New Delhi: OUP, 1991.
Walker, Alice. *In Search of our Mothes' Gardens*. New York: Harcourt Brace Jovanovich, 1983.
Woolf, Virginia. *A Room of One's Own*. London: Hogarth, 1929.

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Instruction to Teachers [Modules 1- 4]:

- The work of each writer mentioned in Modules 1 – 4 has to be placed against the literary backdrop of the age.
- The major works of the writers mentioned in the modules can be made familiar to the students
- The literary significance of the work is to be briefly discussed in the classroom and hence the student is expected to have only a general awareness of the respective author..
- **Questions are to be asked only from the prescribed poems, fiction and drama.**

B.Com I st Semester

Core Course I: CO 1141 – ENVIRONMENTAL STUDIES

No. of instructional hours per week: 4 No. of Credits: 3

Aim of the course: To develop knowledge and understanding of the environment and enable the students to contribute towards maintaining and improving the quality of the environment.

Course objectives:

1. To enable the students to acquire basic ideas about environment and emerging issues about environmental problems.
2. To give awareness about the need and importance of environmental protection

Module I: Environmental studies – meaning – scope – importance (4hrs)

Module II: Ecology and Ecosystems, Biodiversity and its Conservation, and Natural resources –meaning of ecology – structure and function of an ecosystem – producers – consumers – decomposers– energy flow in the ecosystem – ecological succession- food chain – food webs and ecological pyramids . Ecosystem – concept– types of ecosystems – structure and functions of forest ecosystem, grass land ecosystem- desert ecosystem, aquatic ecosystem. Biodiversity and its conservation introduction- definition- genetic, species and ecosystem diversity- value of biodiversity – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of diversity – threats to diversity – conservation of diversity in situ, ex-citu. Natural resources features- air resources, forest resources, water resources, mineral resources, food resources energy resources, land resources- over exploitation of natural resources- consequences conservation of natural resources- role of an individual in conservation of natural resources
(25 Hrs)

Module III: Industry and environment - pollution – environmental pollution – soil pollution – air pollution – water pollution – thermal pollution – noise pollution – causes, effect and control measures – waste management – waste minimisation through cleaner technologies – reuse and recycling - solid waste management.(18hrs)

Module IV: Social issues and environment – Unsustainable to sustainable development – urban problems related to energy - water conservation - water harvesting - resettlement and rehabilitation of people- environment ethics-waste land reclamation-consumerism and waste products. (15 hrs)

Module V: Human Population and environment – population growth – variation amoeg nations – population explosion – environment and human health – human rights – value education – Women and child welfare. (10hrs)

Note: All students must *visit a local area to document environmental issues and prepare a brief report on the same identifying issues involved and suggesting remedies.(This will be a part of the internal marks. i.e. for EVS the internal marks = attendance – 5 marks + test paper – 5 marks + field study report – 10 marks)*

Books recommended

Misra.S.P and Pandey .S.N. *Essential Environmental Studies*, Ane Books India, New Delhi.
Kiran B. Chokkas and others.*Understanding Environment*, Sage Publications New Delhi.
Arumugam N. and Kumaresan V. *Environmental Studies*, Saras Publications, Kanyakumari.
Benny Joseph. *Environmental Studies*, Tata McGraw-Hill Publishing Co.Ltd.,New Delhi.

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SEMESTER I

Paper 4: CO 214- PLANNING AND DEVELOPMENT ADMINISTRATION

Objectives:

1. To generate an overall insight on planning process in Indian Economy
2. To make the students aware about new planning initiatives in India

Module 1 - Structure of Indian Economy- Relevance of sectors in Indian Economy; Primary, Secondary and Tertiary Sectors-National Income-Methods of Computation-Inflation effects on Indian Economy- India's current National Income in comparison with leading economies of the world-Challenges. **(15Hrs)**

Module 2: Planning mechanism in India–Economic planning-features, types-Phases of Economic Planning-Growth and Planning Models-(Briefly mention) -State Planning Board-District Planning Board **(20Hrs)**

Module 3: Fiscal Policy-Centre-State financial relationship-Resource Allocation-Finance Commission-Development and Non Development expenditure-Preparation of budgets: Centre, State and Local Self Government-Deficit financing-Plan and Non-Plan Expenditure (Case Study: Evaluation of current Budget) **(20Hrs)**

Module 4 : Policy Initiatives in the Planning Process –Niti Aayog –Structure– Objectives –Functions-Guiding Principles -Vision Statement-Recent Policy initiatives: Make in India, Jan DhanYojana, Startup India, Swatch Bharath Abhiyan, Mudra Bank, Digital India – Future development initiatives **(20Hrs)**

Module 5: Role of State and Local Self Government-Planning initiatives in Kerala-Kerala Perspective Plan –Mission-Vision-Scope-Local Self Government –Role, Functions and Programmes **(15Hrs)**

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References:

1. Agarwal A.N. and Kundanlal (1999), Economics of Development and Planning, Vikas Publishing House, NewDelhi
2. Seth.M.L. and S.P. Singh (1998), Economic Planning: Theory andPractice, S.Chand and Company Ltd., Ram Nagar, NewDelhi
3. Dhingra.I.C. and V.K.Garg (2000), Economic Development and Planning in India, Sulthan Chand Publications, NewDelhi
4. Mishra S.K. and Puri V.K (2008), 26th Edition, Indian Economy,Himalaya Publishing House Pvt. Ltd.,Mumbai-
5. Desai and Bhale Rao (1986), Economic Planning and Policy,Himalaya Publishing House,Mumbai
6. Madan Mohan Batra (1987), Planning in India: development perspective towards the 21st century, V.K. Publishing House,Mysore
7. Misra and Puri (1999), Development and Planning Theory andPractice, Himalaya Publishing House,Mumbai
8. Gerald. M. Meier, and Robert E. Baldwin,(1957) (Reprint in 1975), Economic Development- Theory, History ,Policy, Asia Publishing House,Mumbai
9. Gerald. M. Meier, James E. Rauch,(2005), Leading Issues inEconomic Development, (8th Edition) Oxford University Press,Oxford,
10. Meier .G.M. (1995), Leading Issues in Economic Development (6thedition) Oxford University Press, NewDelhi.
11. Higgins Benjamin (1963), Economic Development, Principals, Problems and Policies, Central Book Depot,Allahabad
12. Kindleberger C.P. (1977), Economic Development (III edition) McGraw Hill NewYork.
13. Adelman. I (1961), Theories of Economic Growth and Development, Stanford Universities Press,Standford.
14. Bose. A, (1975), Marxian and Post Marxian Political Economy, PenuinLondon
15. Chakrvarthy S (1982), Alternative Approaches to the Theory of Economic Growth, Oxford University Press, NewDelhi.
16. Growth. S, (1986), An Introduction to Development Economics, Allen and Unwin
17. Little IMD (1982), Economic Development : Theory Policy and International Relations, Basic Books, NewYork
18. Schumpeter J.A., (1949), The Theory of Economic Development,Harvard University Press,Cambridige.
19. Bhagavathi J and Desai, (1970), India: Planning for Industrialization,Oxford University Press,Oxford
20. Jolly. R., (1973), Third World Employment, Penguin,Oxford
21. Sen.A.K. (1962), Choice of Techniques, Basil Backwall,Oxford

Scanner by Droid-Veda

SEMESTER I

Paper 1: CO 211- BUSINESS ETHICS AND CORPORATE GOVERNANCE

Objectives:

1. To convey basic understandings on the theories of Business Ethics
2. To provide a understanding on Corporate Governance practices and the provisions of the Companies Act relating to corporate governance

Module 1: Business Ethics and Ethical Practices: Ethics – Sources- Importance - factors influencing Business Ethics – Benchmarks on code of Ethics – Ethics Committees – Training Programmes – Ethical Decision Making – Ethics in Finance - Marketing and HR **(15Hrs)**

Module 2: Organization Culture: Features – Building and Maintaining Organization Culture – Organizational Socialization – Managing cultural Diversity – Work Ethics – Work Culture – Quality of Work Life – Work Life Balance – areas Improving Work Life Balance – Strategies of Work Life Balance **(20Hrs)**

Module 3: Corporate Governance: Importance – Objectives – Basic Ingredients of Corporate Governance – Principles - Theories – Phases of development of Corporate Governance in Global and Indian Perspectives – Code of Corporate Governance – Committees on Corporate Governance (Global and Indian) **(15Hrs)**

Module 4: Corporate Social Responsibility : CSR under Companies Act 2013 – Scope – Relevance – Importance – Areas of CSR – Arguments for and against CSR – Ackerman's model of CSR – SEBI – Clause 49 of listing agreement – Evaluation of Corporate Governance of a Company – Methods – Shareholder Value – EOCE, PAT, EPS, TSR, MVA, EVA and HVA - Corporate Philanthropy – Corporate Citizenship – Social Audit **(25 Hrs)**

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Module 5: Corporate Image and Excellence : Corporate image – building corporate image – Importance – Corporate Excellence – importance – Measures to achieve corporate excellence – New initiatives on corporate excellence - Role of Chairman – Qualifications – Power – Duties and Responsibilities – Board Committees – New Directions **(15Hrs)**

References:

1. Laura P Hartman, Perspectives in Business Ethics, Mc Graw Hill International
2. George A Steiner and John F Steiner, Business , Government and Society, Mc Graw Hill International
3. SK Chakraborthy, Ethics in Management Vedantic Perspectives, Oxford University Press
4. Subhash Sharma, Management in New Age: Western Windows – Eastern Doors, New Age International Publishing , New Delhi
5. Prof (Col.) PS Bajaj, Dr. Raj Agarwal – Business Ethics an Indian Perspectives, Biztantra2006.

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Part B: 11-22	8 out of 12; Short Answer	16
Part C: 23-31	6 out of 9; Short Essay	24
Part D: 32-35	2 out of 4; Essay	30
		Total = 80-80 marks

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Semester – I Core Course - 1 Course Code– CH1141 Credit-4

Inorganic Chemistry I

Lecture -Tutorial-Lab: 2-0-2 *36hrs.*

Aim of the Course

The course builds on the plus-two level introductory chemistry and familiarizes theoretical aspects of atomic structure and periodicity. Subsequently, it delves into the principles of acids, bases and nonaqueous solvents. The course will be highlighting the chemistry of hydrogen as well as s-block elements. The course also introduces the students an idea about environmental chemistry and different types of pollution.

Course objectives

The course helps to learn the students to understand the structure of atom, periodicity and non-aqueous solvents. Upon course completion, the student will be able to appreciate how the inner structure of elements dictates the chemical properties of elements and also understand how the elements are arranged in the periodic table and the properties and application of s -block elements, hydrogen and their compounds.

Course outline

Module I- Atomic Structure and Periodicity *6 hrs.*

Introduction to the structure of atom - Dual nature of electron - de Broglie equation - matter waves and electromagnetic waves - experimental verification of de Broglie relation - Heisenberg's uncertainty principle - expression and significance. Wave mechanical concept of the atom - Schrodinger equation (Derivation not required) -. Quantum numbers - Pauli's exclusion Principle - Aufbau Principle – Hund's rule - Electronic configuration of atoms - classification of elements into s, p, d, f blocks - electronegativity- Pauling's scale, Mulliken and Allred - Rochow scale-(Including numerical problems)

Module II-Hydrogen 6hrs

Position of hydrogen in the periodic table. - Similarities and difference in properties compared with alkali metals and halogens- Atomic and physical properties of hydrogen; Preparation of hydrogen- Reactions of hydrogen. Nascent, atomic and active hydrogen- Ortho and para hydrogen -Deuterium and tritium –Uses of hydrogen- Hydrogen as next generation fuel-Hydrides- Types of hydrides, properties; water; Hydrogen bond-types-consequences of hydrogen bond. Hydrates; Hardness of water- types- different methods water softening. Heavy water- preparation and properties.

Module III-S-Block Elements 9hrs

General characteristics, atomic and ionic radii, ionisation enthalpy, electropositive character, formation of univalent positive ions, hydration of ions, reducing properties, Electrode potentials, characteristic flame colouration, lattice enthalpy, chemical properties, , comparison of lithium with other members of the family, resemblance of lithium and magnesium, uses of alkali metals, properties of alkali metals and their uses, compounds of elements of group 1 – comparative study-oxides, hydroxides, halides, carbonates and bicarbonates General characteristics of group II-atomic and ionic radii, ionisation enthalpy, reducing properties, electrode

potentials, characteristic flame colouration, chemical properties, gradation in properties, comparison of beryllium with other members of the family, Uses of alkaline earth metals, Compounds of alkaline earth metals-Beryllium oxide, beryllium chloride, calcium oxide, calcium hydroxide, calcium cyanamide- preparation and properties. comparison of solubility products of hydroxides and sulphates, Portland cement.

Module IV -Acids, Bases and Non Aqueous Solvents *6hrs*

Lowery-bronsted and Lewis concepts of acids and bases-introduction to SHAB principle. General properties- classification- self ionization and levelling effect- reaction in non-aqueous solvents - protic and aprotic non aqueous solvents- examples- solutions of metals in liquid ammonia- self ionization of liquid ammonia- liquid SO_2, liquid HF, alkali metals in liquid ammonia

Module V - Environmental Chemistry – Air, Water and Soil Pollution *9 hrs.*

Air pollution - ozone layer depletion, ozone hole, protection of ozone umbrella –Air pollution caused by fire works, harmful effects of fireworks, acid rain, green house effect, smog –Classic and photochemical Smog-management of air pollution.

Water pollution: Causes- Heat, industrial waste, sewage water, detergents, agricultural pollutants - treatment of industrial waste water-Activated charcoal, Synthetic resin, reverse osmosis and electro dialysis - Quality of drinking water - Indian standard and W H O standard - Dissolved oxygen - BOD, COD.
Soil pollution - Pesticides, Fertilizers, Industrial waste, plastics - Control of pollution

References

1. T.F.Gieryn, Cultural boundaries of science Univ. Chicago Press 1999.
2. The Golem : What everyone should know about science. H.Collins and T.Pinch. Cambridge Univ Press 1993
3. Alexis Leon & Mathews Leon, Computers Today, Leon Vikas
4. SotiSivendraChanthra Contemporary Science Teaching,
5. ManasChanda, "Atomicstructure and Chemical Bonding including Molecular spectroscopy"
6. E.S. Gilreath "Fundamental concepts of Inorganic Chemistry"
7. Puri, Sharma and Kalia "Inorganic Chemistry"
8. Madan "Inorganic Chemistry".
9. Manku , "Theoretical principles of Inorganic Chemistry" -
10. M. C. Dey and J. Selbin "Theoretical Inorganic Chemistry".
11. F A Cotton and G. Wilkinson "Basic Inroganic Chemistry".
12. S. K. Banerji, "Environmental Chemistry".
13. A. K. De "Environmental Chemistry - An introduction"
14. B. K. Sharma "Air Pollution".
15. V. K. Ahluwalia "Environmental Chemistry"
16. G.W. vanLoon and S. J. Duffy "Environmental Chemistry: A global perspective"
17. Puri, Sharma and Kalia "Inorganic Chemistry"

the day of practical examination before a board of two Examiners for ESE. The viva-voce based on the project is conducted individually. Project topic once chosen shall not be repeated by any later batches of students. List of projects submitted year wise is to be maintained in a register and submitted before the examiners if requested.

The project report may contain the following sections:

1. Preliminary (Title page, declaration, certificate of the supervising teacher, content etc.)
2. Introduction with relevant literature review and objective
3. Materials and Methods
4. Results
5. Discussion
6. Conclusion / Summary 7. References.

Study tour and Factory/ research institute visit

Students are directed to visit one research institute/ chemical factory preferably with in the state of Kerala. Scientifically prepared hand written study tour report along with photographs of candidate at the places of visit must be submitted by each student for ESE on the day of the examination of project evaluation.

The board of examiners can decide the scheme of evaluation of project , study tour report and viva voce

Open Course for Other Majors-
Semester-5 Credit-2 Course-CH1551.1
2017 admission onwards
Essentials of Chemistry

Module 1:Atomic structure and Periodic Classification of Elements (9hrs) Structure of atom- Fundamental particles, atomic mass, atomic number, isotopes. Bohr theory of atom. Orbitals- Quantum numbers, aufbau principle, Hund's rule; Pauli's exclusion principle. Electronic configuration of atoms - half and completely filled orbitals. Modern periodic table: Periods, Groups, Periodicity- valency, atomic radius, electronegativity, Ionisation potential, Electron affinity.

Module 2 :Nuclear Chemistry (9 hrs)

Natural radioactivity, Nature and types of radiations, Properties. Group displacement law. Radio active decay series. Decay rate. Half life period, Average life period, Unit of radioactivity. Radiation dose, artificial radioactivity, nuclear structure. Nuclear fission and Nuclear fusion. Rock dating- Radio carbon dating. (*elementary idea only*)

Module 3 :Polymer Chemistry (9 hrs)

Classification of polymer: Origin, structure, synthesis, Molecular forces. Commercially important polymers: Application of polyethylene, polystyrene, polyhaloolefines, Nylon-6, Nylon-66, Melamine, Terylene, Bakelite, Natural and synthetic rubber, vulcanization, inorganic polymer: (*Examples Only*).

Module 4 :Chemistry in Biological Process (9hrs)

Vitamins: Vitamin-A, Vitamin-B2, Vitamin-C, Vitamin-D, Vitamin-E and Vitamin-K- Name, Source, Function and deficiency diseases. Enzymes- Classifications, characteristics, role, examples. Hormones - Sex hormones- Androgens, oestrogens, progesterone, Example, function. Cortical hormones- A few examples

with function. Nucleic acid- RNA, DNA: Introduction- role in life process (*No structure or chemical reactions needed*)

Module 5 : Chemistry in action (9hrs)

Dyes: classification based on constitution, application, examples, uses. Drugs: Antipyretic, analgesic, antiseptic, disinfectants, tranquilisers, antibiotics structure, name and uses only. Soaps and detergents: Hard and soft soaps, anionic, cationic and non-ionic detergents, cleansing action of soaps, Explosives: TNT, TNG, RDX, Gun cotton: name, structure and action. (*No structure or chemical reactions needed*)

Module 6 :Environmental Chemistry (9hrs)

Air Pollution: Types of pollutant in air- carbon monoxide, carbon dioxide, Nitrogen oxides, Sulphur dioxides, hydrogen sulphide, Cl_2, CFC, particulate matter, metals, fly ash, asbestos, hydrocarbons- source and influence. Acid rain, Green house effect, ozone layer and its depletion. Water Pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents. Hard and soft water, Removal of hardness, disadvantage of hard water. Soil pollution : Due to pesticides, herbicide, fungicide, long term use of fertilizers, plastic waste.

References

1. M. C. Day and J. Selbin,“ Theoretical Inorganic Chemistry”.
2. H. S. Arniker,“ Essentials of Nuclear Chemistry:
3. B.K. Sharma “Environmental Pollution”.
4. Solomons- John- Wiley, “Fundamentals of Organic Chemistry”.
5. F.A. Carey, Mc. GrawHill ,“Organic Chemistry” Inc. 226
6. I.L Finar,“Organic Chemistry”, Vol. 1 Longman
7. Tewari, Mehrotra- Vikas&Vishnoi,“A Text book for Organic Chemistry:
8. M.K. JainJain,“ Principles of Organic Chemistry”.
9. A.K. Dey,“Environmental Chemistry”.

University of Kerala
Model Question Paper
2017 admission onwards
Open Course for other Majors Course CH1551.1
Essentials of Chemistry

Time: 3 Hrs Total marks: 80

Section A.

Answer all the questions. Each question carries 1 mark

1. Who discovered radioactivity?
2. Name any unit of radioactivity. 3.What is the expansion of DNA?
4. Write an example of a sex hormone.
5. Name an enzyme.
6. State Afbau principle.
7. Draw Px orbital.

UNIVERSITY OF KERALA

Career Related First Degree Programme in
Environmental Science
&
Environment and Water Management

Under Choice Based Credit and Semester System
2015

kup 179(4)/2015-16

Table 1. Scheme of Instruction and Evaluation

Seme-ster	Course Code	Study component	Instructional hours / week		Credits	Evaluation		Total Credits
			Theory	Practical		CE	ESE	
I	EN 1111.3	English I	4	-	3	20%	80%	18
	1111.3	Additional Language I	3	-	3	20%	80%	
	EE 1121	Foundation Course I	3	-	3	20%	80%	
	EE 1131	Complementary Course I	3	-	3	20%	80%	
	EE 1132	Complementary Course Practical	-	2	-	20%	80%	
	EE 1141	Core Course I	3	-	3	20%	80%	
	EE 1142	Core Course Practical		2		20%	80%	
	EE 1171	Vocational Course I	3	-	3	20%	80%	
	EE 1172	Vocational Course Practical	-	2	-	20%	80%	
II	EN 1211.3	English II	4	-	3	20%	80%	24
	1211.3	Additional Language II	3	-	3	20%	80%	
	EE 1221	Foundation Course II	2	-	2	20%	80%	
	EE 1231	Complementary Course II	3	-	3	20%	80%	
	EE 1232	Complementary Course Practical		2	2	20%	80%	
	EE 1241	Core Course II	4	-	4	20%	80%	
	EE 1242	Core Course practical		2	2			
	EE 1271	Vocational Course II	3	-	3	20%	80%	
	EE 1272	Vocational Course Practical	-	2	2	20%	80%	
III	EN 1311.3	English III	5	-	3	20%	80%	19
	EE 1331	Complementary Course III	3	-	3	20%	80%	
	EE 1332	Complementary Course Practical	-	2	-	20%	80%	
	EE 1341	Core Course III	3	-	3	20%	80%	
	EE 1342	Core Course IV	3	-	3	20%	80%	
	EE 1343	Core Course Practical	-	2	-	20%	80%	
	EE 1371	Vocational Course III	4	-	4	20%	80%	
	EE 1372	Vocational Course IV	3	-	3	20%	80%	
	EE 1372	Vocational Course Practical	-	2	-	20%	80%	
IV	EN 1411.3	English IV	5	-	3	20%	80%	22
	EE 1431	Complementary Course IV	3	-	3	20%	80%	
	EE 1432	Complementary Course Practical		2	2	20%	80%	
	EE 1441	Core Course V	5	-	4	20%	80%	
	EE 1442	Core Course VI	2	-	2	20%	80%	
	EE 1443	Core Course Practical	-	2	2	20%	80%	
	EE 1471	Vocational Course V	4	-	4	20%	80%	
	EE 1472	Vocational Course Practical	-	2	2	20%	80%	

Seme-ster	Course Code	Study component	Instructional hours / week		Credits	Evaluation		Total Credits
			Theory	Practical		CE	ESE	
V	EE 1541	Core Course VII	4	-	4	20%	80%	16
	EE 1542	Core Course VIII	4	-	4	20%	80%	
	EE 1543	Core Course Practical	-	5	-	20%	80%	
	EE 1551	Open Course I	2	-	2	20%	80%	
	EE 1571	Vocational Course VI	3	-	3	20%	80%	
	EE 1572	Vocational Course VII	3	-	3	20%	80%	
	EE 1572	Vocational Course Practical	-	4	-	20%	80%	
VI	EE 1641	Core Course IX	3	-	3	20%	80%	21
	EE 1642	Core Course III	2	-	2	20%	80%	
	EE 1643	Core Course Practical	-	4	2	20%	80%	
	EE 1661.1 EE 1661.2 EE 1661.3 EE 1661.4	Elective Course I	2	-	2	20%	80%	
	EE 1671	Vocational Course VIII	3	-	3	20%	80%	
	EE 1671	Vocational Course IX	3	-	3	20%	80%	
	EE 1673	Vocational Course Practical	-	4	2	20%	80%	
	EE 1644	Project and Factory Visit	4	-	4	20%	80%	

Table showing the credits for the programme

First language-English

Semester	Working hours/week	No of Courses	No of Credits
Sem 1	4	1	3
Sem 2	4	1	3
Sem 3	5	1	3
Sem 4	5	1	3

Total No. of credits = 12

Additional language (Hindi/Malayalam)

Semester	Working/ hours	No of Courses	No of Credits
Sem 1	3	1	3
Sem2	3	1	3

Total No. of credits = 6

Complementary course (Chemistry)

Semester	Working hours/week Theory Practicals	Total Hours	No of Courses	No of credits
Sem 1	3 2+2#	7	1	3
Sem 2	3 2+2#	7	1	3
Sem 3	3 2+2#	7	1	3
Sem 4	3 2+2#	7	1+1*	3 + 4 *

 # The additional 2 hrs as per university regulation of work load for practicals if number of students exceeds 15 in a batch

**Practical Examinations will be conducted only on even semester by the university*

Total No of Credits 12+4=16

Foundation Course

Semester	Working hours/week Theory Practicals	Total Hours	No of Courses	No of credits
Sem 1	3	3	1	3
Sem 2	2 + 2 # *	6	1+1	2

 # 2 hrs as per university regulation of work load for practicals; Total No of Credits = 5

***Practical examination for foundation course**

Core Course (Environmental science)

Semester	Theory Hrs/ Week	Practical Hrs/week	Total Hrs	No of course	No of credits
Sem1	3	2 + 2#	7	1	3
Sem 2	4		4	1	4
Sem 3	6	2+2#	10	2	6
Sem 4	7	2+2#	11	2+1**	6+4**
Sem 5	8	4+4#	15	2	8
Open	3		3	1	2
Sem 6	5	4+4#	13	2+1***	5+4***
Elective	3		3	1	2

#2 hrs as per university regulation of work load for practicals

* Practical examination for foundation course and core course are conducted together as part I & II and the credit is included with core course of 2 credits

At the end of 4th semester; * At the end of 6th semester

**Practical Exam will be conducted by the university;*

Total No of credits 32+6=38

Vocational Course (Water Management)

Semester	Theory Hrs/ Week	Practical Hrs/week	Total Hrs	No of course	No of credits
Sem1	3	2+2#	7	1	3
Sem2	3	2+2#	7	1+1	3+2=5*
Sem3	7	2+2#	11	2	4+3=7
Sem4	4	2+2#	8	1+1*	4+2=6*
Sem5	6	4+4#+4+4#	22	2	3+3=6
Sem6	6	4+4#	14	2+1 *	3+3+2=8*
Project		4+4#	8	1	4

#2 hrs as per university regulation of work load for practicals

Practical Exam will beconducted by the university;

Total No of Credits 27+8=35

B.Sc Environmental Sciences & Environment and Water Management

Six semesters; One semester-18 weeks

Total No of Courses : 43

Sl.No	Study component	No.of courses	Total credit
1	Language English	4	12
2	Additional Lan(Hin/Mal)	2	6
3	Foundation course	2	5
4	Complementary course	6	16
5	Core course	13	38
6	Vocational course	12	35
7	Open Course	1	2
8	Elective courses	1	2
9	Dissertation	1	4
10	**Total**	**43**	**120**

Total No of Credits = 12+6+16+5+38+35+2+2+4=120

Semester 1

Semester	Study component	Title of course	Instructional Hrs
EN1111.3	English I	-	4x18=72
1111.3	Additional Language (Hin/Mal) I	-	3x18=54
EE1121	Foundation Course I	1. Computer Basics and Informatics	3x18=54
EE1141	Core Course I	1. Research Methodology and Perspectives of Science	3x18=54
EE1142	Core Course Practical	2. Environmental Science lab	2x18=36
EE1171	Vocational Course I	1.Water Resources and Fluid Mechanics	3x18= 54
EE1172	Vocational course Practical	2.Water Management Lab	2x18=36
EE1131	Complementary Course I	1.Theoretical Inorganic chemistry	3x18=54
EE1132	Complemetary Course Practical	2.Chemistry lab	2x18=36

Eng-4; SL-3; FC-3; CoreC-5; Vo C-5; Comp C-5; Total=25 Instructional Hrs/week

Semester II

Semester	Study component	Title of course	Instructional Hrs
EE1211.3	English II	-	4x18=72
EE1211.3	Additional Language (Hin/Mal) II	-	3x18=54
EE1221	Foundation Course	1.Computer Application for Biostatistics	2x18=36
EE1241	Core Course II	1. Environmental studies	4 x 18=72
EE 1242	Core Course practical	Environmental Science lab	2 x 18 = 36
EE1271	Vocational Course II	1.Water Resources management	3x18=54
EE1272	Vocational Course Practical	2.Water Management lab	2x18=36
EE1231	Complementary course II	1. Organic and Environmental Chemistry	3x18=54
EE1232	Complementary course Practical	2.Chemistry lab	2x18=36

Eng-4; SL-3; FC-2; Core C- 6; Vo C-5; Comp C- 5; Total=25 Instructional Hrs/week

Semester 1II

Semester	Study component	Title of course	Instructional Hrs
EE1311.1	English III	-	3x18=54
EE1341	Core Course III	1. Natural Resources and Conservation	3x18=54
EE1342	Core Course IV	2 Environmental Management	3x18=54
EE1343	Core Course Practical	3.Environmental Science lab	2x18=36
EE1371	Vocational III	1.Hydrology	4x18=72

EE1372	Vocational IV	2.Water Quality Parameters and Assessment	3x18=54
EE1373	Vocational Practical	3.Water Management lab	2x18=36
EE1331	Complementary III	1.Analytical Chemistry and Biomolecules	3x18=54
EE1332	Complementary Practical	2.Chemistry lab	2x18=36

Eng-3; CoreC-8; Vo C-9; Comp C-5; Total =25 Instructional Hrs/week

Semester 1V

Semester	Study component	Title of course	Instructional Hrs
EE1411.3	1.English IV	-	5x18=90
EE1441	Core CourseV	1.Environmental Biotechnology & Microbiology	5x18=90
EE1442	Core Course VI	2.Biophysics, Biostatistics and Computer Application	2x18=36
EE1443	Core Course Practical	3. Environmental Science lab	2x18=36
EE1471	Vocational V	1.Water Quality Management	4x18=72
EE1473	Vocational Practical	3.Water Management lab	2x18=36
EE1431	Complementary IV	1.Physical chemistry	3x18=54
EE1432	Complementary Practical	2.Chemistry lab	2x18=36

Eng-5; Core C- 9; Vo C- 6; Comp C-5; Total =25 Instructional Hrs/week

Semester V

Semester	Study component	Title of course	Instructional Hrs
EE1541	Core Course VII	1.Environmental Geology and Mineralogy	4x18=72
EE1542	Core course VIII	2.Natural Hazards and Meteorology	4x18=72
EE1543	Core Course Practicals	3.Environmental Science lab	5x18=90
EE1571	Vocational Course VI	1.Water pollution	3x18=54
EE1572	Vocational Course VII	2.Water quality Management- II	3x18=54
EE1573	Vocational course Practical	3.Water Management lab	4x18=72
EE1551	Open course	1.Solid Waste Management	2x18=36

Core C-13; Vo C-10; Open C-2; Total =25 Instructional Hrs/week

Semester VI

Semester	Study component	Title of course	Instructional Hrs
EE1641	Core course IX	1.Environmental Pollution and Control Measures-I	3x18=54

EE1642	Core course X	2 .Environmental Pollution and Control Measures-II	2x18=36
EE1643	Core Course Practical	3.Environmental Science lab	4x18=72
EE1671	Vocational Course VIII	1.Water Analysis	3x18=54
EE1672	Vocational Course IX	2Watershed Management	3x18=54
EE1673	Vocational Course practical	3.Water Management lab	4x18=72
EE1661.1 EE1641.2 EE1641.3 EE1641.4	4.Elective	a.Rain water Harvesting b.Environmental Aspects of Estuarine System c. Disaster Management d.Elementary Concepts in GIS & GPS	2x18=36
EE1644	Project	Environmental Science/ Water Management	4 x 18 = 72

Core C-9; Vo C-10; Project -4; Elective-2; Total = 25 Instructional Hrs/week

CORE COURSES

I . Research Methodology & Perspectives of Science

II. Environmental Studies

III. (1) Natural Resources and Conservation
(2) Environmental Management

IV. (1) Environmental Biotechnology and Microbiology
(2) Biophysics, Biostatistics and Computer Application

V (1) Environmental Geology and Mineralogy
(2) Natural Hazards and Meteorology

VI. (1) Environmental Pollution and Control Measures I
(2) Environmental Pollution and Control Measures II

VOCATIONAL COURSES

I. Water Resources and Fluid Mechanics

II. Water Resources Management

III (1) Hydrology
(2) Water Quality Parameters and Assessment

IV Water Quality Management -I

V (1) Water Pollution
(2) Water Quality Management-II

Semester 5 (Open Course) Solid Waste Management

VI (1) Water Analysis
(2) Watershed Management

Semester 6 (Elective Course)

a. Rain Water Harvesting
b. Environmental Aspects of Estuarine System
c. Disaster Management
d. Elementary Concepts in GIS & GPS

COMPLEMENTARYCOURSES

I . Theoretical Inorganic Chemistry

II . Organic and Environmental Chemistry

III. Analytical Chemistry and Biomolecules

IV. Physical Chemistry

FOUNDATION COURSE

I . Computer Basics & Informatics

II . Computer Application for Biostatistics

FOUNDATION COURSE

I . **Computer Basics & Informatics** 54 hrs

Computer

History and development of computers - basic knowledge of computer systems - softwares and hardwares - free softwares - M.S Word, Excel, Power point.

Computer ethics - software piracy – internet. Piracy – privacy- computer security; computer crimes - hacking and cracking. 9 hrs

Internet - managing bodies of the internet - Internet Society - Internet Service Provider - Internet application software. 9 hrs

Overview of Information Technology

Features of the modern personal computer and peripherals - Computer network. 9 hrs

Knowledge Skills

Data information and knowledge - Internet as knowledge repository - Introduction to use of IT in teaching and learning. Educational softwares. INFLIBNET - academic services. 9 hrs

Social Informatics

IT and society - overview of it's application in medicine, health care, environmental studies-defence, crime detection, communication. 9 hrs

Applications of IT in weather forecasting, education, film and media - virtual reality. 9 hrs

References

1. Cultural Boundaries of Science. T.F.Gieryn, University of Chicago press, 1999 .
2. Alexis Leon & Mathew Leons, Computers Today, Leon Vikas.
3. Alexis Leon & Mathew Leons, Computers Today, Leon Vikas. Fundamentals of Information Technology. ISBN 08125907890
4. Learning Computer Fundamentals, Khanna Book Publishers, ISBN, 818752252b
5. John Ray 10 Minute Guide to Linnx PHI, ISBN 81-203-1549-9.

II Computer Application for Biostatistics 36 hrs

Computer applications - preliminary concepts - sampling, sampling designs - sampling techniques - sample random – systematic sampling data - data presentation – numeric –alphabetic – alphanumeric. 9 hrs

Collection and representation of data - collection and classification tabulation of data.

Graphical representation of data - methods of preparation of graph - Frequency curve relative frequency map - cumulative frequency map - relative frequency map or ogive. Dot diagram -significance of graphic representation - limitations of graphic representation. 9hrs

Measures of central tendencies - mathematical average, average of position - measures of dispersion - range-mean deviation - standard deviation - distribution patterns. 9 hrs

Types of variability - experimental variation - biological variability, real variability - experimental variability, error, subjective, objective instrumental and sampling error. 9 hrs

References

1. Elements of Biostatistics -S.Prasad. ISBN 81-7133-613-2 Title code bc-33 First edition -2003 Rastogi publications, Gangotri, Shivagiroad-Meerut 250 002.
2. Methods in Biostatistics for Medical students & research works-V.K Mahajan. Jaypee Brothers Medical brothers Pvt Ltd, New Delhi- 6th edition.
3. Introduction to Biostastitics. Pranab Kumar Banerjee and S.Chand. ISBN81-219-2329-8. First edition 2004. Rajendra Raveendra Printers Pvt. Ltd., Ram Nagar, New Delhi 110 055.

FOUNDATION COURSE - PRACTICALS

Semester II Computer Application for Biostatistics

1. Create a power point presentation of wild life population.
2. Graphical representation - Bar, Pie charts of flora and fauna.
3. Plotting straight lines
4. Determination of Central tendencies

CORE COURSE

SEMESTER I Research Methodology & Perspectives of Science 54 hrs

Introduction to research Methodology

Research fundamentals and terminologies. Introduction - scientific method - meaning of research - comparison of scientific method & non scientific method - objectives of research-research methodology - types of research. 12 hrs

Defining research problems - formulation of the problem - developing the research plan. Research design – design – experimentation – evaluation - validity of experiment. 10 hrs

Statistical analysis and interpretation of data. Report writing and presentation. Writing and formatting of reports - report presentation. 8 hrs

Perspective of science

Design of an experiment – experimentation - data collection - interpretation and deduction repeatability and replication - documentation of experiments - record keeping - planning of experiment – designs - instrumental requirements - types of instrumentation - accuracy and precision. 14 hrs

Data handling in science

Significance of statistical tools in data interpretation - errors and inaccuracies. Ethics in science -scientific information - digital sources. 10 hrs

References

1. The Glen: What everyone should know about Science. H.Collins and T.Pinch, Cambridge University press, 1993.
2. Cultural Boundaries of Science. T.F.Gieryn, University of Chicago press, 1999
3. Elements of Biostatistics. S.Prasad. ISBN 81-7133-613-2. Title code bc-33 First edition -2003. Rastogi publications, Gangotri, Shivagiroad- Meerut 250 002.
4. Introduction to Biostastitics. Pranab Kumar Banerjee and S.Chand. ISBN81-219-2329-8, First edition 2004. Rajendra Raveendra Printers Pvt. Ltd. Ram Nagar, New Delhi.
5. Research methodology. Dipak Kumar. Bhatacharya Excel Books, A-5, Naraina, Phase-1, New Delhi.

SEMESTER I Core course (Practicals)

1. Sampling methods - Plant or animal community on land.
2. Population censusing methods - Total count, sampling.
3. Estimation of beetle in wheat flour.
4. Study of common flora and fauna.

II Environmental Studies 72 Hours

Unit 1 : Multidisciplinary nature of environmental studies; Definition, scope and importance, need for public awareness. (2 hrs)

Unit 2 : Natural Resources : Renewable and non-renewable resources : Natural resources and associated problems. a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources : World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. (12 hrs)

Unit 3 : Ecosystems : Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystems :-

a. Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (10 hrs)

Unit 4 : Biodiversity and its conservation : Introduction – Definition : genetic, species and ecosystem diversity.Biogeographical classification of India. Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity. (12 hrs)

Unit 5 : Environmental Pollution : Definition, cause, effects and control measures of :- a. Air pollution, b. Water pollution, c. Soil pollution, d. Marine pollution e. Noise pollution, f. Thermal pollution, g.

Nuclear hazards; Solid waste Management : Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case studies.; Disaster management : floods, earthquake, cyclone and landslides. (12 hrs)

Unit 6 : Social Issues and the Environment : From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rahabilitation of people; its problems and concerns. Case Studies; Environmental ethics : Issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies; Wasteland reclamation; Consumerism and waste products; Environment Protection Act.; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness. (12 hrs)

Unit 7 : Human Population and the Environment : Population growth, variation among nations; Population explosion – Family Welfare Programme; Environment and human health; Human Rights; Value Education; HIV/AIDS; Women and Child Welfare; Role of Information Technology in Environment and human health; Case Studies. (7 hrs

Unit 8 : Field work : Visit to a local area to document environmental assets river/ forest/grassland/hill/ mountain; Visit to a local polluted site-Urban/Rural/Industrial/Agricultural; Study of common plants, insects, birds; Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours). (5 hrs)

REFERENCES

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad –380 013, India, Email:mapin@icenet.net
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment
8. Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
10. Heywood, V.H &Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
16. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
17. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)

19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
20. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
21. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
22. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

SEMESTER II Core course (Practicals)

1. Identification of flora and fauna – terrestrial, marine and freshwater ecosystems
2. Estimation of primary productivity – light and dark bottle method
3. Community study : quadrat and line transect method
4. Construction of food chain/ food web : terrestrial and aquatic ecosystems

III Paper (1) Natural Resources and Conservation **54 hours**

Natural resources- definition and classification-Natural resources with reference to India. Renewable and non-renewable resources - Exhaustible and non- exhaustible resources; Mineral resources – distribution – production-coal fossil fuel 10 hrs

Biotic resources-forest and wild life – Biodiversity-hot spots in India-threat to biodiversity. *In situ* & *Exsitu* conservation. Soil and Land Land use pattern - Green revolution; River systems-climate and climatic regions of India. Seasons - onset and retreat of Monsoon –Drought – flood; Flood control programme. 12 hrs

Energy resources- Energy crises-Conventional and non -conventional energy -Types of energy .Fossile fuel – Hydel – Thermal – Nuclear – Solar – Wind – Biomass-Growing energy needs-Alternate energy sources. 10 hrs

Conservation- Minerals – soil- Forest- Wild life -Biotic resources – Fuel - Energy 10 hrs

Man and population, density, distribution-growth trends-sex ratio-age, Population explosion. 12 hrs

References

1. Economic and commercial geography of India T.C Sharma Coutinho, Vikas publishers- New Delhi
2. A Text book of Environmental sciences-PurohitShamiAgrawal-student Edition
3. India – ComprehensiveGeography.D.R.Khuller-Kalyani Publishers.
4. A.Text Book of Environmental studies.E.Barucha.University Press,Hydrabad.

SEM III Practicals

1. Measuring rainfall and calculation of normal rainfall.
2. Recording of maximum -minimum temperature
3. Recording of humidity.
4. Preparing a field map using prismatic compass.

SEM III Paper (2). Environmental Management **54 hrs**

Definition - Basic principles of Environmental Management. Environment Impact Assessment-Definition and aim, Principles and Concepts of EIA- EIA assessment methodologies - few case studies. 9 hrs

Concept of Sustainable Development - UN and International conferences - Rio summit Johannesburg conference on sustainable development; Copenhagen summit. 9 hrs

Environment laws and policies-Historical background of Environment laws - Environment Protection Act, Forest Conservation Act, The Wildlife protection Act, The Air Act, Water Act. 9 hrs

National Environment policies Public Interest Litigation (PIL)-List of cases like M.C.Mehtha vs Union Government of India. 9 hrs

Environment friendly products - pollution abatement technologies; concept of environmental planning - city planning. 9 hrs

Introduction to Environmental Economics.- environmental issues. 9 hrs

References

1. Environmental laws of India. An introduction. CPR Environmental Education Centre Chennai, 2000.
2. A text book on Environmental Studies. D.K.Asthana and Meera Athana. S.Chand and Co.
3. Ecology and Sustainable Development. P.S.Ramakrishnan. NBS New Delhi, 2001.
4. Environmental laws. Gurudip Singh. Macmillan India ltd.
5. Introductory Text of Environmental policies and laws. V.K.Garg, M.S Bishnoi, C.P Malik Kalyani Publishers, New Delhi.
6. Environmental Laws, Dharmendra.S.Sengar, Prentice Hall of India Pvt.ltd, Dew Delhi, 2000.

SEMESTER III Practicals

1. A Collection and submission of 5 Eco-friendly products.
2. A report of visit to a factory where Pollution abatement technology is implemented.
3. A report on environmental law case study in India.
4. A case study of EIA

SEM IV Paper 1 - Environmental Biotechnology and Microbiology (90 hours)

Biotechnology - definitions. Scope of biotechnology in agriculture, food production and nutrition. Impact of biotechnology on sustainability of the environment. Ethical and social impacts of biotehnology. Genetic Engineering - Brief study of gene cloning in prokaryotes. 12 hrs

Molecular tools for genetic engineering. Enzymes: Restriction endonucleases. Role of resrtiction endonucleases in genetic engineering. Recognition sequences, cleavage patterns. Mention of some common RE's - Eco RI, Bam I. Mention of the role of DNA ligases, Terminal transferase in genetic engineering. 12 hrs

Vectors: Role of vectors in GE. Mention of common vectors such as plasmids, bacteriophages, cosmids, artificial chromosome vectors like HAC, YAC, BAC. Host cells: Role of host cells in GE. Mention of prokaryotic hosts - *E coli*, *Bacillus subtilis*. Methods of gene transfer: Mention of transformation, conjugation, electroporation, lypofection, direct transfer. 12 hrs

Salient features of different microbial groups and their current classification - algae, fungi, bacteria, viruses, protozoa, mycoplasma and ricketsia. Microbial nutrition: Photoautotrophy, chemoaototrophy, heterotrophy. Interactions between microorganisms: commensalism, mutualism, parasitism and ammensalism. 12 hrs

Microbial interactions with plants: mycorhiza, rhizobium, actinomycetes and their interactions with legume associations and rhizosphere. Microorganisms in biomass and energy production: Microbes producing protein - single cell protein. Methane (Biogas or Gobar gas) 12 hrs

Environmental Microbiology - Different fields in environmental microbiology. Microbes and geochemical cycles - Nitrogen cycle, Sulphur cycle,.Microorganisms as geochemical agents. 12 hrs

Growth of micro organisms - cell cycle, population growth, batch culture, continuous culture. Mycelial growth. Environmental factors and microbial growth. 9 hrs

Microbes and environmental clean up - Biodegradation. Bioremediation - Need and scope. Environmental applications of bioremediation. Bioremediation technologies. Removal of toxic chemicals. 12 hrs

Epidemiology of microbial diseases of Man - Tuberculosis, Cholera, Hepatitis, AIDS, Histoplasmos, Aspergillosis, Amoebiasis and Malaria. 9 hrs

REFERENCES

1. Ecology & Environment, P.D. Sharma.
2. Enviromental Biology & Toxicology, P.D. Sharma.
3. General Microbiology Volume I & II C.B, Power & H.F. Daginawala. Himalaya Publishing house, New Delhi, 1982.
4. A text book of microbiology. Anathanarayana,S.
5. Microbiology P.D. Sharma, Restegi& Company, Meerut, 1989.
6. An Introduction to Microbiology, R.P. Singh & Kamal Central Book Depot, Allahabad 1989.
7. Ecology and Biology of Soil microorganisms: S.C. Bhandar & L.L. Somani, Agretech Publishing, Udaipur, 1994.
8. A text book of Microbiology. S.S. Purohit. Student edition, Jodhpur. 2004.
9. Biotechnology Applications and Carriers. MeenakshiMunshi, S.K. Sopory, Viva Book Pvt Ltd.
10. Basic Biotechnology. Rev.Fr. Dr. Ignacimuthu, S. J, Tata Mc Graw_Hill Publication Company Ltd.
11. Modern Concepts of Biotechnology. H.D. Kumar, Vikas Publishing House.
12. Biochemisry. U. Sathyanarayana.

SEMESTER IV PRACTICALS Paper -I

1. Demonstration of Sterilisation by dry heat and wet heat(Steam Autoclaving)
2. Cultutre media preparation using PDA (Potato Dextrose Agar)
3. Growth of *E.Coli* in liquid media.
4. Slides of specimens - Paramecium, Spirogyra, Pencillium, coliform bacteria.

SEMESTER IV Paper(2) Biophysics, Biostatistics and Computer Application 36 hrs

Biophysics

Light observation effect effect-Beer and Lambert's law.Absorption spectrum, Redox potential-Laws of photochemistry. Fluorenscence, phosphorescence and other photochemical reaction. 9 hrs

Principle and applications of light and electron microscopy, Spectrophotometry, mass spectrometry Absorption spectroscopy, X-ray analytical methods. 9 hrs

Biostatistics Various sampling methods, Measures of dispersion Test of significance, Chi square test and t-test statistical analysis using computer. 9 hrs

Internet browsing and websites for statistical analysis (Basic idea only). 9 hrs

References

1. Molecular structure and spectroscopy G.Arul Das, Prentice Hall 2007
2. Bio Physics-Principle and Techniques, -2005M.A Subramoniam .MPJ Publishers Chennai.
3. A.Text book of Spectroscopy.Banwell

SEMESTER V Paper (1) Environmental Geology and Mineralogy 72 hrs

Introduction to Geology - Environmental Geology - Definition and scope - Geological agents-Exogenous, and endogenous geological agents. Current views on origin of earth. 12 hrs

The classification of rocks based on their origin; concept of rock cycle; weathering. River as a geological agent; development of river. Rivers in India. 12 hrs

Streams - Drainage basin - Drainage pattern; energy in streams; factors controlling formation of soil; soil profiles. 12 hrs

Glaciers - Types and geological activity - wind -geological activity of wind. Meteorology -elements and factors of climate-influence weather and climate in agriculture; heat island - effect of climate change in ecosystem. 12 hrs

Crystals and minerals - Physical properties of minerals such as colour, streak lustre, hardness and specific gravity. Composition and diagnostic properties of minerals – Quartz, feldspar, talc gypsum, galena, beryl, corundum. 12 hrs

Nature and genetic relationship with igneous rocks-Textures of igneous rocks Megascopic features of the following rock types - granite, syenite, gabbro, basalt. 12 hrs

A brief study of the origin of sediments and sediment rocks. Feature of the following sedimentary rocks - sand stones. 12 hrs

References

1. Text book of Engineering, Geology,N. Chenna Kesaulu 1993 JNTU College of Engineering, Macmillan India limited.
2. Atmospheric Science and Environment, G.N.Ghosh. ISBN 81-7764-043-7-(C) 2000, Allied publishers Ltd.
3. A text book of Geology. Mukergee,P.K, 1986.
4. Engineering & General Geology, Parbinsingh,S.K.Katariah & sons, Gurunank market New Delhi.

SEMESTER V PRACTICALS Paper -II

1. Identification of common minerals & rocks
2. Identification of soil types - red soil, alluvial soil, black soil
3. Determination of soil moisture content.
4. Determination of soil pH
5. Determination of conductivity.
6. Estimation of organic carbon of soil

SEMESTERV Paper (2) Natural Hazards and Meteorology 72 hrs

Basic concept and definition of natural hazard and disaster - earth quake - distribution and causes; volcanoes - types and causes of volcanic eruptions. 12 hrs

Introduction to landslides, (Tsunami), cyclones, floods, hurricane, tornadoes, drought, fire; Causes, mitigation and management. 12 hrs

Anthropogenic disasters : chemical, industrial hazards, nuclear power plants, occupational hazards; hazards due to dam break. Mitigation measures. 12 hrs

Differences between natural disaster and artificial disasters. Environmental health hazard and risk management; Risk identification and assessment – prevention and mitigation. 12 hrs

Meteorology - elementary concept of climate, weather and climate. Clouds – types and classification; wind – forces affecting wind; types of wind and measurement; precipitation – measurement of precipitation; micrometereology 12 hrs

Climate change in agriculture; urban climatology; drivers of climate change – green house gases; effect of climate change on ecosystems, factors affecting climate. 12 hrs

References

1. A text book of Geology -Mukergee ,P.K 1986
2. Rutley's elements of MinerologyCBS.Publishers.New Delhi
3. Physical geography.StablerA.N.and Strahler,A,.H.1987
4. Principles of Petrology,TyrrelG.W.1948

SEMESTER VI. Paper (1) Environmental Pollution and Control Measures–I (54 hrs)

Air pollution - basic definitions and requirements - structure of atmosphere - composition of air, primary and secondary pollutants - unit for quantification of air pollution. Classification of air pollutants. 12 hrs

Automobiles exhaust - Emission standards - COx, NOx, SOx. Indoor air pollution. Effect of pollutants on plants and human beings. 9 hrs

From Factories - hydrocarbons, polychlorinated hydrocarbons; photochemical smog. 6 hrs

Control of air pollution - from factories-Automobile Exhaust-Automobile emission standards- Specific emission standards; Bharath Stages -I,II,III. Measures to check Industrial pollution. 9 hrs

Sources of correction - Control of particulate - removal of particulate matter. Control strategies - control of specific gaseous pollutants - Air Quality standards. 6 hrs

Hazardous Wastes – definition; dentification & classification - Generation of hazardous wastes - Management of hazardous wastes. Health and environmental effects of hazardous wastes-treatment methods. 12 hrs

References

1. A text book on Environmental Pollution and Control, Dr .H S. Bhatia, Galgotia Publications Private Ltd-5, Ansari road, Darya Ganj, Delhi-110 002.
2. Industrial Pollution, V.P.Kudesia, Pragati Prakashan, Meerut 250 001.
3. Air pollution, V.P.Kudesia, Pragathi Prakasan Meerut 250 001.

SEMESTER VI Paper (2) Environmental Pollution and Control Measures -II 36 hrs

Parameters of water pollution - standards of aquatic life. Classification of industrial wastes. 6 hrs

Land and soil pollution - Disposal on land - pesticides pollution- control of soil pollution. 6 hrs

Noise pollution – definition; measurement - decibels; effect of noise pollution on people; traffic noise pollution; industrial noise pollution. 6 hrs

Railway noise; aircraft noise; reduction of noise; absorption of sound. Control of noise pollution.6 hrs

Radioactive pollution - Kinds of radiation; nuclear reactions; natural sources of radioactive pollution; anthropogenic sources of radiation. Radioactive waste; biological effects of radiation pollution; dangers from nuclear plants. 6 hrs

Control from radiation - methods of control; minimizing X-ray hazard - Hazards of Radioactive pollution - Preventive measures from radiation. 6 hrs

References

1. A text book on Environmental pollution and Control. Dr .H S. Bhatia. Galgotia Publications private limited-5,Ansari road, Darya Ganj, Delhi-110 002.
2. Industrial Pollution. V.P.Kudesia-Pragati Prakashan, Meerut 250 001.
3. Air pollution. V.P.Kudesia, Pragathi Prakasan Meerut 250 001.

SEMESTER VI PRACTICALS Paper -I

INSTRUMENTATION (Demonstration)

1. pH meter
2. Conductivity meter
3. Turbidity meter
4. Colorimeter
5. Spectrophotometer

SEMESTER VI PRACTICALS Paper -II

1. Determination of COD
2. Analysis of anion mixture solution (2 Anions)among the following – Carbonate, sulphide, Thiosulphate, Oxalate, Chloride, Nitrate, Flouride, Sulphate, Phosphate
3. Thin layer Chromatographic separation of plant pigments.

Semester 6 (Elective)

a. Rain water Harvesting 3x18=54 hrs
b . Environmental Aspects of Estuarine System
c. Disaster management
d. Elementary concepts in GIS & GPS

Semester 5 (Open**) Solid Waste management** **54 hrs**

Solid wastes and its characteristics; classification of solid waste – source; factors affecting quality & quantity. Physical and chemical characteristics - collection & transportation. 9 hrs

Solid wastes from households, institutions, commercial establishment, public amenities; demolition sites; construction sites; mining & quarrying; sewage treatment plants. Types of solid wastes – municipal; agriculture; biomedical; hazardous; radioactive wastes. 9 hrs

Waste Management - global perspective - source reduction - Reuse and recycling. Disposal techniques - composting; principles of composting; factors affecting composting. Types of composting - Windrow layout and management. 9 hrs

Methane recovery; sanitary landfill - advantages and disadvantages of sanitary landfill. Methods of landfill. Incineration - types of incinerators - reactions involved - advantages and disadvantages of incineration. 9 hrs

Estimation of moisture content; determination of combustible matter; determination of calorific value; reactions involved. Functional elements of solid waste management. Disposal system with or without recoveries. 9 hrs

Summary of method of collection - transfer station; Vehicle and equipment for secondary collection. Ethical aspects of waste management; Pubic participation Law provisions. 9 hrs

References

A text book on Environmental pollution and Control. Dr .H S. Bhatia, Galgotia Publications private limited-5, Ansari road, Darya Ganj, Delhi-110 002.

Semester 6 (Elective)

a. Rain water Harvesting **36 hrs**

Rain water harvesting- Rainwater collection for drinking purpose; domestic rain water collection-community rain water collection. 6 hrs

Artificial recharge; methods of artificial recharge; roof water harvesting-surface water harvesting; dug cum borewells. 6 hrs

Mini artificial aquifer systems; borewell and hand pumps; artificial recharge in roads and colonies. Recycling and treating- methodology land use planning in watershed. 6 hrs

Rain water harvesting for sustainable development - water related sustainability issues in cities-Depletion of ground water table- concept of zero run off. Urban RWH practices. 6 hrs

The importance of watershed management in Kerala - Rain water harvesting in Institutional buildings. 6 hrs

Legal provisions in rain water harvesting in India and Kerala. 6 hrs

References

1. A.Keldho .T.I Sustainable watershed management strategies in semi arid regions of India .II Bombay email.eldho@civiliitb.ac.in.
2. KRG Rainwater Harvesting Foundation.

Semester 6 (Elective) **36 hrs**

b .Environmental Aspects of Estuarine System

The Estuary- definition - Physical features- salinity, temperature, circulation and mixing processes- Major and minor elements- chemical speciation in estuarine waters- Suspended matter in estuaries- adsorption and desorption processes- Sediment transport and sedimentation- Sediment- water interaction and the geochemistry of interstitial waters. 12 hrs

Nutrients, dissolved gases, and general biogeochemistry in estuaries- Biotic aspects of the chemistry of estuaries - Carbon dioxide - calcium carbonate system in estuaries. 12 hrs

Inorganic pollutants, particularly heavy metals in estuaries - Chlorinated hydrocarbons in estuaries- Oil pollution of the marine environment - with an emphasis on estuarine studies - Recovery and decontamination of estuaries. 12 hrs

References

1. Chemistry and Biogeochemistry of Estuaries. Edited by Eric Olausson and Ingemar Cato- John Wiley and Sons - New York.

2. Estuaries: monitoring and modeling the physical system. By Jack Hardisty. Blackwell Publishing.350 main street maldenMA 02148-5020, USA
3. Biogeochemistry of Estuaries, Thomas S. Bianchi. Department of Oceanography, Texas A&M University. Oxford University Press, 2007
4. Practical handbook of estuarine and marine pollution.

By Michael J. Kennish CRC press marine science series (For Oil Pollution and halogenated hydrocarbons)

Semester 6 (Elective)

d. Elementary concepts in GIS & GPS **36 hrs**

Map language – introduction; map as model; spatial elements terminology; classification of maps; map scale; map projection; grouping of map projection; commonly used map projections - Computer in map production; linkage of GIS to Remote Sensing. 9 hrs

Remote sensing; basic principles – Introduction; electromagnetic remote sensing process; nature of electromagnetic radiation. Electromagnetic spectrum; Energy interaction with earth's surface materials. 9 hrs

Fundamentals of GIS - roots of GIS; over view of information system; contribution; disciplines; GIS definition and terminology – Topology – Models - GIS queries - GIS architechture -Components of a GIS. 9 hrs

GIS Work Flow - functional elements of GIS - fundamentals of operations of GIS - theoretical frame work for GIS. GIS categories - level/scales of measurement. Nature of remote sensing-Remote sensing systems - Image display system. 9 hrs.

References

1. A Text book of Remote Sensing and Geographic Information Systems. M. Anji Reddy BS Publications 4-4-309,Giriraj Lane, sulthan Bazar, Hyderabad 500 095.
2. Remote sensing - Models and methods for image processing. Robert A. Schowengerdt-academic Press525 B street, suite 1900, San Diego,California-92101-4495.USA.

Semester 6 (Elective)
Disaster management **36 hrs**

Natural disasters **:** Introduction to - earthquake, volcanic eruptions, landslides, flash flood (Tsunami), major flood, storm surge, hurricane, tornadoes, drought 9 hrs

Anthropogenic disasters - disasters due to chemical, industrial, nuclear, domestic, dam break. 9 hrs

Pre-disaster, during disaster, post disaster; possibility of disaster - warning system - preparedness relief operations - National, State level, Local level – Agencies; concepts in remote sensing, GIS, GPS – applications. Rehabilitations - immediate, first stage, permanent. 9 hrs

Disaster assessment - casualty assessment; ecosystem damage - assessment. Introduction to disaster management. Management plan - preparedness, vulnerability of disaster, safety measures Role of NGO's - International, National, Regional (UN, Red Cross Army, Paramilitary NCC,NSS) 9 hrs

References

1. R.B.Singh (Ed) Environmental Geography, Heritage Publishers New Delhi,1990.
2. Savinder Singh Environmental Geography, PrayagPustak Bhawan, 1997.
3. Kates,B.I& White, G.F The Environment as Hazards, Oxford, New York, 1978.

4. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000.
5. H.K. Gupta (Ed) Disaster Management, Universities Press, India, 2003.
6. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo, 1994.
7. Dr. Satender , Disaster Management in Hills, Concept Publishing Co., New Delhi, 2003
8. A.S. Arya Action Plan For Earthquake, Disaster, Mitigation. In:V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994.
9. R.K. Bhandani An overview on Natural & Manmade Disaster & their Reduction, CSIR, New Delhi.
10. M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster Management,IIPA, New Delhi, 2001.

VOCATIONAL COURSES

SEMESTER I. Water Resources and Fluid Mechanics 36 hrs

Water as a resource material - multiple uses of water.-consumptive uses- irrigation; Partial consumptive uses-public water supply - Fire demand - Industrial uses - thermal uses. 9 hrs

Nuclear power generation - non consumptive uses - hydropower generation - inland navigation water resources – rivers, ponds, lakes. 9 hrs

Introduction to fluid mechanics - properties of fluids – density – viscosity - surface tension- types of flow - laminar flow - turbulent flow. 9 hrs

Reinhold's Number. Reynold's experiment - flow of water in open channels - pipes, calculation of flow velocity. Head losses – Dary-Weisbach equation; Hazen William's formula; Manning's formula (No derivation). 9 hrs

Reference

1. Ground Water Hydrology. David Keith Todd-Willey International.
2. Water resources Asit.K. Biswas Tata Macgraw Hill publishingcompany Ltd.
3 Hydrology and water resources. Sharma .RK .Dhanapathrai & Sons.
4 Water Technology N.F Gray 2nd Edition. Butterworth Haimann Publication.
5. AText book on Fluid Mechanics. R.K.Rajput.S.Chand & Company, New Delhi.

Practical

SEM- I

1. Measurement of rain fall
2. Measurement of Evaporation(Relative Humidity)
3. Measurement of atmospheric temperature
4. Record of humidity

SEMESTER II. Water Resources Management 54 hrs

Wate resources : types – surface water, ground water, water availability and uses. Water requirement for various uses - Industrial uses – aquaculture - recreational uses; Irrigational uses - definition of irrigation – necessity – benefits; ill effects - systems. 12 hrs

Lift irrigation – advantages – disadvantages-flow irrigation – Inundation – irrigation. Perennial system of irrigation.Direct irrigation-storage irrigation. 12 hrs

Surface irrigation methods - wild (uncontrolled) flooding method - furrow method - countour farming. Sub surface irrigation method - sprinkler irrigation - drip irrigation. Frequency of irrigation-standard of irrigation water. Irrigation efficiency. 12 hrs

Freshwater shortage; impact of climate on freshwater resources; management and conservation 6 hours

Reference

1. Irrigation Engineering, N.N.Basak.

2. Irrigation Water Power & Water resources Engineering, K.R.Arora Anand Publishers and distributors.

SEMESTER- II Practicals

1. Determination of pH of water sample
2. Determination of Alkalinity of water sample
3. Determination of SPM load of water.
4. Determination of Surface tension by drop weight method.
5. Determination of Surface tension by drop number method
6. Determination of Viscosity of a sample by Ostwalds Viscometer method
7. Determination of Humidity by Psychrometer.

SEMESTER III Paper (1)
Hydrology - I 72 hrs

Surface water hydrology

Hydrology (surface water); definition ; importance. Hydrologic cycle; climatic factors influencing hydraulic cycle – humidity, temperature, radiation, wind. Precipitation - condition for occurrence of precipitation. 9 hrs

Measurement of rainfall - different types of rain gauge; rainfall measurement by radar; errors in measurement; estimation of missing rainfall data; average rainfall over an area. Mean and annual rainfall; measurement of snow fall. 9 hrs

Characteristics of precipitations of India. Evaporators; factors affecting evaporation - Estimation of evaporation - evaporation pan method - Evaporation from soil surface. 9 hrs

Transpiration - Factors affecting infiltration rates. Infiltration rate; infiltration capacity; Infiltration indices; runoff; estimation of runoff; hydrograph; global water balance; water losses-inter basin transfer.

Ground water hydrology

Hydrology - ground water hydrology; occurrence of ground water; different types; Aquitard- Aquifuge - ground water collecting systems – wells. 9 hrs

Types of wells-collection – conveyance and distribution-general study-Ground water movement-Darcy's law (No derivation required); Ground water and well hydraulics. 9 hrs

Ground water and environmental influence-ground water level fluctuation due to stream flow-Evapo - transpiration; urbanization - ground water pollution by municipal, industrial, agriculture, domestic sources. 9 hrs

Saline water intrusion - Investigation of Ground water (Outline study only). Surface and ground water intrusion. Various types of underground sources. Infiltration galleries - Infiltration wells -Spring wells - open wells or dug wells - tube wells - different types. 9 hrs

Reference

1. Hydrology & Water Resources. Sharma R.K .Dhanapath Rai & Sons.
2. Engineering Hydrology Subramonian.K Tata Macgraw Hill publishing company ltd.
3.. Irrigation Engineering-N.N.Basak.
4. Water Supply Engineering. Santosh Kumar Garg. Khanna Publishers.
5. Water Resources Asit. K Biswas, Tata Macgraw Hill publishing company ltd.
6. Ground Water Hydrology, David Keeth, Todd-Willy international.
7. Ground Water by Ramakrishnan.

SEMESTER III Paper (2) Water Quality Parameters and Assessment 54 hrs

Water quality parameters - USPHS Scale and WHO scale, sampling; preservation. Water as a solvent. Collection of water sample. Analysis of natural and waste water sampling procedures. Main quality characteristics of water a) Alkalinity b)Hardness c) Total solids. 18 hrs

Physical properties of water- like BP, MP, critical temperature, viscosity, Surface tension, dielectric constant, dipole moment, Heat of vaporization; tolerance limits for trace metals in drinking water (Al, B, Cd, Co, Pb, Mn, Ni, Fe, Zn, Cr, Cu, Mo, Se, Sc). 16 hrs

International standards for Drinking water - pH, BOD, COD, B, As, Cd, Cr, NH_3, Fe, Cl, Hg, Mg, total hardness, pesticides, *E. Coli*, TDS; International standards for drinking water prescribed by WHO. 12 hrs

Water pollution - types of water pollution; Sources of water pollution; Harmful effects of water pollution - Strategies for water pollution control. 8 hrs

Reference

1. Environmental pollution -Management & Control for sustainable development. R. K. Khitoliya S. Chand & Company, Ram Nagar, New Delhi.
2. Laboratory Manual For Environmental Chemistry. SunithaHooda, Samanjeet Kaur. S. Chand & Company Ram Nagar New Delhi.
3. Water pollution. B.K.Sharma, Goel publishing House Meerut.

SEMESTER - III Practicals

1. Determination of Chlorine percentage in a sample of bleaching powder.
2. Determination of concentration of chloride ion in a sample of water sample
3. Determination dissolved oxygen in a sample of water.
4. Determination of density of water

SEMESTER IV Paper (2) Water quality Management -I 72 hrs

Water quality requirement and standards for various uses - drinking, industrial, irrigation aquaculture, cooling, recreation. 9hrs

Quality of water from different sources - water quality monitoring, sampling methods for waste water; stream and lake water, sediment. 9 hrs

Sampling equipments :Niskin water sampler, Nansen water sampler, Dussart flask. 9hrs

Water treatment processes; conventional process – sedimentation, coagulation, flocculation, filtration, disinfection. 9 hrs

Physical and chemical methods, UV rays, iodine and bromine – ozone – potassium permanganate – silver and chlorine. Different forms of chlorination. 9 hrs

Water softening - hardness and measurement of hardness - effects of hardness - removal of hardness. 9 hrs

Specific water treatment; removal of iron, manganese, chromium; Desalination. Reverse osmosis; electrodialysis; freezing method; multi flash evaporators 9 hrs

Fluoridation and de-fluoridation. Removal of dissolved gases from water - removal of oil - removal of radiomaterials. 9 hrs

Reference

1. Water supply Engineering B.C.Punmia, Asok Jain & Arun Jain. Lakshmi Publications, New Delhi.
2. Water and Waste Water Technology, Mark.J.Hammer. J Hammer, Printice Hall India Pvt. Ltd.
3. Waste Water Treatment for Pollution Control and Reuse, Tata Macgraw Hill publishing company.
4. Water Technology, N.F Gray Butter Worth, Heimann Oxford.
5. Chemical and Biological Methods of water pollution studies. R.K. Trivedi & R. K. Goel Environmental publication, Karad 1984.
6. Standard Methods for Examination of Water and Waste Water. APHA-Washington DC1985.
7. Ecological Methods for field and Laboratory Investigation, P.Michael. Tata Macgraw Hill publishing Company. New Delhi.

SEMESTER IV Practicals

1. Determination of BOD of a sample of water.
2. Determination of COD of a water sample
3. Determination of TDS in a sample of water.
4. Determination of Salinity in a sample of water
5. Determination of hardness of water

SEMESTER V Paper (1) Water Pollution 54 hrs

Sources of water pollution; physical pollution of water; chemical pollution of water; biological pollution of water. 9 hrs

Common impurities in water; testing of water; physical test; chemical test; bacteriological test. 9 hrs

Standards of drinking water. Water bone diseases; Maintenance of purity of water. Ground water pollution, factors affecting ground water pollution, harmful effects of ground water pollution. 9 hrs

Surface water pollution; Factors affecting surface water pollution - factors affecting nutrient loss in surface water - lake water pollution. 9 hrs

River water pollution - global river water pollution - sea water pollution-marine pollution. Control of pollution in seawater; role of microorganisms in cleanup operation. 9 hrs

Organic pollutants - synthetic detergents; ecofriendly detergents containing enzymes; eutrophication thermal pollution in water; esticide pollutants. 9 hrs

Reference

1. Water pollution. B.K.Sharma, Goel publishing House Meerut.

2. Water supply Engineering B.C.Punmia,Asok Jain & Arun Jain, Lakshmi Publications, New Delhi.

SEMESTER V Paper (2) Water quality management-II **54 hrs**

Quality and characterization of domestic waste water - physical Chemical and Biological Properties of waste water. Determination of COD, BOD. 9 hrs

Natural methods of sewage disposal : Dilution method, Sewage farming method, Self purification theory; Sanitary water management - sanitary waste; Definition-importance, historical back ground. Systems of sewage disposal. Dry conservancy system & water carriage system. 9 hrs

Sewage sickness - primary and secondary treatment - conventional and low cost - advanced waste water treatment including nitrogen and phosphorous removal - miscellaneous treatment of sewage 9 hrs

Oxidation pond – cesspool - septic tank - soak pit. Waste water disposal and reuse. Characteristics and treatment of industrial waste water : breweries and wineries; distilleries; paper and pulp mill; sugar mill; oil refineries. 9 hrs

Petrochemical industries; tanneries; pharmaceutical plants; fertiliser plant; electroplating industries; textile mills. 9 hrs

Treatment and disposal of sludge : thickening and digestion; conditioning and dewatering-incineration - ultimate disposal. 9 hrs

References

1. A Text book of Hydrology and Water Resources. R.K.Sharma. Dhanapath Rai & Sons.
2. Water Supply Engineering - Santosh Kumar, Garg-Khanna Publishers.
3. Environmental Engineering-N.N.Basak, Tata Macgraw Hill publishing company.
4. Pollution control in process industries-S.P.Mahajan.
5. WaterTechnology. N.F.Gray, Butter worth Heinmanm Publications.

SEMESTER - V Paper –I Practicals

1. Determination of chlorine demand a sample of water.
2. Determination of residual chlorine in a municipal water sample.
3. Determination of moisture percentage of soil.
4. Determination of PH of soil.

SEMESTER - V Paper –II Practicals

1. Gravimetric estimation of-
   a) Sulphate, oxalate
   b) Barium, Calcium, Iron, Nickel
2. Colorimetry & turbidimetry
   a) Sulphide, fluoride, silicate, ammonia & sulphate

SEMESTER -VI Paper -I WATER ANALYSIS 54 hrs

Various methods of analysis; Monitoring techniques and methodology ; Determination of pH - Specific conductance - Dissolved Oxygen, NH_3, NO_3^- & NO_2^-, Cl^-, F^-, CN^-, S^{-2}, SO_4^{-2}, PO_4^{-3}. 6 hrs

Total hardness (Ca& Mg), B, silica, metals and metalloids As, Se, Be, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ag, Zn. 6hrs

Chemical Oxygen Demand, Biological Oxygen Demand, Total Organic carbon, phenols, pesticides, surfactants, tannin and lignin. Microbial examination : Coliforms (*Escherichia coli*) and total bacteria. 6 hrs

Laboratory analysis of water sample; Determination of Turbidity of water sample - By Jacksons Turbidimeter, Baylis Turbidimeter and Nephelometers. Method to find the odour of a given water sample. 6 hrs

Method to find the colour of a given water sample. Method to determine the pH of given sample of water by colorimetric and electrometric method. 6 hrs

Method to find the carbonate, bicarbonate and hydroxide alkalinity of a water sample. Method to determine the concentration of chlorides of a given water sample. 6 hrs

Method to determine the total hardness of a water sample by standard EDTA method. Determination of residual chlorine in a given sample of water by (a) Orthotoludine Test; (b) Starch Iodide Test; (c) DPD Test 6 hrs

Method to determine the chlorine demand of a water sample; Method to determine the available chlorine percentage in a given sample of bleaching powder. 6 hrs

Method to determine the amountof dissolved oxygen (DO) of a water sample by Winkler Method; Method to find out the Suspended solids (SS), Dissolved solids(DS) and Total Solids (TS) of a water sample. 6 hrs

SEMESTER -VI Paper -(2) Watershed Management 54 hrs

Watershed – definition - classification of watershed - sub, milli, micro and mini watershed. Hydrology of watershed. 6 Hrs

Eco system in a watershed - Land use changes and resource degradation in watersheds-Agronomic measures for resource management in a watershed - choice of vegetation. 6 hrs

Land preparation - timely planting. Contour farming - multistoried cropping-mixed cropping-Inter cropping - strip cropping; mulching-cover cropping- crop rotation. 6 hrs

Vegetative hedges - barrier grass land management - agroforestery. Engineering measures - tank - vented cross bars and diversion weirs; stone pitched 6 hrs

Contour bunds, contour trenches and embankments of drains. 6 hrs

Water harvesting cum sediment detention tanks, earthen bunds, subsurface dams. 6 hrs

Watershed management for flood control. Geo textiles in watershed management. 6 hrs

Soil conservation; national water grid and river networking; initial attempts for watershed management in India. 6 hrs

An outline study of watershed management in Western Ghats Development Programme. 6hrs

SEMESTER VI Paper I Practicals

1. Volumetric Estimations

   a) Carbonate hardness-Hehner's method

   b) Non- Carbonate hardness- Hehner's method

   c) Mixture of Carbonate-Bi carbonate-warders method (N/20 HCL & std. sodium carbonate (2600 ppm)

   d) Sulphate ion in $H_2 SO_4$ (N/20 NaOH & std sodium carbonate(2600 ppm)

   e) Iodine in the solution (N/50 thiosulphate & std pot. dichromate (1000 ppm))

SEM -VI Paper II Practicals

f) Colorimetric estimations of

i.	nitrite	ii.	nitrate	iii.	phosphate	iv.	total nitrogen
v.	total phosphorous	vi.	sulphide	vii.	ammonia	viii.	silicate
ix.	fluoride	x.	ferrous iron and total iron.				

Project :-An investigatory Project report. This work may be based on Environmental Science (significance forEnvironment) or, project based on Water quality parameters (Local, Regional,state level, or National level important issues can be the topic of interest)

COMPLEMENTARY COURSES

I	Theoretical Inorganic chemistry	3x18=54 hrs
II	Organic and Environmental chemistry	3x18=54hrs
III	Biomolecules and Analytical chemistry	3x18=54 hrs
IV	Physical chemistry	3x18=54 hours

COMPLEMENTARY COURSES (Auxiliary Chemistry)

Semester-I Theoretical and Inorganic Chemistry **54 hours**

Module-1: Atomic Structure 9 Hrs

Atomic spectrum of Hydrogen - different series, , Bohr theory - postulates - statement of Bohr energy equation - derivation of spectral frequency from Bohr equation. Schrodinger wave equation (no derivation mention only) concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule - Pauli's principle, Hund's rule, stability of filled and half filled orbitals

Module - II Radio Activity and Nuclear Chemistry **9 Hrs**

Radio active equilibrium (qualitative only). Detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter - units of radio activity - Curie and Rutherford - Radio Carbon dating , Rock dating, Neutron activation analysis Applications in agriculture and medicine. A brief study of the biological effects of radiation such as pathological and genetic damage, Dosimetry - Units - rad, gray and roentgen. Nuclear Chemistry - stability of Nucleus - n/p ratio, artificial transmutation and radio activity, mass defect, binding energy, atomic fission and fusion.

Module III - Chemical bonding **9 Hrs**

Energetics of bond formation - Types of Chemical bonds - Energetics of ionic bond formation - Lattice energy - Born Haber Cycle - partial covalent nature of ionic bond - Fajan's rules , polarity of covalent bond

its relation with electronegativity - electro negativity scales - PaulingsScalefactors influencing polarity, dipolemoment-its relation to geometry.

Module IV - Chemical bonding II **9 hrs**

Hydrogen bond - inter and intra molecular - its consequences on boiling point -volatility and solubility. Hybridisation and structure of molecules - SP, SP^2, SP^3, dSP^2, dSP^3, SP^3d^2, and SP^3d^3hybridisation with examples. Explanation of bond angle in water and ammonia VSEPR theory, geometry of molecules with bond pairs of electrons only, geometry of molecules containing bond pairs and lone pairs of electrons, limitations. A brief review of molecular orbital approach, LCAO method -bond order, bond distance and stability of O_2,O_2^{2+},O_2^{2-},NO,NO+,COand HF.

Module V- Metallurgy **9 hrs**

General principles of occurrence and extraction of metals - purification, roasting, calcination and smelting, reduction to metal,different method with examples, refining of metals- electrolytic and zone refining. Van - Arkel method. Metallurgy of titanium, thorium and uranium.

Module VI- Coordination Chemistry **9 hrs**

Types of ligands, Werner's coordination theory, Valence bond theory of bonding in octahedral and tetrahedral complexes, Drawbacks of valence bond theory crystal field theory of octahedral and tetrahedral complexes, examples - high and low spin complexes, magnetic properties ,application in qualitative and quantitative analysis.

Semester II Organic and Environmental Chemistry **(54 hours)**

Module I - Introduction to organic reaction mechanisms **9hrs**

Types of reactions - substitution, addition, elimination and rearrangement reactions. Electrophilic and nucleophilic reagents - concept of inductive effect, hyper conjugative effect and resonance effect - reaction intermediates - carbocations, carbanions, carbenes, and free radicals - their formation, stability and configuration.

Module II - Stereochemistry **9hrs**

Optical isomerism- chirality, racemisation and resolution- relative and absolute configuration- DL and RS notations- asymmetric synthesis- optical isomerism due to restricted rotation- geometrical isomerism- EZ- nomenclature- conformation of ethane, propane, butane and cyclo hexane - Axial and equatorial bonds in cyclo hexane.

Module III - Polymer Chemistry **9 hrs**

Classification of polymers based on origin, structure, synthesis, and molecular forces. Commercially important polymers: structure and application of polyethylene, polystyrene, polyhaloolefines, Nylon-6, Nylon-66, Melamine, Terylene, Bakelite, Natural and synthetic rubber, vulcanization, inorganic polymer-silicones.

Module IV - Carbohydrates **9 hrs**

Classification- Configuration of glyceraldehydes, erythrose, threose, ribose, arabinose,glucose,fructose and mannose- properties of glucose and fructose-inter conversion of glucose and fructose- Industrial uses of cellulose- of macromolecules.

ModuleV - Environmental Chemistry **9 hrs**

Air Pollution: Types of pollutants in air- carbon monoxide, carbon dioxide, Nitrogen oxides, Sulphur dioxides, hydrogen sulphide, Cl_2, CFC, particulate matter, metals, fly ash, asbestos, hydrocarbons- source

and influence. Acid rain, Green house Gases, Green house effect, ozone layer and its depletion- Sulphatic, phosphatic, nitrogenous, chloride fertilizers-pollution due to long term use of fertilizers. Pesticides like chlorinated hydrocarbons, carbamates, organophosphorous compounds, organometallics, inorganic compounds- Non biodegradable pesticides - Environmental impact of pesticides. Detergents - cationic, anionic and non ionic-water pollution by detergents.

Module VI - Organometallic compounds **9 hrs**

Definition and classification - preparation, properties and applications of Grignard reagents, Ferrocene. Biological and environmental aspects. Applications in medicine, agriculture and horticulture - antitumour drugs.

Semester III Analytical Chemistry and Biomolecules **(54 hours)**

Module I - Spectroscopy I **9 hrs**

Regions of electromagnetic spectrum- interaction of radiation with matter-Various types of molecular spectra- Microwave spectroscopy- spectra of diatomic molecules-selection rule-frequency of separation of spectral line- determination of bond length- Infra red spectra-selection rule-frequency of separation- calculation of bond length.

Module II - Spectroscopy II **9 hrs**

Raman spectroscopy: Stoke's and antistoke's lines - Quantum theory of Raman spectra-advantage and disadvantage -complementary nature of Raman and IR spectra- Mutual exclusion principle.

Module III - Instrumental methods of analysis **9hrs**

Principle, Instrumentation and applications of : Atomic Absorption Spectroscopy- Flame photometry-Nephelometry and turbidimetry- colorimetry- spectrophotometry.

Module IV - Analytical Chemistry **9 hrs**

Solubility product- common ion effect- their applications in qualitative analysis- principles of volumetric analysis- primary standard-standard solution-normality and molarity -theory of acid base indicators-redox indicators-theory of complexometric titration. Accuracy and precision-classification of errors-detection and correction of determinate errors.

Module V - Chromatography **9 hrs**

Outline study of adsorption and partition chromatography-column, paper, thin layer, ion exchange , and gas chromatography- Rf value - relative merits of different techniques- separation of amino acids from mixtures.

Module VI- Bioinorganic compounds **9 hrs**

Metalloporphyrins - photosynthesis and respiration- haemoglobin – myoglobin - mechanism of O_2-CO_2 transportation - nitrogen fixation-carbon fixation - carbon cycle - biochemistry of iron toxicity and nutrition-essential and trace elements of biological systems

Semester IV Physical Chemistry **54 hrs**

Module I- Colloids **9hrs**

Properties of colloids-Tyndall effect-Ultra microscope-Brownian movement-electrophoresis-electroosmosis-sedimentation and streaming potentials- origin of charge and stability of colloids-zeta potential-Hardy Schulz rule- protective colloids-gold number- emulsions-gels-application of colloids-clarification of water-Cottrell precipitator-delta formation-medicines-sewage disposal-emulsification and cleansing action of soaps and detergents.

Module II- Electrochemistry **9 hrs**

Conductance- specific, equivalent and molar conductance-measurement using conductivity meter-variation with dilution - conductometric titration- principle-merits- strong acid-strong base titration & weak acid - strong base titration.

Electrochemical cell- cell potential and electrode potential- standard electrode potential -electro chemical series-SHE -measurement of electrode potential- Nernst equation for electrode potential(No derivation)-Calomel electrode, pH electrodes-Glass electrode, Quinhydrone electrode- fuel cell.

Module III- Binary liquid systems **9 hrs**

Completely miscible liquid pairs, vapour pressure - composition curves, boiling point- composition curves, fractional distillation, Azeotropic mixtures, critical solution temperature, Conjugate layers, phenol-water system. Theory of steam distillation, distribution law, limitations of distribution law, application of distribution law solvent extraction.

Module IV- Thermodynamics **9 hrs**

First law - intrinsic energy and enthalpy - work done during reversible isothermal expansion-second law of thermodynamics-entropy and free energy - concept of spontaneity and reversibility, Gibb's Helmholtz equation - derivation of relation between heat of reaction at constant pressure and constant volume - Hess's law - bond energy and bond dissociation energy -measurement based on Hess's law - Third law of thermodynamics.

Module V- Equilibrium **9 hrs**

Chemical equilibrium - relation between Kp and Kc-Vant Hoff's isotherm equation and isochoric equation- relation connecting equilibrium constant and degree of dissociation for the following systems: $2NH_3$ $N_2 + 3H_2$, PCl_5 $PCl_3 + Cl_2$ - degree of dissociation- determination from density measurement- Le Chatelier principle and its applications. Concept of acid and bases-ionic product of water- pH, pOH ,pKw- ionization constants of weak acids and bases- Buffer solution- Henderson equation-calculation of pH of solutions.

Module VI- Chemical Kinetics, Catalysis and Photochemistry **9hrs**

Order and molecularity, derivation of rate equation for zero, first and second order reactions (same initial concentrations) - determination of order of reactions—effect of temperature on rate of reactions-concept of activation energy-illustration of exothermic and endothermic reactions based on it- Arrhenius equation-determination of Arrhenius parameters -intermediate compound formation theory and adsorption theory of catalytic reactions.

Practicals

Semester I & II- Qualitative Analysis **72 hrs**

1) Reactions of anions - carbonate, sulphide, sulphate, thiosulphate, oxalate, nitrite, nitrate, chloride, phosphate, fluoride (No exam)
2) Identification by flame colouration : Lithium, sodium, potassium, barium, calcium, strontium(No exam)
3) Reactions of cations: Ag^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Al^{3+}, Fe^{2+}, Fe^{3+}, Zn^{2+}, Mn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH_4^+
4) Analysis of solution containing mixture of two cations- at least 10 mixtures (Avoid same group)

Semester III & IV- Quantitative Analysis **72 hrs**

I. **Volumetric Analysis**

a) Acidimetry and alkalimetry

1) Estimation of NaOH using Na_2CO_3
2) Estimation of KOH using Na_2CO_3
3) Estimation of K_2CO_3 using Na_2CO_3
4) Estimation of H_2SO_4 using oxalic acid
5) Estimation of HNO_3 using oxalic acid

b) Permanganometry
1) Estimation of Fe^{2+} using oxalic acid
2) Estimation of sod.oxalate using Mohr's salt
3) Estimation of Fe^{2+} using oxalic acid
4) Estimation of Mohr's salt using oxalic acid

c) Dichrometry
1) Estimation of Fe^{2+} using internal indicator
2) Estimation of Fe^{2+} using external indicator

d) Iodometry and Iodimetry
1) Estimation of iodine
2) Estimation of copper

e) Complexometry
1) Estimation of Zinc
2) Estimation of Mg

II Gravimetric Analysis (No Exam)

1) Estimation of water of hydration in barium chloride crystals
2) Estimation of barium in barium chloride solution

References

1) Atomic structure and chemical bonding with introduction to molecular spectroscopy, Manas Chanda.
2) Concise Inorganic Chemistry,J.D.Lee
3) Elements of Nuclear Chemistry, Arnikar
4) EnvironmentalChemistry,A.K De.
5) Essentials of Physical Chemistry, Bahl,Tuli and ArunBahl.
6) A. I. Vogel, "Text book of Qualitative Analysis"
7) A. I. Vogel, "Text book of Quantitative Inorganic Analysis".
8) A. K. Srivasthava and P. C. Jain, "Chemical Analysis".
9) Coordination Chemistry : Bosolo and Johnson.
10) Coordination Chemistry : S. F. A. Kettle.
11) Instrumental Methods of Analysis,B.K Sharma.

UNIVERSITY OF KERALA

Career Related First Degree Programme in Environmental Science

&

Environment and Water Management

Under Choice Based Credit and Semester System

2015

kup 179(4)/2015-'16

സെമസ്റ്റർ	**:**	**IV**
കോഴ്സ് കോഡ്	**:**	**ML 1431**
കോംപ്ലിമെന്ററി കോഴ്സ്	**:**	**VII**
സമയക്രമം	**:**	**ആഴ്ചയിൽ 3 മണിക്കൂർ (18 ആഴ്ചയിൽ 54 മണിക്കൂർ)**
ക്രെഡിറ്റ്	**:**	**3**

ദലിതെഴുത്ത്, പെണ്ണെഴുത്ത്: സിദ്ധാന്തവും ആവിഷ്ക്കാരവും

പഠനോദ്ദേശ്യം:

ദലിത് പഠനമെന്ന വിജ്ഞാനമേഖലയുടെ പശ്ചാത്തലത്തിൽ മലയാളത്തിലെ ദലിത് സാഹിത്യത്തെ തിരിച്ചറിയുക - മലയാളികളുടെ സാംസ്കാരികവൈവിധ്യം സാഹിത്യ വഴിയിൽ മനസ്സിലാക്കുക - ചരിത്രത്തിന്റെ വ്യത്യസ്ത ഇടങ്ങളിൽ പാർശ്വവൽക്കരിക്ക പ്പെട്ട ജനവിഭാഗങ്ങളെയും അവരുടെ സംസ്കാരത്തെയും സാഹിത്യത്തെയും കുറിച്ച് അറിയുക - മുഖ്യധാരാസംസ്കാരത്തിന്റെ സാഹചര്യങ്ങൾക്കു പുറത്ത് രൂപപ്പെട്ട സംസ് കാരത്തിന്റെ ഒരു ജനകീയധാരയെക്കുറിച്ചു ബോധ്യപ്പെടുക.

സമീപകാല സൈദ്ധാന്തികപഠനങ്ങളിൽ ഏറെ പരാമർശിക്കപ്പെടുകയും വിമർശിക്ക പ്പെടുകയുംചെയ്ത 'സ്ത്രീവാദ'ത്തെ പരിചയപ്പെടുക - ലിംഗപരമായ വ്യത്യസ്തത യുടെ അടിസ്ഥാനത്തിലുള്ള വിവേചനത്തിൽ നിന്നും സ്ത്രീകൾക്കു തുല്യനീതി ഉറപ്പാ ക്കുക എന്ന ലക്ഷ്യത്തോടെ രൂപപ്പെടുത്തിയ ചിന്താപദ്ധതിയും പ്രവർത്തനവും എന്ന നിലയിൽ അതിനെ തിരിച്ചറിയുക - സ്ത്രീകളുടെ വൈയക്തികവും സാമൂഹികവുമായ യാഥാർത്ഥ്യത്തെ വെളിപ്പെടുത്തുകയും ലിംഗകേന്ദ്രിതമായ എല്ലാത്തരം പാർശ്വവല്ക്ക രണത്തെയും ചെറുക്കുകയുമാണ് അതിന്റെ രീതിശാസ്ത്രം എന്നു മനസ്സിലാക്കുക - ഫെമിനിസത്തിന്റെ ചരിത്രവികാസത്തിന്റെയും സിദ്ധാന്തങ്ങളുടെയും പൊതു പശ്ചാ ത്തലത്തിൽ മലയാളത്തിലെ സ്ത്രീപക്ഷരചനകളെ പഠിക്കുക.

സംസ്കാരത്തിലെ വംശ, വർഗ്ഗ, മത, ജാതി, ലിംഗനിർണയനങ്ങളെക്കുറിച്ചുള്ള ധാരണ നവീകരിക്കുകയും മാറുന്ന ലോകത്തിന്റെ പരിതഃസ്ഥിതികളിൽ നിന്നുകൊണ്ട് ഒരു പുതിയ മാനവീയതയെക്കുറിച്ചുള്ള അവബോധം സൃഷ്ടിക്കുകയും ചെയ്യുക എന്നതാണ് ഈ കോഴ്സിന്റെ സവിശേഷ ലക്ഷ്യം.

രീതിശാസ്ത്രം

ഈ കോഴ്സിന്റെ പഠനത്തിനു രണ്ടുതലങ്ങളുണ്ട്. ഒന്ന്: സിദ്ധാന്തതലം. രണ്ട്: ആവിഷ്ക്കാരതലം. സിദ്ധാന്തതലത്തിൽ ദലിതെഴുത്തിനും പെണ്ണെഴുത്തിനും ആസ്പദമായ അവസ്ഥകളെയും സിദ്ധാന്തങ്ങളെയും സാമാന്യമായി പരിചയപ്പെടു ത്തുന്നു. ആവിഷ്ക്കാരതലത്തിൽ ദലിതെഴുത്ത്, പെണ്ണെഴുത്ത് മാതൃകകൾ പരിചയ പ്പെടുത്തുകയും വിശദപഠനം ഏതാനും രചനകളിലായി പരിമിതപ്പെടുത്തുകയും ചെയ്യുന്നു.

പാഠ്യപദ്ധതി

മൊഡ്യൂൾ : ഒന്ന് (9 മണിക്കൂർ)

ദലിതെഴുത്ത്

ദലിത് എന്ന പദത്തിന്റെ നിഷ്പത്തി - ഇതര സംജ്ഞകൾ - ദലിത് പദത്തിന്റെ വ്യത്യസ്ത വ്യാഖ്യാനങ്ങൾ - ദലിത്പഠനത്തിന്റെ സാമാന്യചരിത്രം - ആഫ്രിക്കൻ - അമേരിക്കൻ എഴുത്തും കറുപ്പിന്റെ സാംസ്കാരിക മുന്നേറ്റങ്ങളും - ഇന്ത്യൻ പശ്ചാത്തലം - മലയാളത്തിലെ ദലിത് സാഹിത്യം - സാമാന്യ അവലോകനം - വാമൊഴി - വരമൊഴി ഭേദങ്ങൾ.

മൊഡ്യൂൾ : രണ്ട് (18 മണിക്കൂർ)

എ. വാമൊഴി സാഹിത്യമാതൃക :

പാലുവം പെണ്ണിനെത്തേടി (നാടൻപാട്ട്)

ബി. വരമൊഴി സാഹിത്യമാതൃകകൾ :

I കവിത

1. എന്റെ വംശത്തെപ്പറ്റി.... - പൊയ്കയിൽ അപ്പച്ചൻ
2. അമ്മ ഒരു കാല്പനിക കവിത - വിജില ചിറപ്പാട്.
3. കറുത്ത കല്ല് - എസ്. ജോസഫ്

II ചെറുകഥ

1. നിരവത്ത് കയ്യാണി - സി. അയ്യപ്പൻ
2. നിസ്സഹായരുടെ നിലവിളി - നാരായൻ

III നോവൽ

എരി - പ്രദീപൻ പാമ്പിരിക്കുന്ന്

സഹായകഗ്രന്ഥങ്ങൾ

1. ദലിത്പഠനം : സ്വത്വം, സംസ്കാരം, സാഹിത്യം - ഡോ. പ്രദീപൻ പാമ്പിരിക്കുന്ന്, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
2. ദലിത് തിരിച്ചറിവുകൾ (എഡി:) ഡോ. അജു. കെ. നാരായണൻ, ഭൂമിമലയാളം, യു.സി. കോളേജ്, ആലുവ.
3. ദലിത്പാതകൾ : (എഡി.) ബോബി തോമസ്, സൈൻ ബുക്സ്, തിരുവനന്തപുരം.
4. ബുദ്ധനിലേക്കുള്ള ദൂരം - കെ. കെ കൊച്ച്, ഡി. സി. ബുക്സ്.
5. ദലിത് സാഹിത്യപ്രസ്ഥാനം - കെ. എം. പുരുഷോത്തമൻ, സാഹിത്യഅക്കാദമി.
6. ദലിത് സാഹിത്യം - കവിയൂർ മുരളി, കറന്റ് ബുക്സ്, കോട്ടയം.
7. ദലിത് ഭാഷ - കവിയൂർ മുരളി.
8. കീഴാളജീവിതമുദ്രകൾ - ഡോ. പി. ജി. പത്മിനി, സമയം പബ്ലിക്കേഷൻസ്.
9. ദലിത് വർത്തമാനം (എഡി.) രാജേഷ് ചിറപ്പാട്, മൈത്രി ബുക്സ്, തിരുവനന്തപുരം.
10. 500 വർഷത്തെ കേരളം - ചില അറിവടയാളങ്ങൾ - (ജന. എഡി.) ഡോ. സ്കറിയാ സക്കറിയ, താരതമ്യപഠനസംഘം, കറന്റ് ബുക്സ്, കോട്ടയം.

11. വായനയുടെ ദലിത് പാഠം - കെ. കെ. കൊച്ച്, പൂർണ്ണ പബ്ലിക്കേഷൻസ്.
12. ദലിതന്റെ നിനവും നോവും നാടൻ പാട്ടുകളിൽ - ഡോ. കുമാരൻ വയലേരി, പാപ്പിയോൺ, കോഴിക്കോട്.
13. ദലിത് സാഹിത്യം പരസ്യകല - ഡോ. വി. സി. സുപ്രിയ/ ഡോ. കെ. കെ. ശിവദാസ്, ഡോ. സന്തോഷ് മാനിച്ചേരി - മാളുബൻ പബ്ലിക്കേഷൻസ്.
14. കീഴാളന്റെ പ്രതിരോധതന്ത്രം - ഷീബ എം. കുര്യൻ.
15. കാവ്യഭാവനയുടെ സ്ത്രീപഠനങ്ങൾ - ഡോ. എ. ഷീലാകുമാരി.

മൊഡ്യൂൾ : മൂന്ന് (9 മണിക്കൂർ)

പെണ്ണെഴുത്ത്

സ്ത്രീവാദചിന്തയുടെ ആദ്യാങ്കുരങ്ങൾ - ഇക്കാലത്തെ ഫെമിനിസ്റ്റു ചിന്തയിലെ ശ്രദ്ധേയ വ്യക്തിത്വങ്ങൾ - കൃതികൾ - സ്ത്രീവാദത്തിലെ വ്യത്യസ്ത ധാരകൾ - ഒന്നാംതരംഗ സ്ത്രീവാദം - രണ്ടാംതരംഗസ്ത്രീവാദം - മൂന്നാംതരംഗസ്ത്രീവാദം, പ്രധാന വ്യക്തിത്വങ്ങളും കൃതികളും - ശ്രദ്ധേയങ്ങളായ ഉപധാരകൾ - ഉദാരസ്ത്രീവാദം (Liberal feminism), സോഷ്യലിസ്റ്റു സ്ത്രീവാദം, മാർക്സിസ്റ്റുസ്ത്രീവാദം, മൗലിക സ്ത്രീവാദം (Radical feminism), കറുത്തസ്ത്രീവാദം (Black feminism), എക്കോ ഫെമിനിസം - സ്ത്രീവാദവും സാഹിത്യവും - സ്ത്രൈണ സർഗ്ഗാത്മകതയെക്കുറിച്ചുള്ള വ്യത്യസ്ത സമീപനങ്ങൾ - ഭാഷയുടെ ലിംഗകേന്ദ്രിത സ്വഭാവം - ഇവയെക്കുറിച്ചുള്ള സാമാന്യപഠനം - കേരളത്തിലെ സ്ത്രീമുന്നേറ്റങ്ങളുടെ ചരിത്രപശ്ചാത്തലം - മലയാളത്തിലെ സ്ത്രീരചനാപാരമ്പര്യങ്ങൾ - ആദ്യകാല എഴുത്തുകാരികൾ - തുടർന്നുള്ള ഘട്ടങ്ങൾ - മുഖ്യസംഭാവനകൾ.

മൊഡ്യൂൾ : നാല് (18 മണിക്കൂർ)

പെണ്ണെഴുത്ത് : മലയാള മാതൃകകൾ

എ. കവിത

1. കെട്ടിയിട്ട കോലാട് - കമലാദാസ് (വിവ. സച്ചിദാനന്ദൻ)
   (ഈ പേരിലുള്ള കവിത മാത്രം)
2. പ്രതിഷ്ഠ - സാവിത്രിരാജീവൻ
3. പെണ്ണുങ്ങൾ കാണാത്ത പാതിരാനേരങ്ങൾ - വി. എം. ഗിരിജ
   (ഈ പേരിലുള്ള കവിത മാത്രം)

ബി. കഥ

1. പരാജിത - രാജലക്ഷ്മി
2. വനദുർഗ്ഗ - സാറാജോസഫ്
3. ഇത്തവണ രാധ - പ്രിയ. എ. എസ്.

സി. ആത്മകഥ

നഷ്ടബോധങ്ങളില്ലാതെ (ആത്മകഥ) - ദേവകി നിലയങ്ങോട്

സഹായകഗ്രന്ഥങ്ങൾ

1. ഫെമിനിസം : ചരിത്രപരമായ ഒരന്വേഷണം - ഡോ. എം. ലീലാവതി, ചിന്ത, പബ്ലിഷേഴ്സ്.
2. ഫെമിനിസം - വാല്യം 1, 2 (എഡി.) ഡോ. ജാൻസി ജയിംസ്, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
3. കേരളത്തിലെ സ്ത്രീമുന്നേറ്റങ്ങളുടെ ചരിത്രം - സി. എസ്. ചന്ദ്രിക, സാഹിത്യ അക്കാദമി.
4. ആദ്യകാല സ്ത്രീകഥകൾ - (എഡി.) ഡോ. എം. എം. ബഷീർ, ലിപി പബ്ലി ക്കേഷൻസ്.
5. സ്ത്രീവാദം - ജെ. ദേവിക, ഡി. സി. ബുക്സ്.
6. സ്ത്രീരചനാദർശനം : ഒരു അവലോകനം - പ്രശാന്ത് കുമാർ. എൻ., എൻ.ബി. എസ്. കോട്ടയം.
7. സ്ത്രീസ്വത്വാവിഷ്ക്കാരം മലയാളത്തിൽ - ഡോ. എം. ലീലാവതി, സാഹിത്യ അക്കാഡമി, തൃശൂർ.
8. സ്ത്രീവിമോചനം : ചരിത്രം, സിദ്ധാന്തം, പഠനം - എ. കെ. രാമകൃഷ്ണൻ/ കെ. എം. വേണുഗോപാലൻ, നയനാബുക്സ്, പയ്യന്നൂർ.
9. ആധുനിക മലയാളകവിതയിലെ സ്ത്രീപക്ഷ സമീപനങ്ങൾ - പി. ഗീത, ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
10. ഇക്കൊഫെമിനിസം, ഇക്കോടൂറിസം, മാർക്സിസം - എൻ. എം. പിയേഴ്സൺ, കറന്റ് ബുക്സ്, കോട്ടയം.
11. മുടിത്തെയ്യങ്ങൾ - സച്ചിദാനന്ദൻ ('പാപത്തറ' എന്ന സമാഹാരത്തിന്റെ ആമുഖ പഠനം).
12. പ്രത്യവമർശം - ബാലചന്ദ്രൻ വടക്കേടത്ത്, കറന്റ് ബുക്സ്, കോട്ടയം.
13. കുലസ്ത്രീകളും ചന്തപ്പെണ്ണുങ്ങളും ഉണ്ടായത് - (എഡി.) ജെ. ദേവിക.

2018-19

SEMESTER-V

ENVIRONMENTAL STUDIES AND PHYTOGEOGRAPHY

Course code: BO1542

Number of credits: 4

Number of contact hours : Lecture: 90 hrs; Practical: 36 hrs; Total: 126 hrs

Distribution of Hours	Theory	Practical
Environmental Studies	**81 hrs**	**36 hrs**
Phytogeography	**09 hrs**	**00 hrs**
Total	**90 hrs**	**36 hrs**

MODULE- I **14 hrs**

1. Definition- Scope and relevance to society and human environment. Need for public awareness
2. Natural Resources - Renewable and Non renewable - Land & Soil, Water, Energy, Minerals, Food and agriculture , Forests, Plants & Wild life resources
Degradation of natural resources - Land degradation, degradation of water resources, Loss of flora and fauna
Causes – population explosion, over exploitation, deforestation, agriculture mismanagement, desertification, overgrazing, soil erosion, mining, urbanization and industrialization- change in land use, depletion of water resources
3.Conservation of Natural resources
Land and soil- afforestation, regeneration of wasteland
Water - Rain water harvesting, ground water dams
Energy - Promoting use of renewable resources-solar, hydel, tidal and wind; biodiesel, biofuels.
Forests- Reforestation, Community forestry programmes
4. Role of an individual in conservation of natural resources, sustainable life styles.

MODULE II

Ecosystems **22 hr**

1. Ecosystems - Concept, definition, structure and function; components- biotic and abiotic; energy flow
2. Food chains -Food web & ecological Pyramids, biogeochemical cycles - Carbon and Phosphorous cycle
3. Ecological succession-Definition, primary and secondary succession, climax concept, hydrosere and xerosere.
4. Plant adaptations- Morphological, anatomical& physiological adaptations of – Hydrophytes, Xerophytes, Halophytes, Epiphytes, Parasites
5. Introduction- types, characteristic features, structure and functions of the following ecosystems.

1. Forest ecosystem 2. Grassland ecosystem 3. Desert ecosystem 4. Aquatic ecosystems- Ponds, Streams, Rivers, Oceans, Estuaries (brief account only)

MODULE-III

Biodiversity and its conservation **24 hrs**

1. Introduction
2. Definition- genetic, species and ecosystem diversity.
3. Terrestrial (Tropical rain forest) and Aquatic Biomes(mangroves).
4. Hot-spots of biodiversity; India as mega-diversity nation.
5. Threats to biodiversity: land use changes & habitat destruction, poaching of wild life- hunting & export, Overuse of pesticides, invasive species.
6. IUCN, Red data Book; Extinct and Threatened species- endangered & Rare; Endemic species of Western Ghats.
7. Conservation of biodiversity: *In-situ* (National parks and Wild life sanctuaries) and *Ex-situ* conservation (botanical gardens); Biosphere Reserves & World Heritage Sites in India-Ramsar sites.
8. Global initiatives in biodiversity conservation- Stockholm Conference, Montreal Protocol, Convention on Biological diversity Regional initiatives- *Chipko* movement, A brief account on conservation efforts in Kerala- People Biodiversity Register.

MODULE-IV

Environmental pollution & Issues **21 hrs**

1. Definition causes, effects and control measures of – 1. Air pollution 2. Water pollution 3. Soil pollution 4. Marine pollution 5. Noise pollution 6. Thermal pollution 7. Nuclear hazards.
2. Solid Waste Management- waste minimization, Recycling and Reuse, Consuming environment friendly products. E-waste management.
3**.** Environmental Issues **-** Climate change, Global warming, Acid rain, Ozone layer depletion.
4. Environmental Legislations - Environment protection Act (1986); Air [prevention and control of pollution] Act (1981; Amended 1987); Water [prevention and control of pollution] Act (1974; Amended 1988); Wildlife Protection Act (1972); Forest conservation Act (1980). (Scope and relevance only)
5. Environmental Organisations –UNEP, IPCC, WWF, Central Pollution Control Board

MODULE-V

Phytogeography- concept & definition **09 hr**

Vegetation in India – Forests- tropical, temperate, sholas, sub alpine, alpine, mangroves & Grass lands.

Phytogeographical regions of India - Western and eastern Himalayas, Dessert, Western Ghats, Deccan Peninsula, Gangetic Plain, North East India, Coasts & Islands.

Practical **36 hrs**

1. Visit a local polluted site and report major pollutants.
2. Study of ecological and anatomical modifications of Xerophytes, Hydrophytes, Halophytes, Epiphytes and Parasites.
3. Observation and study of different ecosystems mentioned in the syllabus.
4. Phytogeographical regions of India- Photos/ Diagrams

REFERENCE

1. Misra SP and Pandey SN, 2009, Essential Environmental studies, Ane Books Pvt. Ltd
2. Erach Bharucha – Text book of environmental Studies for undergraduate Courses, Universities Press, University Grants Commission
3. Ahluwalia VK and Sunitha Malhotra 2009, Environmental science, Ane Books Pvt. Ltd.
4. Chapman J.L. (2006) Ecology-Principles and Application. Cambridge University Press India Pvt. Ltd
5. Chandoco.S Weaver and Clements – Plant Ecology, McGraw Hill Publications, New York.
6. Verma, P. S. and V. K. Agrawal. 2004. *Cell Biology, Genetics, Molecular Biology, Evolutionand Ecology.* S. Chand & Company Ltd., New Delhi.
7. Prithipal Singh 2007- An Introduction to Biodiversity. Ane Books Pvt. Ltd
8. Verma and Agarwal – Principles of Ecology, S. Chand and Co.
9. Ambasht R.S. – Text book of Plant Ecology, Students and Friends & Co. Varanashi.
10. Odum Eugene P – Fundamentals of Ecology, Edn. Philladephia & Saunders, Tokyo, Toppon.
11. Sharma, P.D. – Elements of Ecology (Rastogi's Company Ltd., Publications).
12. Vashista P.C – Plant Ecology Edu. Vishali Publications.
13. Periasamy, K. – Elements of Plant Ecology, (M.K. Publications).
14. The Geography of Flowering Plants - Good
15. Kumaresan B. – *Plant Ecology & Phytogeography* – Rastrogi Pub:

EC 222: ECONOMICS OF SOCIAL SECTOR AND ENVIRONMENT

(Hours per semester: 110
Hours per week: 6)

Objectives

This course is designed to enable students to: (1) Understand and apply the key economic concepts in the context of social sectors like education, environmentand healthcare, (2) Appreciate how economic factors contribute to the development and implementation of educational policies, (3) Identify the major theories governing the development of human resources, school improvement and development, (4) Recognize the important linkages between the environment and economics, (5) Be aware of the key environmental issues around the globe, and (6) Understand approaches to identify and value costs and outcomes to include in economic evaluation of the environment through benefit cost analysis.

Course Contents

Module 1: Economics of Education (20 hours)

Human Capital – Components of Human Capital – Education as an instrument for economic Growth – Demand for Education – Supply of Education – Determinants of demand for Education – Costs of Education - Private Costs and Social Costs- Benefits of Education – Direct, Indirect and Social Benefits – Wastage and Stagnation in Education – Causes and Measures-Manpower Planning-Meaning and Techniques of Forecasting.

Module 2: Economics of Health (20 hours)

Nature and Scope of Health Economics – Health Dimensions of Development – Determinants of Health – Economic Dimensions of Healthcare – Demand for and Supply of Healthcare – Healthcare Financing – Inequalities of Health – Class and Gender Perspectives – Healthcare Sector in India-Health Insurance Schemes in India-RSBY,ESIS,AABY, JBY.

Module 3: Economics of Environment and Environmental Valuation (25 hours)

Environmental Economics – Meaning and Significance – Interlinkage between economy and Environment – Material Balance Model – Law of Entropy – Environmental Kuznets' Curve

Environmental Valuation – Use Values, Non-use Values, Option Values – Approaches to Environmental Valuation – Direct Methods – Contingent Valuation Method, Trade off Games Method, Costless Choice Method, Delphi Method – Indirect Methods – Revealed Preference

Methods – Travel Cost Method, Hedonic Pricing Method, Preventive Expenditure Method, Surrogate Market Approach, Wage Differential Approach– Cost Based Methods and Other methods of Valuation – Cost Benefit Analysis.

Module 4: Environmental Policies and Issues (25 hours)

Environmental Externalities – Design of Environmental Policy – Quantity Based Instruments – Market based Instruments – Pigouvian tax and Subsidy Approach – Non-Market Instruments – Command and Control – Mixed Instruments – Marketable permits – Tradeable Pollution Permits -Bargaining Solution – Coase Theorem – Informal Regulation – Collective Action – Grass Root Movements (Chipko Movement, Save Silent Valley Movement, Narmada Bachao Andolan, Appiko Movement)– Monitoring and Enforcement – The New Model of Pollution Control – Major Environmental Policies and Legislations in India.

Global Environmental Issues – Climate Change Problems, Global Warming, Bio Diversity Loss, Acid Rain, Deforestation, Environmental Pollution.

Module 5: Economics of Natural Resource Management (20 hours)

Natural Resources – Resource Taxonomy – Theories of Optimum Use of Exhaustible and Renewable Resources – Common Property Resource Management – Tragedy of Commons.

Environment Development Trade off – Sustainable Development – Indicators of Sustainable Development – Equity and Sustainable Development – Environment and Trade in the WTO Regime – Environment and System of National Accounts – Green GDP.

Reading List

Module 1

1. Environmental Education in India (2002) Association of Indian Universities, New Delhi.
2. Schultz., T.W. (1971) Investment in human Capital, Free Press, New York
3. Joy A. Palmer, 1998, Environmental Education in 21st century, Routledge, London.
4. Kolstad, D. Charles (2010), Environmental Economics, Oxford University Press.
5. Cohn E. and T. Gaske (1989), Economics of Education, Pergamon Press, London.
6. McMohan, W.W. (1999), Education and Development: Measuring the Social Benefits, Oxford University Press.
7. Becker G.S. (1974), Human Capital (2nd Edition), National Bureau of Economic Research, New York.

Course Material

Modules 1-3

Core Reading: *English Language Skills for Communication I*

Module 4

Core Reading: *Dramatic Moments: A Book of One Act Plays*. Orient Black Swan, 2013

The following one act plays are prescribed:

H.H.Munro	*The Death Trap*
Philip Moeller	*Helena's Husband*
Serafin and Joaquin Alvarez Qunitero	*Sunny Morning: A Comedy of Madrid*
Margaret Wood	*Day of Atonement*

For further Reading

Marks Jonathan. *English Pronunciation in Use*. New Delhi: CUP, 2007.

Lynch, Tony. *Study Listening*. New Delhi. CUP, 2008.

Kenneth, Anderson, Tony Lynch, Joan Mac Lean. *Study Speaking*. New Delhi: CUP, 2008.

Reference

Jones, Daniel. *English Pronouncing Dictionary 17the edition*. New Delhi: CUP, 2009.4

SEMESTER I

FIRST DEGREE PROGRAMME IN ENGLISH (CBCS System)

Foundation Course I for BA/BSc - WRITINGS ON CONTEMPORARY ISSUES: EN 1121

No. of credits: 2 **No. of instructional hours: 4 per week (Total 72 hrs.)**

AIMS

1. To sensitize students to the major issues in the society and the world.
2. To encourage them to read literary pieces critically.

OBJECTIVES

On completion of the course, the students should be able to

1. have an overall understanding of some of the major issues in the contemporary world.
2. respond empathetically to the issues of the society.
3. read literary texts critically.

COURSE OUTLINE

Module I: Globalization and its Consequences

Essays: (1) "The Globalized World" – Avinash Jha.

(2) "Globalization and Education: Third World Experience" – Amit Bhaduri.

Poem: "Unending Love" - Rabindranath Tagore

Module II: Environmental Issues

Essay: "Forests and Settlements" - Romila Thapar Poems: (1) "God's Grandeur" - G.M.Hopkins (2) "The World is too Much with Us" - Wordsworth

Module III: Human Rights

Essay: "Thinking about Human Rights" - Manisha Priyam, Krishna Menon & Madhulika Banerjee,
Poem: "London" - William Blake
Fiction: *Untouchable* [an extract] – Mulk Raj Anand

Module IV: The Gender Question

Essays: "Gender, Culture and History" – Manisha Priyam, Krishna Menon & Madhulika Banerjee, Fiction: "The Elder Sister" – M. T. Vasudevan Nair

COURSE MATERIAL

Modules 1 - 4

Core reading: *Meeting the World: Writings on Contemporary Issues*. Pearson, 2013.

Semester II

First Degree Programme in English (CBCS System)

Common for B.A/B Sc [EN1211.1] & 2(a) [CG1271]

No. of Credits: 4

No. of instructional hours: 6 per week (Total 90 hrs)

ENVIRONMENTAL STUDIES

Module 1

Environmental studies: Definition, Need, Scope and Importance, Need for public awareness. Natural resources- Forest resources, water resources, mineral resources, food resources, energy resources, land resources- over exploitation, case studies.

Module 2

Eco-system- structure and function, producers, consumers and decomposers energy flow in the ecosystem, ecological succession, forest ecosystem, grassland ecosystem, desert ecosystem and aquatic ecosystem. Biodiversity and its value and conservation, hot spots of biodiversity, India as a mega-diversity nation, endangered and endemic species of India, conversation of bio-diversity. In-situ and Ex-situ conversation of bio-diversity. Sustainable use of forest – water- land -resources –Human population and its impact on environment.

Module 3

Pollution: air, water, soil and marine, noise, thermal and nuclear hazards. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management. Social issues and the Environment: from unsustainable to sustainable development, water conversation-rain water harvesting; global warming; consumerism and waste products: various acts to protect the environment; Environment protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and Control of pollution) Act; Wild Life Protection Act; Forest Conversation Act:

Module 4

Human population and Environment: Population explosion, Family Welfare Programmes, Environment and human health; human rights, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health.

Field work and Project- Visit to ecologically polluted spots: Study of nature: study of forest, insects, animals, birds and plants. Project Report on the basis of field work about 15 pages.

Total Marks: 100 **Written Exam: 60 Marks**

Internal Assessment: 15 Marks (Attendance- 5 marks+ 10 test paper)

Field work and project: 25 Marks

Books for Reference:

Adams, W.M. Future Nature: A Vision for Conservation. London: Earthscan, 2003.

Arnold, David and Ramachandra Guha, ed. Nature, Culture and Imperialism:Essays on the Environmental History of South Asia. New Delhi: Oxford UPM 2001.

Bahuguna, Sunderlal. "Environment and Education". The Cultural Dimension of Ecology. Ed. Kapila Vatsyayan. New Delhi: D.K. Printworld. 1998.

Crson, Rachel. Silent Spring. Boston: Houghton Mifflin, 1962.

Guha, Ramachandra- Environmentalism: A Global History,New Delhi: Oxford UP, 2000.

Hayward, Tim. Ecological Thought: An Introduction: Cambridge; polity, 1994.

Merchant, Crolyn. The Death of Nature. New York: Harper, 1990.

Gleick H.P. 1993. Water in Crisis, Pacific Institute for Studies in development Environment and security. Stockholm Env Institute. OUP 473 p.

Heywood V and Watson R.E. 1995. Global biodiversity Assessment. CUP 1140p

Odum FP. 1971. Fundamentals of Ecology. W.B Saunders Co. USA 574p

Rao. M. N and Dutta A.K. 1987. Waste Water Treatmentt. Oxford and IBH Publ Co Pvt.

Wagner K.D. 1998. Environmental Management. WB Saunders Co. Philadelphia, USA. 499p.

SEMESTER II

FIRST DEGREE PROGRAMME (CBCS System)

MODERN ENGLISH GRAMMAR AND USAGE

Common for BA/BSc: EN 1212.1, BCom: 1211.2 & Career related 2(a):1211.3

(2012 Admission onwards)

No. of credits: 3 **No. of instructional hours: 4 per week (Total 72 hrs.)**

AIMS: 1. To help students have a good understanding of modern English grammar.

2. To enable them produce grammatically and idiomatically correct language.
3. To help them improve their verbal communication skills.
4. To help them minimise mother tongue influence.

SEMESTER VI

FIRST DEGREE PROGRAMME (CBCS System)

Common for

ENGLISH LANGUAGE AND LITERATURE - Core Course XIV: EN 1644
&
CAREER-RELATED FIRST DEGREE PROGRAMME (CBCS) - Group 2 (a) IN ENGLISH & COMMUNICATIVE ENGLISH - Core Course XI - CG 1642

WOMEN'S WRITING

No. of Instructional hours : 4 per week (Total: 72 hrs) – for EN 1644
: 5 per week (Total: 90 hrs) - for CG 1642

No. of Credits : 3 [EN 1644 & CG 1642]

Aims:

1. To introduce students to the development of women's writing in various countries.
2. To familiarize them with the diverse concerns addressed by feminism.
3. To motivate them to critically analyse literary works from a feminist perspective.

Objectives: On completion of the course, the students should be able to

1. The students will have an awareness of class, race and gender as social constructs and about how they influence women's lives.
2. The students will have acquired the skill to understand feminism as a social movement and a critical tool.
3. They will be able to explore the plurality of female experiences.
4. They will be equipped with analytical, critical and creative skills to interrogate the biases in the construction of gender and patriarchal norms.

COURSE OUTLINE

Module 1: Essays
Module 2: Poetry
Module 3: Short Fiction
Module 4: Drama

COURSE MATERIAL

Module 1: Essays **[Detailed study]**

1. Virginia Woolf: "Shakespeare and his Sister" (Excerpt from *A Room of One's Own*)
2. Alice Walker: "In Search of our Mothers' Gardens" (From *In Search of Our Mother's Gardens*)
3. Jasbir Jain: Indian Feminisms: The Nature of Questioning and the Search for Space in

Indian Women's writing. (From *Writing Women Across Cultures*

Module 2: Poetry. **[Detailed study]**

1. Elizabeth Barrett Browning : **"**A Musical Instrument"
2. Marianne Moore : "Poetry"
3. Adrienne Rich : "Aunt Jennifer's Tigers"
4. Sylvia Plath : "Lady Lazarus"
5. Margaret Atwood : "Spelling"
6. Kishwar Naheed : "I am not That Woman"
7. Suniti NamJoshi : "The Grass Blade"
8. Nikki Giovanni : "Woman"

Module 3: Short Fiction **[Non-detailed study]**

1. Katherine Mansfield : "The Fly"
2. Shashi Deshpande : "A Wall is Safer"
3. Sara Joseph : "Inside Every Woman Writer"
4. Amy Tan : "Rules of the Game"

Module 4: Drama **[Non-detailed study]**

1. Sheila Walsh : "Molly and James"
2. Mamta G Sagar : "The Swing of Desire"

Core text:

Modules 1 – 4: Dr Sobhana Kurien, ed. *Breaking the Silence: An Anthology of Women's Literature*. ANE Books.

Books for reference:

Beauvoir, Simone de. *The Second Sex*. UK: Hammond Worth, 1972.
Davis, Angela. *Women, Race and Class*. New York: Random, 1981.
Devi, Mahasweta. *Breast Stories*. Calcutta: Seagull, 1998.
Gilbert, Sandra and Susan Gubar. *The Mad Woman in the Attic: The Woman Writer*. Yale UP, 1978.
Goodman, Lisbeth ed. *Literature and Gender*. New York: Routeledge, 1996.
Green, Gayle and Copelia Kahn. *Making a Difference: Feminist Literary Criticism*. New York: Routeledge.
Humm, Maggie ed. *Feminisms: A Reader*. New York: Wheat Sheaf, 1992.
Jain, Jasbir ed. *Women in Patriarchy: Cross Cultural Readings.* New Delhi: Rawat, 2005
Millett, Kate. *Sexual Politics*. New York: Equinox-Avon, 1971.
Rich, Adrienne. *Of Woman Born*. New York: Norton.
Roudiex, Leos S. ed. *Desire in Language*. New York: Columbia UP, 1975.
Showalter, Elaine. *A Literature of their Own*.
Spacks, Patricia Mayor. *The Female Imagination*. New York: Avon, 1976.
Tharu, Susie and K Lalitha. *Women Writing in India Vol I & II*. New Delhi: OUP, 1991.
Walker, Alice. *In Search of our Mothes' Gardens*. New York: Harcourt Brace Jovanovich, 1983.
Woolf, Virginia. *A Room of One's Own*. London: Hogarth, 1929.

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Instruction to Teachers [Modules 1- 4]:

- The work of each writer mentioned in Modules 1 – 4 has to be placed against the literary backdrop of the age.
- The major works of the writers mentioned in the modules can be made familiar to the students
- The literary significance of the work is to be briefly discussed in the classroom and hence the student is expected to have only a general awareness of the respective author..
- **Questions are to be asked only from the prescribed poems, fiction and drama.**

B.Com I st Semester

Core Course I: CO 1141 – ENVIRONMENTAL STUDIES

No. of instructional hours per week: 4 No. of Credits: 3

Aim of the course: To develop knowledge and understanding of the environment and enable the students to contribute towards maintaining and improving the quality of the environment.

Course objectives:

1. To enable the students to acquire basic ideas about environment and emerging issues about environmental problems.
2. To give awareness about the need and importance of environmental protection

Module I: Environmental studies – meaning – scope – importance (4hrs)

Module II: Ecology and Ecosystems, Biodiversity and its Conservation, and Natural resources –meaning of ecology – structure and function of an ecosystem – producers – consumers – decomposers– energy flow in the ecosystem – ecological succession- food chain – food webs and ecological pyramids . Ecosystem – concept– types of ecosystems – structure and functions of forest ecosystem, grass land ecosystem- desert ecosystem, aquatic ecosystem. Biodiversity and its conservation introduction- definition- genetic, species and ecosystem diversity- value of biodiversity – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of diversity – threats to diversity – conservation of diversity in situ, ex-citu. Natural resources features- air resources, forest resources, water resources, mineral resources, food resources energy resources, land resources- over exploitation of natural resources- consequences conservation of natural resources- role of an individual in conservation of natural resources
(25 Hrs)

Module III: Industry and environment - pollution – environmental pollution – soil pollution – air pollution – water pollution – thermal pollution – noise pollution – causes, effect and control measures – waste management – waste minimisation through cleaner technologies – reuse and recycling - solid waste management.(18hrs)

Module IV: Social issues and environment – Unsustainable to sustainable development – urban problems related to energy - water conservation - water harvesting - resettlement and rehabilitation of people- environment ethics-waste land reclamation-consumerism and waste products. (15 hrs)

Module V: Human Population and environment – population growth – variation amoeg nations – population explosion – environment and human health – human rights – value education – Women and child welfare. (10hrs)

Note: All students must *visit a local area to document environmental issues and prepare a brief report on the same identifying issues involved and suggesting remedies.(This will be a part of the internal marks. i.e. for EVS the internal marks = attendance – 5 marks + test paper – 5 marks + field study report – 10 marks)*

Books recommended

Misra.S.P and Pandey .S.N. *Essential Environmental Studies*, Ane Books India, New Delhi.
Kiran B. Chokkas and others.*Understanding Environment*, Sage Publications New Delhi.
Arumugam N. and Kumaresan V. *Environmental Studies*, Saras Publications, Kanyakumari.
Benny Joseph. *Environmental Studies*, Tata McGraw-Hill Publishing Co.Ltd.,New Delhi.

Scanner by Droid-Veda

SEMESTER I

Paper 4: CO 214- PLANNING AND DEVELOPMENT ADMINISTRATION

Objectives:

1. To generate an overall insight on planning process in Indian Economy
2. To make the students aware about new planning initiatives in India

Module 1 - Structure of Indian Economy- Relevance of sectors in Indian Economy; Primary, Secondary and Tertiary Sectors-National Income-Methods of Computation-Inflation effects on Indian Economy- India's current National Income in comparison with leading economies of the world-Challenges. **(15Hrs)**

Module 2: Planning mechanism in India–Economic planning-features, types-Phases of Economic Planning-Growth and Planning Models-(Briefly mention) -State Planning Board-District Planning Board **(20Hrs)**

Module 3: Fiscal Policy-Centre-State financial relationship-Resource Allocation-Finance Commission-Development and Non Development expenditure-Preparation of budgets: Centre, State and Local Self Government-Deficit financing-Plan and Non-Plan Expenditure (Case Study: Evaluation of current Budget) **(20Hrs)**

Module 4 : Policy Initiatives in the Planning Process –Niti Aayog –Structure– Objectives –Functions-Guiding Principles -Vision Statement-Recent Policy initiatives: Make in India, Jan DhanYojana, Startup India, Swatch Bharath Abhiyan, Mudra Bank, Digital India – Future development initiatives **(20Hrs)**

Module 5: Role of State and Local Self Government-Planning initiatives in Kerala-Kerala Perspective Plan –Mission-Vision-Scope-Local Self Government –Role, Functions and Programmes **(15Hrs)**

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References:

1. Agarwal A.N. and Kundanlal (1999), Economics of Development and Planning, Vikas Publishing House, NewDelhi
2. Seth.M.L. and S.P. Singh (1998), Economic Planning: Theory andPractice, S.Chand and Company Ltd., Ram Nagar, NewDelhi
3. Dhingra.I.C. and V.K.Garg (2000), Economic Development and Planning in India, Sulthan Chand Publications, NewDelhi
4. Mishra S.K. and Puri V.K (2008), 26th Edition, Indian Economy,Himalaya Publishing House Pvt. Ltd.,Mumbai-
5. Desai and Bhale Rao (1986), Economic Planning and Policy,Himalaya Publishing House,Mumbai
6. Madan Mohan Batra (1987), Planning in India: development perspective towards the 21st century, V.K. Publishing House,Mysore
7. Misra and Puri (1999), Development and Planning Theory andPractice, Himalaya Publishing House,Mumbai
8. Gerald. M. Meier, and Robert E. Baldwin,(1957) (Reprint in 1975), Economic Development- Theory, History ,Policy, Asia Publishing House,Mumbai
9. Gerald. M. Meier, James E. Rauch,(2005), Leading Issues inEconomic Development, (8th Edition) Oxford University Press,Oxford,
10. Meier .G.M. (1995), Leading Issues in Economic Development (6thedition) Oxford University Press, NewDelhi.
11. Higgins Benjamin (1963), Economic Development, Principals, Problems and Policies, Central Book Depot,Allahabad
12. Kindleberger C.P. (1977), Economic Development (III edition) McGraw Hill NewYork.
13. Adelman. I (1961), Theories of Economic Growth and Development, Stanford Universities Press,Standford.
14. Bose. A, (1975), Marxian and Post Marxian Political Economy, PenuinLondon
15. Chakrvarthy S (1982), Alternative Approaches to the Theory of Economic Growth, Oxford University Press, NewDelhi.
16. Growth. S, (1986), An Introduction to Development Economics, Allen and Unwin
17. Little IMD (1982), Economic Development : Theory Policy and International Relations, Basic Books, NewYork
18. Schumpeter J.A., (1949), The Theory of Economic Development,Harvard University Press,Cambridige.
19. Bhagavathi J and Desai, (1970), India: Planning for Industrialization,Oxford University Press,Oxford
20. Jolly. R., (1973), Third World Employment, Penguin,Oxford
21. Sen.A.K. (1962), Choice of Techniques, Basil Backwall,Oxford

Scanner by Droid-Veda

SEMESTER I

Paper 1: CO 211- BUSINESS ETHICS AND CORPORATE GOVERNANCE

Objectives:

1. To convey basic understandings on the theories of Business Ethics
2. To provide a understanding on Corporate Governance practices and the provisions of the Companies Act relating to corporate governance

Module 1: Business Ethics and Ethical Practices: Ethics – Sources- Importance - factors influencing Business Ethics – Benchmarks on code of Ethics – Ethics Committees – Training Programmes – Ethical Decision Making – Ethics in Finance - Marketing and HR **(15Hrs)**

Module 2: Organization Culture: Features – Building and Maintaining Organization Culture – Organizational Socialization – Managing cultural Diversity – Work Ethics – Work Culture – Quality of Work Life – Work Life Balance – areas Improving Work Life Balance – Strategies of Work Life Balance **(20Hrs)**

Module 3: Corporate Governance: Importance – Objectives – Basic Ingredients of Corporate Governance – Principles - Theories – Phases of development of Corporate Governance in Global and Indian Perspectives – Code of Corporate Governance – Committees on Corporate Governance (Global and Indian) **(15Hrs)**

Module 4: Corporate Social Responsibility : CSR under Companies Act 2013 – Scope – Relevance – Importance – Areas of CSR – Arguments for and against CSR – Ackerman's model of CSR – SEBI – Clause 49 of listing agreement – Evaluation of Corporate Governance of a Company – Methods – Shareholder Value – EOCE, PAT, EPS, TSR, MVA, EVA and HVA - Corporate Philanthropy – Corporate Citizenship – Social Audit **(25 Hrs)**

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Module 5: Corporate Image and Excellence : Corporate image – building corporate image – Importance – Corporate Excellence – importance – Measures to achieve corporate excellence – New initiatives on corporate excellence - Role of Chairman – Qualifications – Power – Duties and Responsibilities – Board Committees – New Directions **(15Hrs)**

References:

1. Laura P Hartman, Perspectives in Business Ethics, Mc Graw Hill International
2. George A Steiner and John F Steiner, Business , Government and Society, Mc Graw Hill International
3. SK Chakraborthy, Ethics in Management Vedantic Perspectives, Oxford University Press
4. Subhash Sharma, Management in New Age: Western Windows – Eastern Doors, New Age International Publishing , New Delhi
5. Prof (Col.) PS Bajaj, Dr. Raj Agarwal – Business Ethics an Indian Perspectives, Biztantra2006.

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Part B: 11-22	8 out of 12; Short Answer	16
Part C: 23-31	6 out of 9; Short Essay	24
Part D: 32-35	2 out of 4; Essay	30
		Total = 80-80 marks

SYLLABUS FOR B.Sc. CHEMISTRY PROGRAMME

Semester – I Core Course - 1 Course Code– CH1141 Credit-4

Inorganic Chemistry I

Lecture -Tutorial-Lab: 2-0-2 *36hrs.*

Aim of the Course

The course builds on the plus-two level introductory chemistry and familiarizes theoretical aspects of atomic structure and periodicity. Subsequently, it delves into the principles of acids, bases and nonaqueous solvents. The course will be highlighting the chemistry of hydrogen as well as s-block elements. The course also introduces the students an idea about environmental chemistry and different types of pollution.

Course objectives

The course helps to learn the students to understand the structure of atom, periodicity and non-aqueous solvents. Upon course completion, the student will be able to appreciate how the inner structure of elements dictates the chemical properties of elements and also understand how the elements are arranged in the periodic table and the properties and application of s -block elements, hydrogen and their compounds.

Course outline

Module I- Atomic Structure and Periodicity *6 hrs.*

Introduction to the structure of atom - Dual nature of electron - de Broglie equation - matter waves and electromagnetic waves - experimental verification of de Broglie relation - Heisenberg's uncertainty principle - expression and significance. Wave mechanical concept of the atom - Schrodinger equation (Derivation not required) -. Quantum numbers - Pauli's exclusion Principle - Aufbau Principle – Hund's rule - Electronic configuration of atoms - classification of elements into s, p, d, f blocks - electronegativity- Pauling's scale, Mulliken and Allred - Rochow scale-(Including numerical problems)

Module II-Hydrogen 6hrs

Position of hydrogen in the periodic table. - Similarities and difference in properties compared with alkali metals and halogens- Atomic and physical properties of hydrogen; Preparation of hydrogen- Reactions of hydrogen. Nascent, atomic and active hydrogen- Ortho and para hydrogen -Deuterium and tritium –Uses of hydrogen- Hydrogen as next generation fuel-Hydrides- Types of hydrides, properties; water; Hydrogen bond-types-consequences of hydrogen bond. Hydrates; Hardness of water- types- different methods water softening. Heavy water- preparation and properties.

Module III-S-Block Elements 9hrs

General characteristics, atomic and ionic radii, ionisation enthalpy, electropositive character, formation of univalent positive ions, hydration of ions, reducing properties, Electrode potentials, characteristic flame colouration, lattice enthalpy, chemical properties, , comparison of lithium with other members of the family, resemblance of lithium and magnesium, uses of alkali metals, properties of alkali metals and their uses, compounds of elements of group 1 – comparative study-oxides, hydroxides, halides, carbonates and bicarbonates General characteristics of group II-atomic and ionic radii, ionisation enthalpy, reducing properties, electrode

potentials, characteristic flame colouration, chemical properties, gradation in properties, comparison of beryllium with other members of the family, Uses of alkaline earth metals, Compounds of alkaline earth metals-Beryllium oxide, beryllium chloride, calcium oxide, calcium hydroxide, calcium cyanamide- preparation and properties. comparison of solubility products of hydroxides and sulphates, Portland cement.

Module IV -Acids, Bases and Non Aqueous Solvents *6hrs*

Lowery-bronsted and Lewis concepts of acids and bases-introduction to SHAB principle. General properties- classification- self ionization and levelling effect- reaction in non-aqueous solvents - protic and aprotic non aqueous solvents- examples- solutions of metals in liquid ammonia- self ionization of liquid ammonia- liquid SO_2, liquid HF, alkali metals in liquid ammonia

Module V - Environmental Chemistry – Air, Water and Soil Pollution *9 hrs.*

Air pollution - ozone layer depletion, ozone hole, protection of ozone umbrella –Air pollution caused by fire works, harmful effects of fireworks, acid rain, green house effect, smog –Classic and photochemical Smog-management of air pollution.

Water pollution: Causes- Heat, industrial waste, sewage water, detergents, agricultural pollutants - treatment of industrial waste water-Activated charcoal, Synthetic resin, reverse osmosis and electro dialysis - Quality of drinking water - Indian standard and W H O standard - Dissolved oxygen - BOD, COD.
Soil pollution - Pesticides, Fertilizers, Industrial waste, plastics - Control of pollution

References

1. T.F.Gieryn, Cultural boundaries of science Univ. Chicago Press 1999.
2. The Golem : What everyone should know about science. H.Collins and T.Pinch. Cambridge Univ Press 1993
3. Alexis Leon & Mathews Leon, Computers Today, Leon Vikas
4. SotiSivendraChanthra Contemporary Science Teaching,
5. ManasChanda, "Atomicstructure and Chemical Bonding including Molecular spectroscopy"
6. E.S. Gilreath "Fundamental concepts of Inorganic Chemistry"
7. Puri, Sharma and Kalia "Inorganic Chemistry"
8. Madan "Inorganic Chemistry".
9. Manku , "Theoretical principles of Inorganic Chemistry" -
10. M. C. Dey and J. Selbin "Theoretical Inorganic Chemistry".
11. F A Cotton and G. Wilkinson "Basic Inroganic Chemistry".
12. S. K. Banerji, "Environmental Chemistry".
13. A. K. De "Environmental Chemistry - An introduction"
14. B. K. Sharma "Air Pollution".
15. V. K. Ahluwalia "Environmental Chemistry"
16. G.W. vanLoon and S. J. Duffy "Environmental Chemistry: A global perspective"
17. Puri, Sharma and Kalia "Inorganic Chemistry"

the day of practical examination before a board of two Examiners for ESE. The viva-voce based on the project is conducted individually. Project topic once chosen shall not be repeated by any later batches of students. List of projects submitted year wise is to be maintained in a register and submitted before the examiners if requested.

The project report may contain the following sections:

1. Preliminary (Title page, declaration, certificate of the supervising teacher, content etc.)
2. Introduction with relevant literature review and objective
3. Materials and Methods
4. Results
5. Discussion
6. Conclusion / Summary 7. References.

Study tour and Factory/ research institute visit

Students are directed to visit one research institute/ chemical factory preferably with in the state of Kerala. Scientifically prepared hand written study tour report along with photographs of candidate at the places of visit must be submitted by each student for ESE on the day of the examination of project evaluation.

The board of examiners can decide the scheme of evaluation of project , study tour report and viva voce

Open Course for Other Majors-
Semester-5 Credit-2 Course-CH1551.1
2017 admission onwards
Essentials of Chemistry

Module 1:Atomic structure and Periodic Classification of Elements (9hrs) Structure of atom- Fundamental particles, atomic mass, atomic number, isotopes. Bohr theory of atom. Orbitals- Quantum numbers, aufbau principle, Hund's rule; Pauli's exclusion principle. Electronic configuration of atoms - half and completely filled orbitals. Modern periodic table: Periods, Groups, Periodicity- valency, atomic radius, electronegativity, Ionisation potential, Electron affinity.

Module 2 :Nuclear Chemistry (9 hrs)

Natural radioactivity, Nature and types of radiations, Properties. Group displacement law. Radio active decay series. Decay rate. Half life period, Average life period, Unit of radioactivity. Radiation dose, artificial radioactivity, nuclear structure. Nuclear fission and Nuclear fusion. Rock dating- Radio carbon dating. (*elementary idea only*)

Module 3 :Polymer Chemistry (9 hrs)

Classification of polymer: Origin, structure, synthesis, Molecular forces. Commercially important polymers: Application of polyethylene, polystyrene, polyhaloolefines, Nylon-6, Nylon-66, Melamine, Terylene, Bakelite, Natural and synthetic rubber, vulcanization, inorganic polymer: (*Examples Only*).

Module 4 :Chemistry in Biological Process (9hrs)

Vitamins: Vitamin-A, Vitamin-B2, Vitamin-C, Vitamin-D, Vitamin-E and Vitamin-K- Name, Source, Function and deficiency diseases. Enzymes- Classifications, characteristics, role, examples. Hormones - Sex hormones- Androgens, oestrogens, progesterone, Example, function. Cortical hormones- A few examples

with function. Nucleic acid- RNA, DNA: Introduction- role in life process (*No structure or chemical reactions needed*)

Module 5 : Chemistry in action (9hrs)

Dyes: classification based on constitution, application, examples, uses. Drugs: Antipyretic, analgesic, antiseptic, disinfectants, tranquilisers, antibiotics structure, name and uses only. Soaps and detergents: Hard and soft soaps, anionic, cationic and non-ionic detergents, cleansing action of soaps, Explosives: TNT, TNG, RDX, Gun cotton: name, structure and action. (*No structure or chemical reactions needed*)

Module 6 :Environmental Chemistry (9hrs)

Air Pollution: Types of pollutant in air- carbon monoxide, carbon dioxide, Nitrogen oxides, Sulphur dioxides, hydrogen sulphide, Cl_2, CFC, particulate matter, metals, fly ash, asbestos, hydrocarbons- source and influence. Acid rain, Green house effect, ozone layer and its depletion. Water Pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents. Hard and soft water, Removal of hardness, disadvantage of hard water. Soil pollution : Due to pesticides, herbicide, fungicide, long term use of fertilizers, plastic waste.

References

1. M. C. Day and J. Selbin,“ Theoretical Inorganic Chemistry”.
2. H. S. Arniker,“ Essentials of Nuclear Chemistry:
3. B.K. Sharma “Environmental Pollution”.
4. Solomons- John- Wiley, “Fundamentals of Organic Chemistry”.
5. F.A. Carey, Mc. GrawHill ,“Organic Chemistry” Inc. 226
6. I.L Finar,“Organic Chemistry”, Vol. 1 Longman
7. Tewari, Mehrotra- Vikas&Vishnoi,“A Text book for Organic Chemistry:
8. M.K. JainJain,“ Principles of Organic Chemistry”.
9. A.K. Dey,“Environmental Chemistry”.

University of Kerala
Model Question Paper
2017 admission onwards
Open Course for other Majors Course CH1551.1
Essentials of Chemistry

Time: 3 Hrs Total marks: 80

Section A.

Answer all the questions. Each question carries 1 mark

1. Who discovered radioactivity?
2. Name any unit of radioactivity. 3.What is the expansion of DNA?
4. Write an example of a sex hormone.
5. Name an enzyme.
6. State Afbau principle.
7. Draw Px orbital.

UNIVERSITY OF KERALA

Career Related First Degree Programme in
Environmental Science
&
Environment and Water Management

Under Choice Based Credit and Semester System
2015

kup 179(4)/2015-16

Table 1. Scheme of Instruction and Evaluation

Seme-ster	Course Code	Study component	Instructional hours / week		Credits	Evaluation		Total Credits
			Theory	Practical		CE	ESE	
I	EN 1111.3	English I	4	-	3	20%	80%	18
	1111.3	Additional Language I	3	-	3	20%	80%	
	EE 1121	Foundation Course I	3	-	3	20%	80%	
	EE 1131	Complementary Course I	3	-	3	20%	80%	
	EE 1132	Complementary Course Practical	-	2	-	20%	80%	
	EE 1141	Core Course I	3	-	3	20%	80%	
	EE 1142	Core Course Practical		2		20%	80%	
	EE 1171	Vocational Course I	3	-	3	20%	80%	
	EE 1172	Vocational Course Practical	-	2	-	20%	80%	
II	EN 1211.3	English II	4	-	3	20%	80%	24
	1211.3	Additional Language II	3	-	3	20%	80%	
	EE 1221	Foundation Course II	2	-	2	20%	80%	
	EE 1231	Complementary Course II	3	-	3	20%	80%	
	EE 1232	Complementary Course Practical		2	2	20%	80%	
	EE 1241	Core Course II	4	-	4	20%	80%	
	EE 1242	Core Course practical		2	2			
	EE 1271	Vocational Course II	3	-	3	20%	80%	
	EE 1272	Vocational Course Practical	-	2	2	20%	80%	
III	EN 1311.3	English III	5	-	3	20%	80%	19
	EE 1331	Complementary Course III	3	-	3	20%	80%	
	EE 1332	Complementary Course Practical	-	2	-	20%	80%	
	EE 1341	Core Course III	3	-	3	20%	80%	
	EE 1342	Core Course IV	3	-	3	20%	80%	
	EE 1343	Core Course Practical	-	2	-	20%	80%	
	EE 1371	Vocational Course III	4	-	4	20%	80%	
	EE 1372	Vocational Course IV	3	-	3	20%	80%	
	EE 1372	Vocational Course Practical	-	2	-	20%	80%	
IV	EN 1411.3	English IV	5	-	3	20%	80%	22
	EE 1431	Complementary Course IV	3	-	3	20%	80%	
	EE 1432	Complementary Course Practical		2	2	20%	80%	
	EE 1441	Core Course V	5	-	4	20%	80%	
	EE 1442	Core Course VI	2	-	2	20%	80%	
	EE 1443	Core Course Practical	-	2	2	20%	80%	
	EE 1471	Vocational Course V	4	-	4	20%	80%	
	EE 1472	Vocational Course Practical	-	2	2	20%	80%	

Seme-ster	Course Code	Study component	Instructional hours / week		Credits	Evaluation		Total Credits
			Theory	Practical		CE	ESE	
V	EE 1541	Core Course VII	4	-	4	20%	80%	16
	EE 1542	Core Course VIII	4	-	4	20%	80%	
	EE 1543	Core Course Practical	-	5	-	20%	80%	
	EE 1551	Open Course I	2	-	2	20%	80%	
	EE 1571	Vocational Course VI	3	-	3	20%	80%	
	EE 1572	Vocational Course VII	3	-	3	20%	80%	
	EE 1572	Vocational Course Practical	-	4	-	20%	80%	
VI	EE 1641	Core Course IX	3	-	3	20%	80%	21
	EE 1642	Core Course III	2	-	2	20%	80%	
	EE 1643	Core Course Practical	-	4	2	20%	80%	
	EE 1661.1 EE 1661.2 EE 1661.3 EE 1661.4	Elective Course I	2	-	2	20%	80%	
	EE 1671	Vocational Course VIII	3	-	3	20%	80%	
	EE 1671	Vocational Course IX	3	-	3	20%	80%	
	EE 1673	Vocational Course Practical	-	4	2	20%	80%	
	EE 1644	Project and Factory Visit	4	-	4	20%	80%	

Table showing the credits for the programme

First language-English

Semester	Working hours/week	No of Courses	No of Credits
Sem 1	4	1	3
Sem 2	4	1	3
Sem 3	5	1	3
Sem 4	5	1	3

Total No. of credits = 12

Additional language (Hindi/Malayalam)

Semester	Working/ hours	No of Courses	No of Credits
Sem 1	3	1	3
Sem2	3	1	3

Total No. of credits = 6

Complementary course (Chemistry)

Semester	Working hours/week Theory Practicals	Total Hours	No of Courses	No of credits
Sem 1	3 2+2#	7	1	3
Sem 2	3 2+2#	7	1	3
Sem 3	3 2+2#	7	1	3
Sem 4	3 2+2#	7	1+1*	3 + 4 *

 # The additional 2 hrs as per university regulation of work load for practicals if number of students exceeds 15 in a batch

**Practical Examinations will be conducted only on even semester by the university*

Total No of Credits 12+4=16

Foundation Course

Semester	Working hours/week Theory Practicals	Total Hours	No of Courses	No of credits
Sem 1	3	3	1	3
Sem 2	2 + 2 # *	6	1+1	2

 # 2 hrs as per university regulation of work load for practicals; Total No of Credits = 5

***Practical examination for foundation course**

Core Course (Environmental science)

Semester	Theory Hrs/ Week	Practical Hrs/week	Total Hrs	No of course	No of credits
Sem1	3	2 + 2#	7	1	3
Sem 2	4		4	1	4
Sem 3	6	2+2#	10	2	6
Sem 4	7	2+2#	11	2+1**	6+4**
Sem 5	8	4+4#	15	2	8
Open	3		3	1	2
Sem 6	5	4+4#	13	2+1***	5+4***
Elective	3		3	1	2

#2 hrs as per university regulation of work load for practicals

* Practical examination for foundation course and core course are conducted together as part I & II and the credit is included with core course of 2 credits

At the end of 4th semester; * At the end of 6th semester

**Practical Exam will be conducted by the university;*

Total No of credits 32+6=38

Vocational Course (Water Management)

Semester	Theory Hrs/ Week	Practical Hrs/week	Total Hrs	No of course	No of credits
Sem1	3	2+2#	7	1	3
Sem2	3	2+2#	7	1+1	3+2=5*
Sem3	7	2+2#	11	2	4+3=7
Sem4	4	2+2#	8	1+1*	4+2=6*
Sem5	6	4+4#+4+4#	22	2	3+3=6
Sem6	6	4+4#	14	2+1 *	3+3+2=8*
Project		4+4#	8	1	4

#2 hrs as per university regulation of work load for practicals

Practical Exam will beconducted by the university;

Total No of Credits 27+8=35

B.Sc Environmental Sciences & Environment and Water Management

Six semesters; One semester-18 weeks

Total No of Courses : 43

Sl.No	Study component	No.of courses	Total credit
1	Language English	4	12
2	Additional Lan(Hin/Mal)	2	6
3	Foundation course	2	5
4	Complementary course	6	16
5	Core course	13	38
6	Vocational course	12	35
7	Open Course	1	2
8	Elective courses	1	2
9	Dissertation	1	4
10	**Total**	**43**	**120**

Total No of Credits = 12+6+16+5+38+35+2+2+4=120

Semester 1

Semester	Study component	Title of course	Instructional Hrs
EN1111.3	English I	-	4x18=72
1111.3	Additional Language (Hin/Mal) I	-	3x18=54
EE1121	Foundation Course I	1. Computer Basics and Informatics	3x18=54
EE1141	Core Course I	1. Research Methodology and Perspectives of Science	3x18=54
EE1142	Core Course Practical	2. Environmental Science lab	2x18=36
EE1171	Vocational Course I	1.Water Resources and Fluid Mechanics	3x18= 54
EE1172	Vocational course Practical	2.Water Management Lab	2x18=36
EE1131	Complementary Course I	1.Theoretical Inorganic chemistry	3x18=54
EE1132	Complemetary Course Practical	2.Chemistry lab	2x18=36

Eng-4; SL-3; FC-3; CoreC-5; Vo C-5; Comp C-5; Total=25 Instructional Hrs/week

Semester II

Semester	Study component	Title of course	Instructional Hrs
EE1211.3	English II	-	4x18=72
EE1211.3	Additional Language (Hin/Mal) II	-	3x18=54
EE1221	Foundation Course	1.Computer Application for Biostatistics	2x18=36
EE1241	Core Course II	1. Environmental studies	4 x 18=72
EE 1242	Core Course practical	Environmental Science lab	2 x 18 = 36
EE1271	Vocational Course II	1.Water Resources management	3x18=54
EE1272	Vocational Course Practical	2.Water Management lab	2x18=36
EE1231	Complementary course II	1. Organic and Environmental Chemistry	3x18=54
EE1232	Complementary course Practical	2.Chemistry lab	2x18=36

Eng-4; SL-3; FC-2; Core C- 6; Vo C-5; Comp C- 5; Total=25 Instructional Hrs/week

Semester 1II

Semester	Study component	Title of course	Instructional Hrs
EE1311.1	English III	-	3x18=54
EE1341	Core Course III	1. Natural Resources and Conservation	3x18=54
EE1342	Core Course IV	2 Environmental Management	3x18=54
EE1343	Core Course Practical	3.Environmental Science lab	2x18=36
EE1371	Vocational III	1.Hydrology	4x18=72

EE1372	Vocational IV	2.Water Quality Parameters and Assessment	3x18=54
EE1373	Vocational Practical	3.Water Management lab	2x18=36
EE1331	Complementary III	1.Analytical Chemistry and Biomolecules	3x18=54
EE1332	Complementary Practical	2.Chemistry lab	2x18=36

Eng-3; CoreC-8; Vo C-9; Comp C-5; Total =25 Instructional Hrs/week

Semester 1V

Semester	Study component	Title of course	Instructional Hrs
EE1411.3	1.English IV	-	5x18=90
EE1441	Core CourseV	1.Environmental Biotechnology & Microbiology	5x18=90
EE1442	Core Course VI	2.Biophysics, Biostatistics and Computer Application	2x18=36
EE1443	Core Course Practical	3. Environmental Science lab	2x18=36
EE1471	Vocational V	1.Water Quality Management	4x18=72
EE1473	Vocational Practical	3.Water Management lab	2x18=36
EE1431	Complementary IV	1.Physical chemistry	3x18=54
EE1432	Complementary Practical	2.Chemistry lab	2x18=36

Eng-5; Core C- 9; Vo C- 6; Comp C-5; Total =25 Instructional Hrs/week

Semester V

Semester	Study component	Title of course	Instructional Hrs
EE1541	Core Course VII	1.Environmental Geology and Mineralogy	4x18=72
EE1542	Core course VIII	2.Natural Hazards and Meteorology	4x18=72
EE1543	Core Course Practicals	3.Environmental Science lab	5x18=90
EE1571	Vocational Course VI	1.Water pollution	3x18=54
EE1572	Vocational Course VII	2.Water quality Management- II	3x18=54
EE1573	Vocational course Practical	3.Water Management lab	4x18=72
EE1551	Open course	1.Solid Waste Management	2x18=36

Core C-13; Vo C-10; Open C-2; Total =25 Instructional Hrs/week

Semester VI

Semester	Study component	Title of course	Instructional Hrs
EE1641	Core course IX	1.Environmental Pollution and Control Measures-I	3x18=54

EE1642	Core course X	2 .Environmental Pollution and Control Measures-II	2x18=36
EE1643	Core Course Practical	3.Environmental Science lab	4x18=72
EE1671	Vocational Course VIII	1.Water Analysis	3x18=54
EE1672	Vocational Course IX	2Watershed Management	3x18=54
EE1673	Vocational Course practical	3.Water Management lab	4x18=72
EE1661.1 EE1641.2 EE1641.3 EE1641.4	4.Elective	a.Rain water Harvesting b.Environmental Aspects of Estuarine System c. Disaster Management d.Elementary Concepts in GIS & GPS	2x18=36
EE1644	Project	Environmental Science/ Water Management	4 x 18 = 72

Core C-9; Vo C-10; Project -4; Elective-2; Total = 25 Instructional Hrs/week

CORE COURSES

I . Research Methodology & Perspectives of Science

II. Environmental Studies

III. (1) Natural Resources and Conservation
(2) Environmental Management

IV. (1) Environmental Biotechnology and Microbiology
(2) Biophysics, Biostatistics and Computer Application

V (1) Environmental Geology and Mineralogy
(2) Natural Hazards and Meteorology

VI. (1) Environmental Pollution and Control Measures I
(2) Environmental Pollution and Control Measures II

VOCATIONAL COURSES

I. Water Resources and Fluid Mechanics

II. Water Resources Management

III (1) Hydrology
(2) Water Quality Parameters and Assessment

IV Water Quality Management -I

V (1) Water Pollution
(2) Water Quality Management-II

Semester 5 (Open Course) Solid Waste Management

VI (1) Water Analysis
(2) Watershed Management

Semester 6 (Elective Course)

a. Rain Water Harvesting
b. Environmental Aspects of Estuarine System
c. Disaster Management
d. Elementary Concepts in GIS & GPS

COMPLEMENTARYCOURSES

I . Theoretical Inorganic Chemistry

II . Organic and Environmental Chemistry

III. Analytical Chemistry and Biomolecules

IV. Physical Chemistry

FOUNDATION COURSE

I . Computer Basics & Informatics

II . Computer Application for Biostatistics

FOUNDATION COURSE

I . **Computer Basics & Informatics** 54 hrs

Computer

History and development of computers - basic knowledge of computer systems - softwares and hardwares - free softwares - M.S Word, Excel, Power point.

Computer ethics - software piracy – internet. Piracy – privacy- computer security; computer crimes - hacking and cracking. 9 hrs

Internet - managing bodies of the internet - Internet Society - Internet Service Provider - Internet application software. 9 hrs

Overview of Information Technology

Features of the modern personal computer and peripherals - Computer network. 9 hrs

Knowledge Skills

Data information and knowledge - Internet as knowledge repository - Introduction to use of IT in teaching and learning. Educational softwares. INFLIBNET - academic services. 9 hrs

Social Informatics

IT and society - overview of it's application in medicine, health care, environmental studies-defence, crime detection, communication. 9 hrs

Applications of IT in weather forecasting, education, film and media - virtual reality. 9 hrs

References

1. Cultural Boundaries of Science. T.F.Gieryn, University of Chicago press, 1999 .
2. Alexis Leon & Mathew Leons, Computers Today, Leon Vikas.
3. Alexis Leon & Mathew Leons, Computers Today, Leon Vikas. Fundamentals of Information Technology. ISBN 08125907890
4. Learning Computer Fundamentals, Khanna Book Publishers, ISBN, 818752252b
5. John Ray 10 Minute Guide to Linnx PHI, ISBN 81-203-1549-9.

II Computer Application for Biostatistics 36 hrs

Computer applications - preliminary concepts - sampling, sampling designs - sampling techniques - sample random – systematic sampling data - data presentation – numeric –alphabetic – alphanumeric. 9 hrs

Collection and representation of data - collection and classification tabulation of data.

Graphical representation of data - methods of preparation of graph - Frequency curve relative frequency map - cumulative frequency map - relative frequency map or ogive. Dot diagram -significance of graphic representation - limitations of graphic representation. 9hrs

Measures of central tendencies - mathematical average, average of position - measures of dispersion - range-mean deviation - standard deviation - distribution patterns. 9 hrs

Types of variability - experimental variation - biological variability, real variability - experimental variability, error, subjective, objective instrumental and sampling error. 9 hrs

References

1. Elements of Biostatistics -S.Prasad. ISBN 81-7133-613-2 Title code bc-33 First edition -2003 Rastogi publications, Gangotri, Shivagiroad-Meerut 250 002.
2. Methods in Biostatistics for Medical students & research works-V.K Mahajan. Jaypee Brothers Medical brothers Pvt Ltd, New Delhi- 6th edition.
3. Introduction to Biostastitics. Pranab Kumar Banerjee and S.Chand. ISBN81-219-2329-8. First edition 2004. Rajendra Raveendra Printers Pvt. Ltd., Ram Nagar, New Delhi 110 055.

FOUNDATION COURSE - PRACTICALS

Semester II Computer Application for Biostatistics

1. Create a power point presentation of wild life population.
2. Graphical representation - Bar, Pie charts of flora and fauna.
3. Plotting straight lines
4. Determination of Central tendencies

CORE COURSE

SEMESTER I Research Methodology & Perspectives of Science 54 hrs

Introduction to research Methodology

Research fundamentals and terminologies. Introduction - scientific method - meaning of research - comparison of scientific method & non scientific method - objectives of research-research methodology - types of research. 12 hrs

Defining research problems - formulation of the problem - developing the research plan. Research design – design – experimentation – evaluation - validity of experiment. 10 hrs

Statistical analysis and interpretation of data. Report writing and presentation. Writing and formatting of reports - report presentation. 8 hrs

Perspective of science

Design of an experiment – experimentation - data collection - interpretation and deduction repeatability and replication - documentation of experiments - record keeping - planning of experiment – designs - instrumental requirements - types of instrumentation - accuracy and precision. 14 hrs

Data handling in science

Significance of statistical tools in data interpretation - errors and inaccuracies. Ethics in science -scientific information - digital sources. 10 hrs

References

1. The Glen: What everyone should know about Science. H.Collins and T.Pinch, Cambridge University press, 1993.
2. Cultural Boundaries of Science. T.F.Gieryn, University of Chicago press, 1999
3. Elements of Biostatistics. S.Prasad. ISBN 81-7133-613-2. Title code bc-33 First edition -2003. Rastogi publications, Gangotri, Shivagiroad- Meerut 250 002.
4. Introduction to Biostastitics. Pranab Kumar Banerjee and S.Chand. ISBN81-219-2329-8, First edition 2004. Rajendra Raveendra Printers Pvt. Ltd. Ram Nagar, New Delhi.
5. Research methodology. Dipak Kumar. Bhatacharya Excel Books, A-5, Naraina, Phase-1, New Delhi.

SEMESTER I Core course (Practicals)

1. Sampling methods - Plant or animal community on land.
2. Population censusing methods - Total count, sampling.
3. Estimation of beetle in wheat flour.
4. Study of common flora and fauna.

II Environmental Studies 72 Hours

Unit 1 : Multidisciplinary nature of environmental studies; Definition, scope and importance, need for public awareness. (2 hrs)

Unit 2 : Natural Resources : Renewable and non-renewable resources : Natural resources and associated problems. a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources : World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. (12 hrs)

Unit 3 : Ecosystems : Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystems :-

a. Forest ecosystem, b. Grassland ecosystem, c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (10 hrs)

Unit 4 : Biodiversity and its conservation : Introduction – Definition : genetic, species and ecosystem diversity.Biogeographical classification of India. Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity. (12 hrs)

Unit 5 : Environmental Pollution : Definition, cause, effects and control measures of :- a. Air pollution, b. Water pollution, c. Soil pollution, d. Marine pollution e. Noise pollution, f. Thermal pollution, g.

Nuclear hazards; Solid waste Management : Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case studies.; Disaster management : floods, earthquake, cyclone and landslides. (12 hrs)

Unit 6 : Social Issues and the Environment : From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rahabilitation of people; its problems and concerns. Case Studies; Environmental ethics : Issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies; Wasteland reclamation; Consumerism and waste products; Environment Protection Act.; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness. (12 hrs)

Unit 7 : Human Population and the Environment : Population growth, variation among nations; Population explosion – Family Welfare Programme; Environment and human health; Human Rights; Value Education; HIV/AIDS; Women and Child Welfare; Role of Information Technology in Environment and human health; Case Studies. (7 hrs

Unit 8 : Field work : Visit to a local area to document environmental assets river/ forest/grassland/hill/ mountain; Visit to a local polluted site-Urban/Rural/Industrial/Agricultural; Study of common plants, insects, birds; Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours). (5 hrs)

REFERENCES

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad –380 013, India, Email:mapin@icenet.net
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment
8. Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
10. Heywood, V.H &Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
11. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
15. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
16. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
17. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
18. Survey of the Environment, The Hindu (M)

19. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
20. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
21. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
22. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

SEMESTER II Core course (Practicals)

1. Identification of flora and fauna – terrestrial, marine and freshwater ecosystems
2. Estimation of primary productivity – light and dark bottle method
3. Community study : quadrat and line transect method
4. Construction of food chain/ food web : terrestrial and aquatic ecosystems

III Paper (1) Natural Resources and Conservation **54 hours**

Natural resources- definition and classification-Natural resources with reference to India. Renewable and non-renewable resources - Exhaustible and non- exhaustible resources; Mineral resources – distribution – production-coal fossil fuel 10 hrs

Biotic resources-forest and wild life – Biodiversity-hot spots in India-threat to biodiversity. *In situ* & *Exsitu* conservation. Soil and Land Land use pattern - Green revolution; River systems-climate and climatic regions of India. Seasons - onset and retreat of Monsoon –Drought – flood; Flood control programme. 12 hrs

Energy resources- Energy crises-Conventional and non -conventional energy -Types of energy .Fossile fuel – Hydel – Thermal – Nuclear – Solar – Wind – Biomass-Growing energy needs-Alternate energy sources. 10 hrs

Conservation- Minerals – soil- Forest- Wild life -Biotic resources – Fuel - Energy 10 hrs

Man and population, density, distribution-growth trends-sex ratio-age, Population explosion. 12 hrs

References

1. Economic and commercial geography of India T.C Sharma Coutinho, Vikas publishers- New Delhi
2. A Text book of Environmental sciences-PurohitShamiAgrawal-student Edition
3. India – ComprehensiveGeography.D.R.Khuller-Kalyani Publishers.
4. A.Text Book of Environmental studies.E.Barucha.University Press,Hydrabad.

SEM III Practicals

1. Measuring rainfall and calculation of normal rainfall.
2. Recording of maximum -minimum temperature
3. Recording of humidity.
4. Preparing a field map using prismatic compass.

SEM III Paper (2). Environmental Management **54 hrs**

Definition - Basic principles of Environmental Management. Environment Impact Assessment-Definition and aim, Principles and Concepts of EIA- EIA assessment methodologies - few case studies. 9 hrs

Concept of Sustainable Development - UN and International conferences - Rio summit Johannesburg conference on sustainable development; Copenhagen summit. 9 hrs

Environment laws and policies-Historical background of Environment laws - Environment Protection Act, Forest Conservation Act, The Wildlife protection Act, The Air Act, Water Act. 9 hrs

National Environment policies Public Interest Litigation (PIL)-List of cases like M.C.Mehtha vs Union Government of India. 9 hrs

Environment friendly products - pollution abatement technologies; concept of environmental planning - city planning. 9 hrs

Introduction to Environmental Economics.- environmental issues. 9 hrs

References

1. Environmental laws of India. An introduction. CPR Environmental Education Centre Chennai, 2000.
2. A text book on Environmental Studies. D.K.Asthana and Meera Athana. S.Chand and Co.
3. Ecology and Sustainable Development. P.S.Ramakrishnan. NBS New Delhi, 2001.
4. Environmental laws. Gurudip Singh. Macmillan India ltd.
5. Introductory Text of Environmental policies and laws. V.K.Garg, M.S Bishnoi, C.P Malik Kalyani Publishers, New Delhi.
6. Environmental Laws, Dharmendra.S.Sengar, Prentice Hall of India Pvt.ltd, Dew Delhi, 2000.

SEMESTER III Practicals

1. A Collection and submission of 5 Eco-friendly products.
2. A report of visit to a factory where Pollution abatement technology is implemented.
3. A report on environmental law case study in India.
4. A case study of EIA

SEM IV Paper 1 - Environmental Biotechnology and Microbiology (90 hours)

Biotechnology - definitions. Scope of biotechnology in agriculture, food production and nutrition. Impact of biotechnology on sustainability of the environment. Ethical and social impacts of biotehnology. Genetic Engineering - Brief study of gene cloning in prokaryotes. 12 hrs

Molecular tools for genetic engineering. Enzymes: Restriction endonucleases. Role of resrtiction endonucleases in genetic engineering. Recognition sequences, cleavage patterns. Mention of some common RE's - Eco RI, Bam I. Mention of the role of DNA ligases, Terminal transferase in genetic engineering. 12 hrs

Vectors: Role of vectors in GE. Mention of common vectors such as plasmids, bacteriophages, cosmids, artificial chromosome vectors like HAC, YAC, BAC. Host cells: Role of host cells in GE. Mention of prokaryotic hosts - *E coli*, *Bacillus subtilis*. Methods of gene transfer: Mention of transformation, conjugation, electroporation, lypofection, direct transfer. 12 hrs

Salient features of different microbial groups and their current classification - algae, fungi, bacteria, viruses, protozoa, mycoplasma and ricketsia. Microbial nutrition: Photoautotrophy, chemoaototrophy, heterotrophy. Interactions between microorganisms: commensalism, mutualism, parasitism and ammensalism. 12 hrs

Microbial interactions with plants: mycorhiza, rhizobium, actinomycetes and their interactions with legume associations and rhizosphere. Microorganisms in biomass and energy production: Microbes producing protein - single cell protein. Methane (Biogas or Gobar gas) 12 hrs

Environmental Microbiology - Different fields in environmental microbiology. Microbes and geochemical cycles - Nitrogen cycle, Sulphur cycle,.Microorganisms as geochemical agents. 12 hrs

Growth of micro organisms - cell cycle, population growth, batch culture, continuous culture. Mycelial growth. Environmental factors and microbial growth. 9 hrs

Microbes and environmental clean up - Biodegradation. Bioremediation - Need and scope. Environmental applications of bioremediation. Bioremediation technologies. Removal of toxic chemicals. 12 hrs

Epidemiology of microbial diseases of Man - Tuberculosis, Cholera, Hepatitis, AIDS, Histoplasmos, Aspergillosis, Amoebiasis and Malaria. 9 hrs

REFERENCES

1. Ecology & Environment, P.D. Sharma.
2. Enviromental Biology & Toxicology, P.D. Sharma.
3. General Microbiology Volume I & II C.B, Power & H.F. Daginawala. Himalaya Publishing house, New Delhi, 1982.
4. A text book of microbiology. Anathanarayana,S.
5. Microbiology P.D. Sharma, Restegi& Company, Meerut, 1989.
6. An Introduction to Microbiology, R.P. Singh & Kamal Central Book Depot, Allahabad 1989.
7. Ecology and Biology of Soil microorganisms: S.C. Bhandar & L.L. Somani, Agretech Publishing, Udaipur, 1994.
8. A text book of Microbiology. S.S. Purohit. Student edition, Jodhpur. 2004.
9. Biotechnology Applications and Carriers. MeenakshiMunshi, S.K. Sopory, Viva Book Pvt Ltd.
10. Basic Biotechnology. Rev.Fr. Dr. Ignacimuthu, S. J, Tata Mc Graw_Hill Publication Company Ltd.
11. Modern Concepts of Biotechnology. H.D. Kumar, Vikas Publishing House.
12. Biochemisry. U. Sathyanarayana.

SEMESTER IV PRACTICALS Paper -I

1. Demonstration of Sterilisation by dry heat and wet heat(Steam Autoclaving)
2. Cultutre media preparation using PDA (Potato Dextrose Agar)
3. Growth of *E.Coli* in liquid media.
4. Slides of specimens - Paramecium, Spirogyra, Pencillium, coliform bacteria.

SEMESTER IV Paper(2) Biophysics, Biostatistics and Computer Application 36 hrs

Biophysics

Light observation effect effect-Beer and Lambert's law.Absorption spectrum, Redox potential-Laws of photochemistry. Fluorenscence, phosphorescence and other photochemical reaction. 9 hrs

Principle and applications of light and electron microscopy, Spectrophotometry, mass spectrometry Absorption spectroscopy, X-ray analytical methods. 9 hrs

Biostatistics Various sampling methods, Measures of dispersion Test of significance, Chi square test and t-test statistical analysis using computer. 9 hrs

Internet browsing and websites for statistical analysis (Basic idea only). 9 hrs

References

1. Molecular structure and spectroscopy G.Arul Das, Prentice Hall 2007
2. Bio Physics-Principle and Techniques, -2005M.A Subramoniam .MPJ Publishers Chennai.
3. A.Text book of Spectroscopy.Banwell

SEMESTER V Paper (1) Environmental Geology and Mineralogy 72 hrs

Introduction to Geology - Environmental Geology - Definition and scope - Geological agents-Exogenous, and endogenous geological agents. Current views on origin of earth. 12 hrs

The classification of rocks based on their origin; concept of rock cycle; weathering. River as a geological agent; development of river. Rivers in India. 12 hrs

Streams - Drainage basin - Drainage pattern; energy in streams; factors controlling formation of soil; soil profiles. 12 hrs

Glaciers - Types and geological activity - wind -geological activity of wind. Meteorology -elements and factors of climate-influence weather and climate in agriculture; heat island - effect of climate change in ecosystem. 12 hrs

Crystals and minerals - Physical properties of minerals such as colour, streak lustre, hardness and specific gravity. Composition and diagnostic properties of minerals – Quartz, feldspar, talc gypsum, galena, beryl, corundum. 12 hrs

Nature and genetic relationship with igneous rocks-Textures of igneous rocks Megascopic features of the following rock types - granite, syenite, gabbro, basalt. 12 hrs

A brief study of the origin of sediments and sediment rocks. Feature of the following sedimentary rocks - sand stones. 12 hrs

References

1. Text book of Engineering, Geology,N. Chenna Kesaulu 1993 JNTU College of Engineering, Macmillan India limited.
2. Atmospheric Science and Environment, G.N.Ghosh. ISBN 81-7764-043-7-(C) 2000, Allied publishers Ltd.
3. A text book of Geology. Mukergee,P.K, 1986.
4. Engineering & General Geology, Parbinsingh,S.K.Katariah & sons, Gurunank market New Delhi.

SEMESTER V PRACTICALS Paper -II

1. Identification of common minerals & rocks
2. Identification of soil types - red soil, alluvial soil, black soil
3. Determination of soil moisture content.
4. Determination of soil pH
5. Determination of conductivity.
6. Estimation of organic carbon of soil

SEMESTERV Paper (2) Natural Hazards and Meteorology 72 hrs

Basic concept and definition of natural hazard and disaster - earth quake - distribution and causes; volcanoes - types and causes of volcanic eruptions. 12 hrs

Introduction to landslides, (Tsunami), cyclones, floods, hurricane, tornadoes, drought, fire; Causes, mitigation and management. 12 hrs

Anthropogenic disasters : chemical, industrial hazards, nuclear power plants, occupational hazards; hazards due to dam break. Mitigation measures. 12 hrs

Differences between natural disaster and artificial disasters. Environmental health hazard and risk management; Risk identification and assessment – prevention and mitigation. 12 hrs

Meteorology - elementary concept of climate, weather and climate. Clouds – types and classification; wind – forces affecting wind; types of wind and measurement; precipitation – measurement of precipitation; micrometereology 12 hrs

Climate change in agriculture; urban climatology; drivers of climate change – green house gases; effect of climate change on ecosystems, factors affecting climate. 12 hrs

References

1. A text book of Geology -Mukergee ,P.K 1986
2. Rutley's elements of MinerologyCBS.Publishers.New Delhi
3. Physical geography.StablerA.N.and Strahler,A,.H.1987
4. Principles of Petrology,TyrrelG.W.1948

SEMESTER VI. Paper (1) Environmental Pollution and Control Measures–I (54 hrs)

Air pollution - basic definitions and requirements - structure of atmosphere - composition of air, primary and secondary pollutants - unit for quantification of air pollution. Classification of air pollutants. 12 hrs

Automobiles exhaust - Emission standards - COx, NOx, SOx. Indoor air pollution. Effect of pollutants on plants and human beings. 9 hrs

From Factories - hydrocarbons, polychlorinated hydrocarbons; photochemical smog. 6 hrs

Control of air pollution - from factories-Automobile Exhaust-Automobile emission standards- Specific emission standards; Bharath Stages -I,II,III. Measures to check Industrial pollution. 9 hrs

Sources of correction - Control of particulate - removal of particulate matter. Control strategies - control of specific gaseous pollutants - Air Quality standards. 6 hrs

Hazardous Wastes – definition; dentification & classification - Generation of hazardous wastes - Management of hazardous wastes. Health and environmental effects of hazardous wastes-treatment methods. 12 hrs

References

1. A text book on Environmental Pollution and Control, Dr .H S. Bhatia, Galgotia Publications Private Ltd-5, Ansari road, Darya Ganj, Delhi-110 002.
2. Industrial Pollution, V.P.Kudesia, Pragati Prakashan, Meerut 250 001.
3. Air pollution, V.P.Kudesia, Pragathi Prakasan Meerut 250 001.

SEMESTER VI Paper (2) Environmental Pollution and Control Measures -II 36 hrs

Parameters of water pollution - standards of aquatic life. Classification of industrial wastes. 6 hrs

Land and soil pollution - Disposal on land - pesticides pollution- control of soil pollution. 6 hrs

Noise pollution – definition; measurement - decibels; effect of noise pollution on people; traffic noise pollution; industrial noise pollution. 6 hrs

Railway noise; aircraft noise; reduction of noise; absorption of sound. Control of noise pollution.6 hrs

Radioactive pollution - Kinds of radiation; nuclear reactions; natural sources of radioactive pollution; anthropogenic sources of radiation. Radioactive waste; biological effects of radiation pollution; dangers from nuclear plants. 6 hrs

Control from radiation - methods of control; minimizing X-ray hazard - Hazards of Radioactive pollution - Preventive measures from radiation. 6 hrs

References

1. A text book on Environmental pollution and Control. Dr .H S. Bhatia. Galgotia Publications private limited-5,Ansari road, Darya Ganj, Delhi-110 002.
2. Industrial Pollution. V.P.Kudesia-Pragati Prakashan, Meerut 250 001.
3. Air pollution. V.P.Kudesia, Pragathi Prakasan Meerut 250 001.

SEMESTER VI PRACTICALS Paper -I

INSTRUMENTATION (Demonstration)

1. pH meter
2. Conductivity meter
3. Turbidity meter
4. Colorimeter
5. Spectrophotometer

SEMESTER VI PRACTICALS Paper -II

1. Determination of COD
2. Analysis of anion mixture solution (2 Anions)among the following – Carbonate, sulphide, Thiosulphate, Oxalate, Chloride, Nitrate, Flouride, Sulphate, Phosphate
3. Thin layer Chromatographic separation of plant pigments.

Semester 6 (Elective)

a. Rain water Harvesting 3x18=54 hrs
b . Environmental Aspects of Estuarine System
c. Disaster management
d. Elementary concepts in GIS & GPS

Semester 5 (Open**) Solid Waste management** **54 hrs**

Solid wastes and its characteristics; classification of solid waste – source; factors affecting quality & quantity. Physical and chemical characteristics - collection & transportation. 9 hrs

Solid wastes from households, institutions, commercial establishment, public amenities; demolition sites; construction sites; mining & quarrying; sewage treatment plants. Types of solid wastes – municipal; agriculture; biomedical; hazardous; radioactive wastes. 9 hrs

Waste Management - global perspective - source reduction - Reuse and recycling. Disposal techniques - composting; principles of composting; factors affecting composting. Types of composting - Windrow layout and management. 9 hrs

Methane recovery; sanitary landfill - advantages and disadvantages of sanitary landfill. Methods of landfill. Incineration - types of incinerators - reactions involved - advantages and disadvantages of incineration. 9 hrs

Estimation of moisture content; determination of combustible matter; determination of calorific value; reactions involved. Functional elements of solid waste management. Disposal system with or without recoveries. 9 hrs

Summary of method of collection - transfer station; Vehicle and equipment for secondary collection. Ethical aspects of waste management; Pubic participation Law provisions. 9 hrs

References

A text book on Environmental pollution and Control. Dr .H S. Bhatia, Galgotia Publications private limited-5, Ansari road, Darya Ganj, Delhi-110 002.

Semester 6 (Elective)

a. Rain water Harvesting **36 hrs**

Rain water harvesting- Rainwater collection for drinking purpose; domestic rain water collection-community rain water collection. 6 hrs

Artificial recharge; methods of artificial recharge; roof water harvesting-surface water harvesting; dug cum borewells. 6 hrs

Mini artificial aquifer systems; borewell and hand pumps; artificial recharge in roads and colonies. Recycling and treating- methodology land use planning in watershed. 6 hrs

Rain water harvesting for sustainable development - water related sustainability issues in cities-Depletion of ground water table- concept of zero run off. Urban RWH practices. 6 hrs

The importance of watershed management in Kerala - Rain water harvesting in Institutional buildings. 6 hrs

Legal provisions in rain water harvesting in India and Kerala. 6 hrs

References

1. A.Keldho .T.I Sustainable watershed management strategies in semi arid regions of India .II Bombay email.eldho@civiliitb.ac.in.
2. KRG Rainwater Harvesting Foundation.

Semester 6 (Elective) **36 hrs**

b .Environmental Aspects of Estuarine System

The Estuary- definition - Physical features- salinity, temperature, circulation and mixing processes- Major and minor elements- chemical speciation in estuarine waters- Suspended matter in estuaries- adsorption and desorption processes- Sediment transport and sedimentation- Sediment- water interaction and the geochemistry of interstitial waters. 12 hrs

Nutrients, dissolved gases, and general biogeochemistry in estuaries- Biotic aspects of the chemistry of estuaries - Carbon dioxide - calcium carbonate system in estuaries. 12 hrs

Inorganic pollutants, particularly heavy metals in estuaries - Chlorinated hydrocarbons in estuaries- Oil pollution of the marine environment - with an emphasis on estuarine studies - Recovery and decontamination of estuaries. 12 hrs

References

1. Chemistry and Biogeochemistry of Estuaries. Edited by Eric Olausson and Ingemar Cato- John Wiley and Sons - New York.

2. Estuaries: monitoring and modeling the physical system. By Jack Hardisty. Blackwell Publishing.350 main street maldenMA 02148-5020, USA
3. Biogeochemistry of Estuaries, Thomas S. Bianchi. Department of Oceanography, Texas A&M University. Oxford University Press, 2007
4. Practical handbook of estuarine and marine pollution.

By Michael J. Kennish CRC press marine science series (For Oil Pollution and halogenated hydrocarbons)

Semester 6 (Elective)

d. Elementary concepts in GIS & GPS **36 hrs**

Map language – introduction; map as model; spatial elements terminology; classification of maps; map scale; map projection; grouping of map projection; commonly used map projections - Computer in map production; linkage of GIS to Remote Sensing. 9 hrs

Remote sensing; basic principles – Introduction; electromagnetic remote sensing process; nature of electromagnetic radiation. Electromagnetic spectrum; Energy interaction with earth's surface materials. 9 hrs

Fundamentals of GIS - roots of GIS; over view of information system; contribution; disciplines; GIS definition and terminology – Topology – Models - GIS queries - GIS architechture -Components of a GIS. 9 hrs

GIS Work Flow - functional elements of GIS - fundamentals of operations of GIS - theoretical frame work for GIS. GIS categories - level/scales of measurement. Nature of remote sensing-Remote sensing systems - Image display system. 9 hrs.

References

1. A Text book of Remote Sensing and Geographic Information Systems. M. Anji Reddy BS Publications 4-4-309,Giriraj Lane, sulthan Bazar, Hyderabad 500 095.
2. Remote sensing - Models and methods for image processing. Robert A. Schowengerdt-academic Press525 B street, suite 1900, San Diego,California-92101-4495.USA.

Semester 6 (Elective)
Disaster management **36 hrs**

Natural disasters **:** Introduction to - earthquake, volcanic eruptions, landslides, flash flood (Tsunami), major flood, storm surge, hurricane, tornadoes, drought 9 hrs

Anthropogenic disasters - disasters due to chemical, industrial, nuclear, domestic, dam break. 9 hrs

Pre-disaster, during disaster, post disaster; possibility of disaster - warning system - preparedness relief operations - National, State level, Local level – Agencies; concepts in remote sensing, GIS, GPS – applications. Rehabilitations - immediate, first stage, permanent. 9 hrs

Disaster assessment - casualty assessment; ecosystem damage - assessment. Introduction to disaster management. Management plan - preparedness, vulnerability of disaster, safety measures Role of NGO's - International, National, Regional (UN, Red Cross Army, Paramilitary NCC,NSS) 9 hrs

References

1. R.B.Singh (Ed) Environmental Geography, Heritage Publishers New Delhi,1990.
2. Savinder Singh Environmental Geography, PrayagPustak Bhawan, 1997.
3. Kates,B.I& White, G.F The Environment as Hazards, Oxford, New York, 1978.

4. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000.
5. H.K. Gupta (Ed) Disaster Management, Universities Press, India, 2003.
6. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo, 1994.
7. Dr. Satender , Disaster Management in Hills, Concept Publishing Co., New Delhi, 2003
8. A.S. Arya Action Plan For Earthquake, Disaster, Mitigation. In:V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994.
9. R.K. Bhandani An overview on Natural & Manmade Disaster & their Reduction, CSIR, New Delhi.
10. M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster Management,IIPA, New Delhi, 2001.

VOCATIONAL COURSES

SEMESTER I. Water Resources and Fluid Mechanics 36 hrs

Water as a resource material - multiple uses of water.-consumptive uses- irrigation; Partial consumptive uses-public water supply - Fire demand - Industrial uses - thermal uses. 9 hrs

Nuclear power generation - non consumptive uses - hydropower generation - inland navigation water resources – rivers, ponds, lakes. 9 hrs

Introduction to fluid mechanics - properties of fluids – density – viscosity - surface tension- types of flow - laminar flow - turbulent flow. 9 hrs

Reinhold's Number. Reynold's experiment - flow of water in open channels - pipes, calculation of flow velocity. Head losses – Dary-Weisbach equation; Hazen William's formula; Manning's formula (No derivation). 9 hrs

Reference

1. Ground Water Hydrology. David Keith Todd-Willey International.
2. Water resources Asit.K. Biswas Tata Macgraw Hill publishingcompany Ltd.
3 Hydrology and water resources. Sharma .RK .Dhanapathrai & Sons.
4 Water Technology N.F Gray 2nd Edition. Butterworth Haimann Publication.
5. AText book on Fluid Mechanics. R.K.Rajput.S.Chand & Company, New Delhi.

Practical

SEM- I

1. Measurement of rain fall
2. Measurement of Evaporation(Relative Humidity)
3. Measurement of atmospheric temperature
4. Record of humidity

SEMESTER II. Water Resources Management 54 hrs

Wate resources : types – surface water, ground water, water availability and uses. Water requirement for various uses - Industrial uses – aquaculture - recreational uses; Irrigational uses - definition of irrigation – necessity – benefits; ill effects - systems. 12 hrs

Lift irrigation – advantages – disadvantages-flow irrigation – Inundation – irrigation. Perennial system of irrigation.Direct irrigation-storage irrigation. 12 hrs

Surface irrigation methods - wild (uncontrolled) flooding method - furrow method - countour farming. Sub surface irrigation method - sprinkler irrigation - drip irrigation. Frequency of irrigation-standard of irrigation water. Irrigation efficiency. 12 hrs

Freshwater shortage; impact of climate on freshwater resources; management and conservation 6 hours

Reference

1. Irrigation Engineering, N.N.Basak.

2. Irrigation Water Power & Water resources Engineering, K.R.Arora Anand Publishers and distributors.

SEMESTER- II Practicals

1. Determination of pH of water sample
2. Determination of Alkalinity of water sample
3. Determination of SPM load of water.
4. Determination of Surface tension by drop weight method.
5. Determination of Surface tension by drop number method
6. Determination of Viscosity of a sample by Ostwalds Viscometer method
7. Determination of Humidity by Psychrometer.

SEMESTER III Paper (1)
Hydrology - I 72 hrs

Surface water hydrology

Hydrology (surface water); definition ; importance. Hydrologic cycle; climatic factors influencing hydraulic cycle – humidity, temperature, radiation, wind. Precipitation - condition for occurrence of precipitation. 9 hrs

Measurement of rainfall - different types of rain gauge; rainfall measurement by radar; errors in measurement; estimation of missing rainfall data; average rainfall over an area. Mean and annual rainfall; measurement of snow fall. 9 hrs

Characteristics of precipitations of India. Evaporators; factors affecting evaporation - Estimation of evaporation - evaporation pan method - Evaporation from soil surface. 9 hrs

Transpiration - Factors affecting infiltration rates. Infiltration rate; infiltration capacity; Infiltration indices; runoff; estimation of runoff; hydrograph; global water balance; water losses-inter basin transfer.

Ground water hydrology

Hydrology - ground water hydrology; occurrence of ground water; different types; Aquitard- Aquifuge - ground water collecting systems – wells. 9 hrs

Types of wells-collection – conveyance and distribution-general study-Ground water movement-Darcy's law (No derivation required); Ground water and well hydraulics. 9 hrs

Ground water and environmental influence-ground water level fluctuation due to stream flow-Evapo - transpiration; urbanization - ground water pollution by municipal, industrial, agriculture, domestic sources. 9 hrs

Saline water intrusion - Investigation of Ground water (Outline study only). Surface and ground water intrusion. Various types of underground sources. Infiltration galleries - Infiltration wells -Spring wells - open wells or dug wells - tube wells - different types. 9 hrs

Reference

1. Hydrology & Water Resources. Sharma R.K .Dhanapath Rai & Sons.
2. Engineering Hydrology Subramonian.K Tata Macgraw Hill publishing company ltd.
3.. Irrigation Engineering-N.N.Basak.
4. Water Supply Engineering. Santosh Kumar Garg. Khanna Publishers.
5. Water Resources Asit. K Biswas, Tata Macgraw Hill publishing company ltd.
6. Ground Water Hydrology, David Keeth, Todd-Willy international.
7. Ground Water by Ramakrishnan.

SEMESTER III Paper (2) Water Quality Parameters and Assessment 54 hrs

Water quality parameters - USPHS Scale and WHO scale, sampling; preservation. Water as a solvent. Collection of water sample. Analysis of natural and waste water sampling procedures. Main quality characteristics of water a) Alkalinity b)Hardness c) Total solids. 18 hrs

Physical properties of water- like BP, MP, critical temperature, viscosity, Surface tension, dielectric constant, dipole moment, Heat of vaporization; tolerance limits for trace metals in drinking water (Al, B, Cd, Co, Pb, Mn, Ni, Fe, Zn, Cr, Cu, Mo, Se, Sc). 16 hrs

International standards for Drinking water - pH, BOD, COD, B, As, Cd, Cr, NH_3, Fe, Cl, Hg, Mg, total hardness, pesticides, *E. Coli*, TDS; International standards for drinking water prescribed by WHO. 12 hrs

Water pollution - types of water pollution; Sources of water pollution; Harmful effects of water pollution - Strategies for water pollution control. 8 hrs

Reference

1. Environmental pollution -Management & Control for sustainable development. R. K. Khitoliya S. Chand & Company, Ram Nagar, New Delhi.
2. Laboratory Manual For Environmental Chemistry. SunithaHooda, Samanjeet Kaur. S. Chand & Company Ram Nagar New Delhi.
3. Water pollution. B.K.Sharma, Goel publishing House Meerut.

SEMESTER - III Practicals

1. Determination of Chlorine percentage in a sample of bleaching powder.
2. Determination of concentration of chloride ion in a sample of water sample
3. Determination dissolved oxygen in a sample of water.
4. Determination of density of water

SEMESTER IV Paper (2) Water quality Management -I 72 hrs

Water quality requirement and standards for various uses - drinking, industrial, irrigation aquaculture, cooling, recreation. 9hrs

Quality of water from different sources - water quality monitoring, sampling methods for waste water; stream and lake water, sediment. 9 hrs

Sampling equipments :Niskin water sampler, Nansen water sampler, Dussart flask. 9hrs

Water treatment processes; conventional process – sedimentation, coagulation, flocculation, filtration, disinfection. 9 hrs

Physical and chemical methods, UV rays, iodine and bromine – ozone – potassium permanganate – silver and chlorine. Different forms of chlorination. 9 hrs

Water softening - hardness and measurement of hardness - effects of hardness - removal of hardness. 9 hrs

Specific water treatment; removal of iron, manganese, chromium; Desalination. Reverse osmosis; electrodialysis; freezing method; multi flash evaporators 9 hrs

Fluoridation and de-fluoridation. Removal of dissolved gases from water - removal of oil - removal of radiomaterials. 9 hrs

Reference

1. Water supply Engineering B.C.Punmia, Asok Jain & Arun Jain. Lakshmi Publications, New Delhi.
2. Water and Waste Water Technology, Mark.J.Hammer. J Hammer, Printice Hall India Pvt. Ltd.
3. Waste Water Treatment for Pollution Control and Reuse, Tata Macgraw Hill publishing company.
4. Water Technology, N.F Gray Butter Worth, Heimann Oxford.
5. Chemical and Biological Methods of water pollution studies. R.K. Trivedi & R. K. Goel Environmental publication, Karad 1984.
6. Standard Methods for Examination of Water and Waste Water. APHA-Washington DC1985.
7. Ecological Methods for field and Laboratory Investigation, P.Michael. Tata Macgraw Hill publishing Company. New Delhi.

SEMESTER IV Practicals

1. Determination of BOD of a sample of water.
2. Determination of COD of a water sample
3. Determination of TDS in a sample of water.
4. Determination of Salinity in a sample of water
5. Determination of hardness of water

SEMESTER V Paper (1) Water Pollution 54 hrs

Sources of water pollution; physical pollution of water; chemical pollution of water; biological pollution of water. 9 hrs

Common impurities in water; testing of water; physical test; chemical test; bacteriological test. 9 hrs

Standards of drinking water. Water bone diseases; Maintenance of purity of water. Ground water pollution, factors affecting ground water pollution, harmful effects of ground water pollution. 9 hrs

Surface water pollution; Factors affecting surface water pollution - factors affecting nutrient loss in surface water - lake water pollution. 9 hrs

River water pollution - global river water pollution - sea water pollution-marine pollution. Control of pollution in seawater; role of microorganisms in cleanup operation. 9 hrs

Organic pollutants - synthetic detergents; ecofriendly detergents containing enzymes; eutrophication thermal pollution in water; esticide pollutants. 9 hrs

Reference

1. Water pollution. B.K.Sharma, Goel publishing House Meerut.

2. Water supply Engineering B.C.Punmia,Asok Jain & Arun Jain, Lakshmi Publications, New Delhi.

SEMESTER V Paper (2) Water quality management-II **54 hrs**

Quality and characterization of domestic waste water - physical Chemical and Biological Properties of waste water. Determination of COD, BOD. 9 hrs

Natural methods of sewage disposal : Dilution method, Sewage farming method, Self purification theory; Sanitary water management - sanitary waste; Definition-importance, historical back ground. Systems of sewage disposal. Dry conservancy system & water carriage system. 9 hrs

Sewage sickness - primary and secondary treatment - conventional and low cost - advanced waste water treatment including nitrogen and phosphorous removal - miscellaneous treatment of sewage 9 hrs

Oxidation pond – cesspool - septic tank - soak pit. Waste water disposal and reuse. Characteristics and treatment of industrial waste water : breweries and wineries; distilleries; paper and pulp mill; sugar mill; oil refineries. 9 hrs

Petrochemical industries; tanneries; pharmaceutical plants; fertiliser plant; electroplating industries; textile mills. 9 hrs

Treatment and disposal of sludge : thickening and digestion; conditioning and dewatering-incineration - ultimate disposal. 9 hrs

References

1. A Text book of Hydrology and Water Resources. R.K.Sharma. Dhanapath Rai & Sons.
2. Water Supply Engineering - Santosh Kumar, Garg-Khanna Publishers.
3. Environmental Engineering-N.N.Basak, Tata Macgraw Hill publishing company.
4. Pollution control in process industries-S.P.Mahajan.
5. WaterTechnology. N.F.Gray, Butter worth Heinmanm Publications.

SEMESTER - V Paper –I Practicals

1. Determination of chlorine demand a sample of water.
2. Determination of residual chlorine in a municipal water sample.
3. Determination of moisture percentage of soil.
4. Determination of PH of soil.

SEMESTER - V Paper –II Practicals

1. Gravimetric estimation of-
   a) Sulphate, oxalate
   b) Barium, Calcium, Iron, Nickel
2. Colorimetry & turbidimetry
   a) Sulphide, fluoride, silicate, ammonia & sulphate

SEMESTER -VI Paper -I WATER ANALYSIS 54 hrs

Various methods of analysis; Monitoring techniques and methodology ; Determination of pH - Specific conductance - Dissolved Oxygen, NH_3, NO_3^- & NO_2^-, Cl^-, F^-, CN^-, S^{-2}, SO_4^{-2}, PO_4^{-3}. 6 hrs

Total hardness (Ca& Mg), B, silica, metals and metalloids As, Se, Be, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ag, Zn. 6hrs

Chemical Oxygen Demand, Biological Oxygen Demand, Total Organic carbon, phenols, pesticides, surfactants, tannin and lignin. Microbial examination : Coliforms (*Escherichia coli*) and total bacteria. 6 hrs

Laboratory analysis of water sample; Determination of Turbidity of water sample - By Jacksons Turbidimeter, Baylis Turbidimeter and Nephelometers. Method to find the odour of a given water sample. 6 hrs

Method to find the colour of a given water sample. Method to determine the pH of given sample of water by colorimetric and electrometric method. 6 hrs

Method to find the carbonate, bicarbonate and hydroxide alkalinity of a water sample. Method to determine the concentration of chlorides of a given water sample. 6 hrs

Method to determine the total hardness of a water sample by standard EDTA method. Determination of residual chlorine in a given sample of water by (a) Orthotoludine Test; (b) Starch Iodide Test; (c) DPD Test 6 hrs

Method to determine the chlorine demand of a water sample; Method to determine the available chlorine percentage in a given sample of bleaching powder. 6 hrs

Method to determine the amountof dissolved oxygen (DO) of a water sample by Winkler Method; Method to find out the Suspended solids (SS), Dissolved solids(DS) and Total Solids (TS) of a water sample. 6 hrs

SEMESTER -VI Paper -(2) Watershed Management 54 hrs

Watershed – definition - classification of watershed - sub, milli, micro and mini watershed. Hydrology of watershed. 6 Hrs

Eco system in a watershed - Land use changes and resource degradation in watersheds-Agronomic measures for resource management in a watershed - choice of vegetation. 6 hrs

Land preparation - timely planting. Contour farming - multistoried cropping-mixed cropping-Inter cropping - strip cropping; mulching-cover cropping- crop rotation. 6 hrs

Vegetative hedges - barrier grass land management - agroforestery. Engineering measures - tank - vented cross bars and diversion weirs; stone pitched 6 hrs

Contour bunds, contour trenches and embankments of drains. 6 hrs

Water harvesting cum sediment detention tanks, earthen bunds, subsurface dams. 6 hrs

Watershed management for flood control. Geo textiles in watershed management. 6 hrs

Soil conservation; national water grid and river networking; initial attempts for watershed management in India. 6 hrs

An outline study of watershed management in Western Ghats Development Programme. 6hrs

SEMESTER VI Paper I Practicals

1. Volumetric Estimations

   a) Carbonate hardness-Hehner's method

   b) Non- Carbonate hardness- Hehner's method

   c) Mixture of Carbonate-Bi carbonate-warders method (N/20 HCL & std. sodium carbonate (2600 ppm)

   d) Sulphate ion in $H_2 SO_4$ (N/20 NaOH & std sodium carbonate(2600 ppm)

   e) Iodine in the solution (N/50 thiosulphate & std pot. dichromate (1000 ppm))

SEM -VI Paper II Practicals

f) Colorimetric estimations of

i.	nitrite	ii.	nitrate	iii.	phosphate	iv.	total nitrogen
v.	total phosphorous	vi.	sulphide	vii.	ammonia	viii.	silicate
ix.	fluoride	x.	ferrous iron and total iron.				

Project :-An investigatory Project report. This work may be based on Environmental Science (significance forEnvironment) or, project based on Water quality parameters (Local, Regional,state level, or National level important issues can be the topic of interest)

COMPLEMENTARY COURSES

I	Theoretical Inorganic chemistry	3x18=54 hrs
II	Organic and Environmental chemistry	3x18=54hrs
III	Biomolecules and Analytical chemistry	3x18=54 hrs
IV	Physical chemistry	3x18=54 hours

COMPLEMENTARY COURSES (Auxiliary Chemistry)

Semester-I Theoretical and Inorganic Chemistry **54 hours**

Module-1: Atomic Structure 9 Hrs

Atomic spectrum of Hydrogen - different series, , Bohr theory - postulates - statement of Bohr energy equation - derivation of spectral frequency from Bohr equation. Schrodinger wave equation (no derivation mention only) concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule - Pauli's principle, Hund's rule, stability of filled and half filled orbitals

Module - II Radio Activity and Nuclear Chemistry **9 Hrs**

Radio active equilibrium (qualitative only). Detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter - units of radio activity - Curie and Rutherford - Radio Carbon dating , Rock dating, Neutron activation analysis Applications in agriculture and medicine. A brief study of the biological effects of radiation such as pathological and genetic damage, Dosimetry - Units - rad, gray and roentgen. Nuclear Chemistry - stability of Nucleus - n/p ratio, artificial transmutation and radio activity, mass defect, binding energy, atomic fission and fusion.

Module III - Chemical bonding **9 Hrs**

Energetics of bond formation - Types of Chemical bonds - Energetics of ionic bond formation - Lattice energy - Born Haber Cycle - partial covalent nature of ionic bond - Fajan's rules , polarity of covalent bond

its relation with electronegativity - electro negativity scales - PaulingsScalefactors influencing polarity, dipolemoment-its relation to geometry.

Module IV - Chemical bonding II **9 hrs**

Hydrogen bond - inter and intra molecular - its consequences on boiling point -volatility and solubility. Hybridisation and structure of molecules - SP, SP^2, SP^3, dSP^2, dSP^3, SP^3d^2, and SP^3d^3hybridisation with examples. Explanation of bond angle in water and ammonia VSEPR theory, geometry of molecules with bond pairs of electrons only, geometry of molecules containing bond pairs and lone pairs of electrons, limitations. A brief review of molecular orbital approach, LCAO method -bond order, bond distance and stability of O_2,O_2^{2+},O_2^{2-},NO,NO+,COand HF.

Module V- Metallurgy **9 hrs**

General principles of occurrence and extraction of metals - purification, roasting, calcination and smelting, reduction to metal,different method with examples, refining of metals- electrolytic and zone refining. Van - Arkel method. Metallurgy of titanium, thorium and uranium.

Module VI- Coordination Chemistry **9 hrs**

Types of ligands, Werner's coordination theory, Valence bond theory of bonding in octahedral and tetrahedral complexes, Drawbacks of valence bond theory crystal field theory of octahedral and tetrahedral complexes, examples - high and low spin complexes, magnetic properties ,application in qualitative and quantitative analysis.

Semester II Organic and Environmental Chemistry **(54 hours)**

Module I - Introduction to organic reaction mechanisms **9hrs**

Types of reactions - substitution, addition, elimination and rearrangement reactions. Electrophilic and nucleophilic reagents - concept of inductive effect, hyper conjugative effect and resonance effect - reaction intermediates - carbocations, carbanions, carbenes, and free radicals - their formation, stability and configuration.

Module II - Stereochemistry **9hrs**

Optical isomerism- chirality, racemisation and resolution- relative and absolute configuration- DL and RS notations- asymmetric synthesis- optical isomerism due to restricted rotation- geometrical isomerism- EZ- nomenclature- conformation of ethane, propane, butane and cyclo hexane - Axial and equatorial bonds in cyclo hexane.

Module III - Polymer Chemistry **9 hrs**

Classification of polymers based on origin, structure, synthesis, and molecular forces. Commercially important polymers: structure and application of polyethylene, polystyrene, polyhaloolefines, Nylon-6, Nylon-66, Melamine, Terylene, Bakelite, Natural and synthetic rubber, vulcanization, inorganic polymer-silicones.

Module IV - Carbohydrates **9 hrs**

Classification- Configuration of glyceraldehydes, erythrose, threose, ribose, arabinose,glucose,fructose and mannose- properties of glucose and fructose-inter conversion of glucose and fructose- Industrial uses of cellulose- of macromolecules.

ModuleV - Environmental Chemistry **9 hrs**

Air Pollution: Types of pollutants in air- carbon monoxide, carbon dioxide, Nitrogen oxides, Sulphur dioxides, hydrogen sulphide, Cl_2, CFC, particulate matter, metals, fly ash, asbestos, hydrocarbons- source

and influence. Acid rain, Green house Gases, Green house effect, ozone layer and its depletion- Sulphatic, phosphatic, nitrogenous, chloride fertilizers-pollution due to long term use of fertilizers. Pesticides like chlorinated hydrocarbons, carbamates, organophosphorous compounds, organometallics, inorganic compounds- Non biodegradable pesticides - Environmental impact of pesticides. Detergents - cationic, anionic and non ionic-water pollution by detergents.

Module VI - Organometallic compounds **9 hrs**

Definition and classification - preparation, properties and applications of Grignard reagents, Ferrocene. Biological and environmental aspects. Applications in medicine, agriculture and horticulture - antitumour drugs.

Semester III Analytical Chemistry and Biomolecules **(54 hours)**

Module I - Spectroscopy I **9 hrs**

Regions of electromagnetic spectrum- interaction of radiation with matter-Various types of molecular spectra- Microwave spectroscopy- spectra of diatomic molecules-selection rule-frequency of separation of spectral line- determination of bond length- Infra red spectra-selection rule-frequency of separation- calculation of bond length.

Module II - Spectroscopy II **9 hrs**

Raman spectroscopy: Stoke's and antistoke's lines - Quantum theory of Raman spectra-advantage and disadvantage -complementary nature of Raman and IR spectra- Mutual exclusion principle.

Module III - Instrumental methods of analysis **9hrs**

Principle, Instrumentation and applications of : Atomic Absorption Spectroscopy- Flame photometry-Nephelometry and turbidimetry- colorimetry- spectrophotometry.

Module IV - Analytical Chemistry **9 hrs**

Solubility product- common ion effect- their applications in qualitative analysis- principles of volumetric analysis- primary standard-standard solution-normality and molarity -theory of acid base indicators-redox indicators-theory of complexometric titration. Accuracy and precision-classification of errors-detection and correction of determinate errors.

Module V - Chromatography **9 hrs**

Outline study of adsorption and partition chromatography-column, paper, thin layer, ion exchange , and gas chromatography- Rf value - relative merits of different techniques- separation of amino acids from mixtures.

Module VI- Bioinorganic compounds **9 hrs**

Metalloporphyrins - photosynthesis and respiration- haemoglobin – myoglobin - mechanism of O_2-CO_2 transportation - nitrogen fixation-carbon fixation - carbon cycle - biochemistry of iron toxicity and nutrition-essential and trace elements of biological systems

Semester IV Physical Chemistry **54 hrs**

Module I- Colloids **9hrs**

Properties of colloids-Tyndall effect-Ultra microscope-Brownian movement-electrophoresis-electroosmosis-sedimentation and streaming potentials- origin of charge and stability of colloids-zeta potential-Hardy Schulz rule- protective colloids-gold number- emulsions-gels-application of colloids-clarification of water-Cottrell precipitator-delta formation-medicines-sewage disposal-emulsification and cleansing action of soaps and detergents.

Module II- Electrochemistry **9 hrs**

Conductance- specific, equivalent and molar conductance-measurement using conductivity meter-variation with dilution - conductometric titration- principle-merits- strong acid-strong base titration & weak acid - strong base titration.

Electrochemical cell- cell potential and electrode potential- standard electrode potential -electro chemical series-SHE -measurement of electrode potential- Nernst equation for electrode potential(No derivation)-Calomel electrode, pH electrodes-Glass electrode, Quinhydrone electrode- fuel cell.

Module III- Binary liquid systems **9 hrs**

Completely miscible liquid pairs, vapour pressure - composition curves, boiling point- composition curves, fractional distillation, Azeotropic mixtures, critical solution temperature, Conjugate layers, phenol-water system. Theory of steam distillation, distribution law, limitations of distribution law, application of distribution law solvent extraction.

Module IV- Thermodynamics **9 hrs**

First law - intrinsic energy and enthalpy - work done during reversible isothermal expansion-second law of thermodynamics-entropy and free energy - concept of spontaneity and reversibility, Gibb's Helmholtz equation - derivation of relation between heat of reaction at constant pressure and constant volume - Hess's law - bond energy and bond dissociation energy -measurement based on Hess's law - Third law of thermodynamics.

Module V- Equilibrium **9 hrs**

Chemical equilibrium - relation between Kp and Kc-Vant Hoff's isotherm equation and isochoric equation- relation connecting equilibrium constant and degree of dissociation for the following systems: $2NH_3$ $N_2 + 3H_2$, PCl_5 $PCl_3 + Cl_2$ - degree of dissociation- determination from density measurement- Le Chatelier principle and its applications. Concept of acid and bases-ionic product of water- pH, pOH ,pKw- ionization constants of weak acids and bases- Buffer solution- Henderson equation-calculation of pH of solutions.

Module VI- Chemical Kinetics, Catalysis and Photochemistry **9hrs**

Order and molecularity, derivation of rate equation for zero, first and second order reactions (same initial concentrations) - determination of order of reactions—effect of temperature on rate of reactions-concept of activation energy-illustration of exothermic and endothermic reactions based on it- Arrhenius equation-determination of Arrhenius parameters -intermediate compound formation theory and adsorption theory of catalytic reactions.

Practicals

Semester I & II- Qualitative Analysis **72 hrs**

1) Reactions of anions - carbonate, sulphide, sulphate, thiosulphate, oxalate, nitrite, nitrate, chloride, phosphate, fluoride (No exam)
2) Identification by flame colouration : Lithium, sodium, potassium, barium, calcium, strontium(No exam)
3) Reactions of cations: Ag^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Al^{3+}, Fe^{2+}, Fe^{3+}, Zn^{2+}, Mn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH_4^+
4) Analysis of solution containing mixture of two cations- at least 10 mixtures (Avoid same group)

Semester III & IV- Quantitative Analysis **72 hrs**

I. **Volumetric Analysis**

a) Acidimetry and alkalimetry

1) Estimation of NaOH using Na_2CO_3
2) Estimation of KOH using Na_2CO_3
3) Estimation of K_2CO_3 using Na_2CO_3
4) Estimation of H_2SO_4 using oxalic acid
5) Estimation of HNO_3 using oxalic acid

b) Permanganometry
1) Estimation of Fe^{2+} using oxalic acid
2) Estimation of sod.oxalate using Mohr's salt
3) Estimation of Fe^{2+} using oxalic acid
4) Estimation of Mohr's salt using oxalic acid

c) Dichrometry
1) Estimation of Fe^{2+} using internal indicator
2) Estimation of Fe^{2+} using external indicator

d) Iodometry and Iodimetry
1) Estimation of iodine
2) Estimation of copper

e) Complexometry
1) Estimation of Zinc
2) Estimation of Mg

II Gravimetric Analysis (No Exam)

1) Estimation of water of hydration in barium chloride crystals
2) Estimation of barium in barium chloride solution

References

1) Atomic structure and chemical bonding with introduction to molecular spectroscopy, Manas Chanda.
2) Concise Inorganic Chemistry,J.D.Lee
3) Elements of Nuclear Chemistry, Arnikar
4) EnvironmentalChemistry,A.K De.
5) Essentials of Physical Chemistry, Bahl,Tuli and ArunBahl.
6) A. I. Vogel, "Text book of Qualitative Analysis"
7) A. I. Vogel, "Text book of Quantitative Inorganic Analysis".
8) A. K. Srivasthava and P. C. Jain, "Chemical Analysis".
9) Coordination Chemistry : Bosolo and Johnson.
10) Coordination Chemistry : S. F. A. Kettle.
11) Instrumental Methods of Analysis,B.K Sharma.

UNIVERSITY OF KERALA

Career Related First Degree Programme in Environmental Science

&

Environment and Water Management

Under Choice Based Credit and Semester System

2015

kup 179(4)/2015-'16

20. രസകൗമുദി - ഡോ. പൂജപ്പുര കൃഷ്ണൻ നായർ.
21. ആധുനികാനന്തര സാഹിത്യസമീപനങ്ങൾ - സി. ജെ. ജോർജ്ജ് (എഡി:).
22. ഛന്ദസ്സ് നമ്മുടെ കവിതയിൽ - സച്ചിദാനന്ദൻ, മലയാളകവിതാപഠനങ്ങൾ, മാതൃഭൂമി ബുക്സ്, പുറം 83-99.
23. ദലിത് സാഹിത്യപ്രസ്ഥാനം - കെ. എം. പുരുഷോത്തമൻ.
24. ഭാരതീയേതര സാഹിത്യസിദ്ധാന്തങ്ങൾ - ഡോ. തോമസ് സ്കറിയ.

സെമസ്റ്റർ	:	**III**
കോഴ്സ് കോഡ്	:	**ML 1331**
കോംപ്ലിമെന്ററി കോഴ്സ്	:	**V**
സമയക്രമം	:	**ആഴ്ചയിൽ 3 മണിക്കൂർ (18 ആഴ്ചയിൽ 54 മണിക്കൂർ)**
ക്രെഡിറ്റ്	:	**3**

പരിസ്ഥിതി : സിദ്ധാന്തവും ആവിഷ്ക്കാരവും

പഠനോദ്ദേശ്യം

പരിസ്ഥിതിദർശനവുമായി ബന്ധപ്പെട്ട ആശയങ്ങൾ, തത്ത്വങ്ങൾ, പ്രവണതകൾ, പ്രതിഭാസങ്ങൾ എന്നിവയെക്കുറിച്ചുള്ള അറിവുകൾ നേടുക - പ്രകൃതിസ്രോതസ്സുകളെയും അവയുമായി ബന്ധപ്പെട്ട പ്രശ്നങ്ങളെയും കുറിച്ചു മനസ്സിലാക്കുക - പരിസ്ഥിതിയുടെ ജൈവ, സാമൂഹിക, സാംസ്കാരിക, രാഷ്ട്രീയ, സാമ്പത്തിക വശങ്ങൾ, പാരിസ്ഥിതിക മേഖലയിൽ മനുഷ്യനുള്ള സ്വാധീനത്തിന്റെ പ്രത്യേകത, ഭൂമിയിൽ ജീവൻ നിലനിർത്തുന്നതിനാവശ്യമായ സാഹചര്യങ്ങൾ എന്നിവയെക്കുറിച്ചു മനസ്സിലാക്കുക - സർഗ്ഗാത്മകതലത്തിൽ, പരിസ്ഥിതിദർശനത്തിന്റെ ഭൂമികയിൽ നിന്നുകൊണ്ട് കലയെയും സാഹിത്യത്തെയും കാണുവാനും വിലയിരുത്തുവാനുമുള്ള മനോഭാവം സൃഷ്ടിക്കുക.

പാഠ്യപദ്ധതി

മൊഡ്യൂൾ : ഒന്ന് (9 മണിക്കൂർ)

എ. പരിസ്ഥിതിദർശനം

പരിസ്ഥിതി - അർത്ഥവും വ്യാപ്തിയും - പരിസ്ഥിതി സമീപനങ്ങൾ - പരിസ്ഥിതി ദർശനങ്ങൾ - ഗഹനപരിസ്ഥിതിവാദം - സാമൂഹിക പരിസ്ഥിതിവാദം - പാരിസ്ഥിതിക സ്ത്രീവാദം - പാരിസ്ഥിതിക മാർക്സിസം - പാരിസ്ഥിതികപ്രസ്ഥാനങ്ങൾ - ഇവയെക്കുറിച്ചുള്ള പഠനം.

ബി. പരിസ്ഥിതിദർശനം സർഗ്ഗാത്മകതലത്തിൽ

പരിസ്ഥിതിബോധം സാമൂഹിക, സാംസ്കാരികതലങ്ങളിൽ, പരിസ്ഥിതിബോധം സർഗ്ഗാത്മകതലത്തിൽ - പാരിസ്ഥിതിക സൗന്ദര്യശാസ്ത്രം - പരിസ്ഥിതിദർശനം കലാരൂപങ്ങളിൽ - സാഹിത്യത്തിൽ - സാമാന്യപഠനം.

മൊഡ്യൂൾ : രണ്ട് (9 മണിക്കൂർ)

പരിസ്ഥിതി ദർശനം – പഠനങ്ങൾ

വിശദപഠനം :

1. പരിസ്ഥിതിസൗന്ദര്യശാസ്ത്രത്തിന് ഒരു മുഖവുര – ഡോ. ടി. പി. സുകുമാരൻ (ഈ പേരിലുള്ള ലേഖനം മാത്രം) – ബോധി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
2. സംസ്കാരവും ആവാസവ്യവസ്ഥയും – ജി. മധുസൂദനൻ (ഭാവനയുടെ ജലസ്ഥലികൾ).

മൊഡ്യൂൾ : മൂന്ന് (9 മണിക്കൂർ)

പരിസ്ഥിതിദർശനം കഥയിൽ

വിശദപഠനം

1. ആമസോൺ – അശോകൻ ചരുവിൽ
2. ഹരിതമോഹനം – സുസ്മേഷ് ചന്ദ്രോത്ത്

മൊഡ്യൂൾ : നാല് (9 മണിക്കൂർ)

പരിസ്ഥിതിദർശനം നോവലിൽ

വിശദപഠനം

ജൈവം – പി. സുരേന്ദ്രൻ

മൊഡ്യൂൾ : അഞ്ച് (9 മണിക്കൂർ)

പരിസ്ഥിതിദർശനം കവിതയിൽ

വിശദപഠനം

1. കൊച്ചിയിലെ വൃക്ഷങ്ങൾ – കെ. ജി. ശങ്കരപ്പിള്ള
2. ഭൂമിയുടെ ചടങ്ങുകൾ – സച്ചിദാനന്ദൻ
3. അതിരപ്പിള്ളിക്കാട്ടിൽ – പി. എൻ. ഗോപീകൃഷ്ണൻ
   (ഇടിക്കാലൂരി പനമ്പട്ടടി – മാതൃഭൂമി പ്രസിദ്ധീകരണം)

മൊഡ്യൂൾ : ആറ് (9 മണിക്കൂർ)

ഹരിതദർശനം നാടകത്തിലും ചലച്ചിത്രത്തിലും

വിശദപഠനം

(എ) നാടകം: കനകം വിളയുന്ന മണ്ണ് – തിക്കോടിയൻ.

(ബി) ചലച്ചിത്രം: 1. പേരറിയാത്തവർ – ഡോ. ബിജു.
2. അരജീവിതങ്ങൾക്ക് ഒരു സ്വർഗ്ഗം – എം. എ. റഹ്മാൻ.
3. ഓരോപുഴയും പറയുന്നത് – അലിഫ്ഷാ.

സഹായകഗ്രന്ഥങ്ങൾ

1. ഹരിതനിരൂപണം മലയാളത്തിൽ - (എഡി.) ജി. മധുസൂദനൻ, കറന്റ് ബുക്സ്, തൃശൂർ.
2. കഥയും പരിസ്ഥിതിയും - ജി. മധുസൂദനൻ, കറന്റ് ബുക്സ്, തൃശൂർ.
3. പരിസ്ഥിതി കവിതയ്ക്കൊരാമുഖം - പി. പി. കെ. പൊതുവാൾ, ഡി. സി. ബുക്സ്,
4. പരിസ്ഥിതിബോധവും സംസ്കാരവും - പി. പി. കെ. പൊതുവാൾ, മാതൃഭൂമി ബുക്സ്.
5. പരിസ്ഥിതിവിജ്ഞാനം - എൻ. ബാലകൃഷ്ണൻ നായർ, ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
6. പ്രകൃതി, പരിസ്ഥിതി ദാരിദ്ര്യം ഊർജ്ജം - ആനന്ദ്, ഡി. സി. ബുക്സ്.
7. ഹരിതരാഷ്ട്രീയം : ചരിത്രം സിദ്ധാന്തം പ്രയോഗം- ജോർജ് കെ. അലക്സ്, ഡി. സി. ബുക്സ്.
8. ജീവന്റെ കയ്യൊപ്പ് - ആഷാമേനോൻ: ഡി. സി. ബുക്സ്.
9. പരിസ്ഥിതി സൗന്ദര്യശാസ്ത്രത്തിന് ഒരു മുഖവുര - ഡോ. ടി. പി. സുകുമാരൻ, ബോധി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
10. കവിതയുടെ രഥോത്സവം - (എഡി.) അജയപുരം ജ്യോതിഷ്കുമാർ, ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
11. ഹരിതസാഹിത്യദർശനം - എം. അച്യുതൻ.
12. കവിതയും പരിസ്ഥിതിയും - എസ്. രാജശേഖരൻ.
13. കാലിഫോർണിയ കാടുകളിൽ - സുഗതകുമാരി.
14. ഹരിതദർശനം ആധുനികാനന്തരകവിതയിൽ - ഡോ. സി. ആർ. പ്രസാദ്.
15. പ്രതിരോധചിന്തകൾ - ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
16. മലയാള കവിതയും പരിസ്ഥിതിയും - ഡോ. ആനന്ദ് കാവാലം.
17. പടരുന്ന മഷിച്ചാലുകൾ - ഐറിസ് കൊയ്ലിയോ.
18. ഭാവനയുടെ ജലസ്ഥലികൾ - ജി. മധുസൂദനൻ.
19. പ്രകൃതി സമീപനങ്ങൾ ആദ്യകാല കവിതകളിൽ - ഡോ. സീമ ജെറോം.
20. പരിസ്ഥിതിയുടെ രാഷ്ട്രീയം - (എഡി.) സി. റഹിം, ഫേബിയൻ ബുക്സ്.

സെമസ്റ്റർ	**:**	**IV**
കോഴ്സ് കോഡ്	**:**	**ML 1431**
കോംപ്ലിമെന്ററി കോഴ്സ്	**:**	**VII**
സമയക്രമം	**:**	**ആഴ്ചയിൽ 3 മണിക്കൂർ (18 ആഴ്ചയിൽ 54 മണിക്കൂർ)**
ക്രെഡിറ്റ്	**:**	**3**

ദലിതെഴുത്ത്, പെണ്ണെഴുത്ത്: സിദ്ധാന്തവും ആവിഷ്ക്കാരവും

പഠനോദ്ദേശ്യം:

ദലിത് പഠനമെന്ന വിജ്ഞാനമേഖലയുടെ പശ്ചാത്തലത്തിൽ മലയാളത്തിലെ ദലിത് സാഹിത്യത്തെ തിരിച്ചറിയുക - മലയാളികളുടെ സാംസ്കാരികവൈവിധ്യം സാഹിത്യ വഴിയിൽ മനസ്സിലാക്കുക - ചരിത്രത്തിന്റെ വ്യത്യസ്ത ഇടങ്ങളിൽ പാർശ്വവൽക്കരിക്ക പ്പെട്ട ജനവിഭാഗങ്ങളെയും അവരുടെ സംസ്കാരത്തെയും സാഹിത്യത്തെയും കുറിച്ച് അറിയുക - മുഖ്യധാരാസംസ്കാരത്തിന്റെ സാഹചര്യങ്ങൾക്കു പുറത്ത് രൂപപ്പെട്ട സംസ് കാരത്തിന്റെ ഒരു ജനകീയധാരയെക്കുറിച്ചു ബോധ്യപ്പെടുക.

സമീപകാല സൈദ്ധാന്തികപഠനങ്ങളിൽ ഏറെ പരാമർശിക്കപ്പെടുകയും വിമർശിക്ക പ്പെടുകയുംചെയ്ത 'സ്ത്രീവാദ'ത്തെ പരിചയപ്പെടുക - ലിംഗപരമായ വ്യത്യസ്തത യുടെ അടിസ്ഥാനത്തിലുള്ള വിവേചനത്തിൽ നിന്നും സ്ത്രീകൾക്കു തുല്യനീതി ഉറപ്പാ ക്കുക എന്ന ലക്ഷ്യത്തോടെ രൂപപ്പെടുത്തിയ ചിന്താപദ്ധതിയും പ്രവർത്തനവും എന്ന നിലയിൽ അതിനെ തിരിച്ചറിയുക - സ്ത്രീകളുടെ വൈയക്തികവും സാമൂഹികവുമായ യാഥാർത്ഥ്യത്തെ വെളിപ്പെടുത്തുകയും ലിംഗകേന്ദ്രിതമായ എല്ലാത്തരം പാർശ്വവല്ക്ക രണത്തെയും ചെറുക്കുകയുമാണ് അതിന്റെ രീതിശാസ്ത്രം എന്നു മനസ്സിലാക്കുക - ഫെമിനിസത്തിന്റെ ചരിത്രവികാസത്തിന്റെയും സിദ്ധാന്തങ്ങളുടെയും പൊതു പശ്ചാ ത്തലത്തിൽ മലയാളത്തിലെ സ്ത്രീപക്ഷരചനകളെ പഠിക്കുക.

സംസ്കാരത്തിലെ വംശ, വർഗ്ഗ, മത, ജാതി, ലിംഗനിർണയനങ്ങളെക്കുറിച്ചുള്ള ധാരണ നവീകരിക്കുകയും മാറുന്ന ലോകത്തിന്റെ പരിതഃസ്ഥിതികളിൽ നിന്നുകൊണ്ട് ഒരു പുതിയ മാനവീയതയെക്കുറിച്ചുള്ള അവബോധം സൃഷ്ടിക്കുകയും ചെയ്യുക എന്നതാണ് ഈ കോഴ്സിന്റെ സവിശേഷ ലക്ഷ്യം.

രീതിശാസ്ത്രം

ഈ കോഴ്സിന്റെ പഠനത്തിനു രണ്ടുതലങ്ങളുണ്ട്. ഒന്ന്: സിദ്ധാന്തതലം. രണ്ട്: ആവിഷ്ക്കാരതലം. സിദ്ധാന്തതലത്തിൽ ദലിതെഴുത്തിനും പെണ്ണെഴുത്തിനും ആസ്പദമായ അവസ്ഥകളെയും സിദ്ധാന്തങ്ങളെയും സാമാന്യമായി പരിചയപ്പെടു ത്തുന്നു. ആവിഷ്ക്കാരതലത്തിൽ ദലിതെഴുത്ത്, പെണ്ണെഴുത്ത് മാതൃകകൾ പരിചയ പ്പെടുത്തുകയും വിശദപഠനം ഏതാനും രചനകളിലായി പരിമിതപ്പെടുത്തുകയും ചെയ്യുന്നു.

പാഠ്യപദ്ധതി

മൊഡ്യൂൾ : ഒന്ന് (9 മണിക്കൂർ)

ദലിതെഴുത്ത്

ദലിത് എന്ന പദത്തിന്റെ നിഷ്പത്തി - ഇതര സംജ്ഞകൾ - ദലിത് പദത്തിന്റെ വ്യത്യസ്ത വ്യാഖ്യാനങ്ങൾ - ദലിത്പഠനത്തിന്റെ സാമാന്യചരിത്രം - ആഫ്രിക്കൻ - അമേരിക്കൻ എഴുത്തും കറുപ്പിന്റെ സാംസ്കാരിക മുന്നേറ്റങ്ങളും - ഇന്ത്യൻ പശ്ചാത്തലം - മലയാളത്തിലെ ദലിത് സാഹിത്യം - സാമാന്യ അവലോകനം - വാമൊഴി - വരമൊഴി ഭേദങ്ങൾ.

മൊഡ്യൂൾ : രണ്ട് (18 മണിക്കൂർ)

എ. വാമൊഴി സാഹിത്യമാതൃക :

പാലുവം പെണ്ണിനെത്തേടി (നാടൻപാട്ട്)

ബി. വരമൊഴി സാഹിത്യമാതൃകകൾ :

I കവിത

1. എന്റെ വംശത്തെപ്പറ്റി.... - പൊയ്കയിൽ അപ്പച്ചൻ
2. അമ്മ ഒരു കാല്പനിക കവിത - വിജില ചിറപ്പാട്.
3. കറുത്ത കല്ല് - എസ്. ജോസഫ്

II ചെറുകഥ

1. നിരവത്ത് കയ്യാണി - സി. അയ്യപ്പൻ
2. നിസ്സഹായരുടെ നിലവിളി - നാരായൻ

III നോവൽ

എരി - പ്രദീപൻ പാമ്പിരിക്കുന്ന്

സഹായകഗ്രന്ഥങ്ങൾ

1. ദലിത്പഠനം : സ്വത്വം, സംസ്കാരം, സാഹിത്യം - ഡോ. പ്രദീപൻ പാമ്പിരിക്കുന്ന്, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
2. ദലിത് തിരിച്ചറിവുകൾ (എഡി:) ഡോ. അജു. കെ. നാരായണൻ, ഭൂമിമലയാളം, യു.സി. കോളേജ്, ആലുവ.
3. ദലിത്പാതകൾ : (എഡി.) ബോബി തോമസ്, സൈൻ ബുക്സ്, തിരുവനന്തപുരം.
4. ബുദ്ധനിലേക്കുള്ള ദൂരം - കെ. കെ കൊച്ച്, ഡി. സി. ബുക്സ്.
5. ദലിത് സാഹിത്യപ്രസ്ഥാനം - കെ. എം. പുരുഷോത്തമൻ, സാഹിത്യഅക്കാദമി.
6. ദലിത് സാഹിത്യം - കവിയൂർ മുരളി, കറന്റ് ബുക്സ്, കോട്ടയം.
7. ദലിത് ഭാഷ - കവിയൂർ മുരളി.
8. കീഴാളജീവിതമുദ്രകൾ - ഡോ. പി. ജി. പത്മിനി, സമയം പബ്ലിക്കേഷൻസ്.
9. ദലിത് വർത്തമാനം (എഡി.) രാജേഷ് ചിറപ്പാട്, മൈത്രി ബുക്സ്, തിരുവനന്തപുരം.
10. 500 വർഷത്തെ കേരളം - ചില അറിവടയാളങ്ങൾ - (ജന. എഡി.) ഡോ. സ്കറിയാ സക്കറിയ, താരതമ്യപഠനസംഘം, കറന്റ് ബുക്സ്, കോട്ടയം.

11. വായനയുടെ ദലിത് പാഠം - കെ. കെ. കൊച്ച്, പൂർണ്ണ പബ്ലിക്കേഷൻസ്.
12. ദലിതന്റെ നിനവും നോവും നാടൻ പാട്ടുകളിൽ - ഡോ. കുമാരൻ വയലേരി, പാപ്പിയോൺ, കോഴിക്കോട്.
13. ദലിത് സാഹിത്യം പരസ്യകല - ഡോ. വി. സി. സുപ്രിയ/ ഡോ. കെ. കെ. ശിവദാസ്, ഡോ. സന്തോഷ് മാനിച്ചേരി - മാളുബൻ പബ്ലിക്കേഷൻസ്.
14. കീഴാളന്റെ പ്രതിരോധതന്ത്രം - ഷീബ എം. കുര്യൻ.
15. കാവ്യഭാവനയുടെ സ്ത്രീപഠനങ്ങൾ - ഡോ. എ. ഷീലാകുമാരി.

മൊഡ്യൂൾ : മൂന്ന് (9 മണിക്കൂർ)

പെണ്ണെഴുത്ത്

സ്ത്രീവാദചിന്തയുടെ ആദ്യാങ്കുരങ്ങൾ - ഇക്കാലത്തെ ഫെമിനിസ്റ്റു ചിന്തയിലെ ശ്രദ്ധേയ വ്യക്തിത്വങ്ങൾ - കൃതികൾ - സ്ത്രീവാദത്തിലെ വ്യത്യസ്ത ധാരകൾ - ഒന്നാംതരംഗ സ്ത്രീവാദം - രണ്ടാംതരംഗസ്ത്രീവാദം - മൂന്നാംതരംഗസ്ത്രീവാദം, പ്രധാന വ്യക്തിത്വങ്ങളും കൃതികളും - ശ്രദ്ധേയങ്ങളായ ഉപധാരകൾ - ഉദാരസ്ത്രീവാദം (Liberal feminism), സോഷ്യലിസ്റ്റു സ്ത്രീവാദം, മാർക്സിസ്റ്റുസ്ത്രീവാദം, മൗലിക സ്ത്രീവാദം (Radical feminism), കറുത്തസ്ത്രീവാദം (Black feminism), എക്കോ ഫെമിനിസം - സ്ത്രീവാദവും സാഹിത്യവും - സ്ത്രൈണ സർഗ്ഗാത്മകതയെക്കുറിച്ചുള്ള വ്യത്യസ്ത സമീപനങ്ങൾ - ഭാഷയുടെ ലിംഗകേന്ദ്രിത സ്വഭാവം - ഇവയെക്കുറിച്ചുള്ള സാമാന്യപഠനം - കേരളത്തിലെ സ്ത്രീമുന്നേറ്റങ്ങളുടെ ചരിത്രപശ്ചാത്തലം - മലയാളത്തിലെ സ്ത്രീരചനാപാരമ്പര്യങ്ങൾ - ആദ്യകാല എഴുത്തുകാരികൾ - തുടർന്നുള്ള ഘട്ടങ്ങൾ - മുഖ്യസംഭാവനകൾ.

മൊഡ്യൂൾ : നാല് (18 മണിക്കൂർ)

പെണ്ണെഴുത്ത് : മലയാള മാതൃകകൾ

എ. കവിത

1. കെട്ടിയിട്ട കോലാട് - കമലാദാസ് (വിവ. സച്ചിദാനന്ദൻ)
   (ഈ പേരിലുള്ള കവിത മാത്രം)
2. പ്രതിഷ്ഠ - സാവിത്രിരാജീവൻ
3. പെണ്ണുങ്ങൾ കാണാത്ത പാതിരാനേരങ്ങൾ - വി. എം. ഗിരിജ
   (ഈ പേരിലുള്ള കവിത മാത്രം)

ബി. കഥ

1. പരാജിത - രാജലക്ഷ്മി
2. വനദുർഗ്ഗ - സാറാജോസഫ്
3. ഇത്തവണ രാധ - പ്രിയ. എ. എസ്.

സി. ആത്മകഥ

നഷ്ടബോധങ്ങളില്ലാതെ (ആത്മകഥ) - ദേവകി നിലയങ്ങോട്

സഹായകഗ്രന്ഥങ്ങൾ

1. ഫെമിനിസം : ചരിത്രപരമായ ഒരന്വേഷണം - ഡോ. എം. ലീലാവതി, ചിന്ത, പബ്ലിഷേഴ്സ്.
2. ഫെമിനിസം - വാല്യം 1, 2 (എഡി.) ഡോ. ജാൻസി ജയിംസ്, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്.
3. കേരളത്തിലെ സ്ത്രീമുന്നേറ്റങ്ങളുടെ ചരിത്രം - സി. എസ്. ചന്ദ്രിക, സാഹിത്യ അക്കാദമി.
4. ആദ്യകാല സ്ത്രീകഥകൾ - (എഡി.) ഡോ. എം. എം. ബഷീർ, ലിപി പബ്ലി ക്കേഷൻസ്.
5. സ്ത്രീവാദം - ജെ. ദേവിക, ഡി. സി. ബുക്സ്.
6. സ്ത്രീരചനാദർശനം : ഒരു അവലോകനം - പ്രശാന്ത് കുമാർ. എൻ., എൻ.ബി. എസ്. കോട്ടയം.
7. സ്ത്രീസ്വത്വാവിഷ്ക്കാരം മലയാളത്തിൽ - ഡോ. എം. ലീലാവതി, സാഹിത്യ അക്കാഡമി, തൃശൂർ.
8. സ്ത്രീവിമോചനം : ചരിത്രം, സിദ്ധാന്തം, പഠനം - എ. കെ. രാമകൃഷ്ണൻ/ കെ. എം. വേണുഗോപാലൻ, നയനാബുക്സ്, പയ്യന്നൂർ.
9. ആധുനിക മലയാളകവിതയിലെ സ്ത്രീപക്ഷ സമീപനങ്ങൾ - പി. ഗീത, ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്.
10. ഇക്കൊഫെമിനിസം, ഇക്കോടൂറിസം, മാർക്സിസം - എൻ. എം. പിയേഴ്സൺ, കറന്റ് ബുക്സ്, കോട്ടയം.
11. മുടിത്തെയ്യങ്ങൾ - സച്ചിദാനന്ദൻ ('പാപത്തറ' എന്ന സമാഹാരത്തിന്റെ ആമുഖ പഠനം).
12. പ്രത്യവമർശം - ബാലചന്ദ്രൻ വടക്കേടത്ത്, കറന്റ് ബുക്സ്, കോട്ടയം.
13. കുലസ്ത്രീകളും ചന്തപ്പെണ്ണുങ്ങളും ഉണ്ടായത് - (എഡി.) ജെ. ദേവിക.

SEMESTER-II

FOUNDATION COURSE

METHODOLOGY AND PERSPECTIVES IN PLANT SCIENCES

Course code : BO1221

Number of credits : 3

Number of contact hours: 36 hrs (Lecture); 36hrs (Practical) = 72 hours

Distribution of Hours	Theory	Practical
MODULE-I - Scientific Studies	08 hrs	
MODULE- II - Data handling in science	12 hrs	16 hrs
MODULE-III - Microtechnique	06 hrs	08 hrs
MODULE-IV - Biophysics	10 hrs	12 hrs
Total	36 hrs	36 hrs

Aim of the course: To introduce the methodology and perspectives of Science in generalso as to enable the students to systematically pursue his particular discipline in science in relation to other disciplines that come under the rubric of sciences.

Objectives:

• To familiarize the students with the fundamental characteristics of science as a human enterprise

• To see how science works

• To apply scientific methods independently

• To interpret scientific data using basic statistical methods

MODULE-I Scientific Studies **08 hrs**

1. Types of knowledge: practical, theoretical and scientific knowledge

2. Information: What is science; what is not science; laws of science; basis of scientific laws and factual truths.

3. Science as a human activity; scientific temper and empiricism, Science disciplines

4. Revolution in Science and Technology

5. Ethics in Science: Scientific information; depositories of scientific information, Primary, secondary and digital sources; sharing of knowledge; transparency and Honesty; danger of pre conceived ideas.

6. Methods and tools in science: Steps in scientific method. Null hypothesis and alternative hypothesis. Inductive and deductive reasoning.

MODULE- II Data handling in science- 12 hrs

1. Nature and types of data-typical examples, Data collection, Data presentation- Classification and tabulation, diagrammatic (bar, pie diagrams) and graphic presentation.
2. Samples and sampling techniques.
3. Statistical treatment of data: Statistical terms and symbols. Measures of central tendencies (mean, median, mode), Measures of dispersion (range, mean deviation, variance, standard deviation, coefficient of variation), Significance tests (chi-square test).
4. Data analysis – Normal frequency distribution and binomial distribution.

Practical 16 hrs

1. Workout problems on frequency distribution, measures of central tendencies (Mean, Median, Mode)
2. Workout problems on measures of dispersion. (range, mean deviation, variance, standard deviation, coefficient of variation)
3. Workout problems on chi-square test.

MODULE-I11

Microtechnique 06 hrs

1. Introduction - microscopy - simple and compound – phase contrast; dark field illumination and electron microscopes (SEM and TEM).
2. Micrometry, Camera lucida
3. Sectioning - hand and microtome– rotary and sledge
4. Killing and fixation agents – Carnoy's formula, Farmers formula, F .A. A
5. Dehydration - reagents
6. Stains and staining techniques - double staining. General account; Stains: safranin, haematoxylin, acetocarmine.
7. Mounting media - D. P. X and Canada balsam
8. Whole mounts - cytological methods: maceration, smear and squash preparation.

Practical 08 hrs

1. Familiarize stains, fixatives and mounting media
2. General awareness of Micro technique - maceration, smears & squash
3. Demonstration of microtome sectioning and hand sectioning
4. Measurement of specimens using micrometer (Demonstration only).
5. Photomicrography and Camera lucida drawings (Demonstration only).