



Faculty of Science

M.Sc Environmental Sciences

Syllabus

2019

MASTER OF SCIENCE [M.Sc.]

COURSE ORDINANCE

1. PREAMBLE

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system.

Faculty of Science. Shree Guru Gobind Singh Tercentenary University, Gurugram with the aim to enhance academic standards in quality of higher education has adopted the UGC guide lines as such in all PG courses.

The grading system is considered to be better than the conventional marks system and in order to facilitate student mobility across institutions with in India and across countries the community grade point average (CGPA) has been introduced in all the PG courses. The guidelines as follows,

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

- a. Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
- b. Elective Course: Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
 - i. Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The

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University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

- ii. **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
- c. Skill Enhancement Course: The course based upon the content that leads to Knowledge enhancement.

2. GOALS:

- Employment prospects for post graduates are very good. The scientific knowledge and mathematical and analytic skills acquired help to place across a wide range of industries including aerospace, pharmaceutical, dyes, fabrics, electronics, semiconductors, petroleum, communications, computing, education, commerce, civil services and many more.
- ii. The course will build a rich knowledge base to provide a foundation for the continued study of science.
- iii. The theoretical and experimental skills necessary to analyze and solve a range of advances problems, providing an excellent foundation for leadership.
- iv. Post-graduation leads to abundance of research opportunities.

3. OBJECTIVES

The postgraduate training should enable the student to:

- i. Practice efficiently various investigative procedures backed by scientific knowledge including basic sciences and skills.
- ii. Get expertise in his/her field of interest
- iii. Play the assigned role in the implementation of required practical skills.
- iv. Be a motivated 'teacher' defined as one keen to share knowledge and skills with a colleague or a junior or any learner continue to evince keen interest in continuing education irrespective of whether he/she is in a teaching institution or is practicing and use appropriate learning resources.
- v. Exercise empathy and a caring attitude and maintain professional integrity, honesty and high ethical standards.
- vi. The student is expected to know his subject in depth; however, emphasis should be on the analytical techniques. Knowledge of recent advances and basic sciences as applicable to his/her specialty should get high priority.
- vii. Competence in skills commensurate with the specialty (actual hands-on training) must be ensured.

4. Duration and Nomenclature of the Course:

The duration of M.Sc (Physics /Chemistry /Mathematics /Forensic Science/Envi ronmental Science course shall be of two academic years consisting of four (4) semesters (15-17 weeks) under Choice Based Credit System(CBCS). On successful completion of all the four semesters, the student will be awarded M.Sc.Degree in the concerned course. The student

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shall complete the course within a maximum period of 4 years from the date of admission to the first semester, failing which he/she will be disqualified from the course.

5. Admission to the Course:

i. Eligibility for Admission:

For admission to the 1st Semester of M.Sc. (Physics) course, the candidate must have passed B.Sc. (Pass) with Physics as one of the subjects/B.Sc. (Hons.) Physicswith 50% marks (45% marks in case of SC/ST candidates of Haryana only) in aggregate or equivalent grade from any university recognized by UGC

For admission to the 1st Semester of M.Sc. (Chemistry) course, the candidate must have passed B.Sc. (Pass) with Chemistry as one of the subjects/B.Sc. (Hons.) Chemistry with 50% marks (45% marks in case of SC/ST candidates of Harvana only) in aggregate or equivalent grade from any university recognized by UGC.

For admission to the 1st Semester of M.Sc. (Mathematics) course, the candidate must have passed B.Sc. (Pass) with Mathematics as one of the subjects/B.Sc. (Hons.) Mathematics /B.A (Pass) with Mathematics/ as one of the subjects/ B.A (Hons.) Mathematics with 50% marks (45% marks in case of SC/ST candidates of Harvana only) in aggregate or equivalent grade from any university recognized by UGC.

For admission to the 1st Semester of M.Sc. (Forensic Science) course, the candidate must be graduate with Physics, Chemistry & Mathematics, Physics, Chemistry & Biology OR Agricultural sciences OR BCA OR B.Pharm. OR B.Sc.(Nursing) OR Engineering sciences OR B.Sc.(Forensic Sciences) OR Medical sciences with 50% marks (45% marks in case of SC/ST candidates of Haryana only) in aggregate or equivalent grade from any university recognized by UGC.

For admission to the 1st Semester of M.Sc. (Environmental Science) course, the candidate must have passed B.Sc(Non Medical/ Environmental Sciences/Life Sciences/Bio Sciences/ Agriculture) with 50% marks (45% marks in case of SC/ST candidates of Haryana only) in aggregate or equivalent grade from any university recognized by UGC.

ii. Schedule of admission and payment of fees:

The admission schedule, along with last date for the submission of admission forms and payment of fees, shall be fixed by the Vice-Chancellor from time to time.

6. Mode of Selection of Candidates for Admission:

The admissions will be made as per the following criteria:

Sr.No.	Criteria	Condition
1	On the Basis of the Merit of the qualifying	If the no. of applicants is up to 3
	Examination.	times of the intake
2	On the Basis of the Merit of the Entrance	
	Examination.	than 3 times of the intake

7. Syllabus:

The syllabus is based on Choice Based Credit System (CBCS) and is recommended by Board of Studies and approved by Academic Council from time to time.

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8. Scheme of Examination, distribution of marks, credit system and Syllabus:

The Scheme of examination, distribution of marks in various papers along with the credit system and the syllabus of the course shall be as approved by Board of Studies/Academic Council from time to time.

9. Medium of Instruction and Examination:

The medium of the instruction and the examination shall be English only.

10. Attendance Requirements/Eligibility to Appear in Examination:

The student should fulfill the following criteria to be eligible for appearing in the End Term Semester Examinations:

- i. He/she should bear a good moral character.
- ii. He/she should be on the rolls of the Dept./Faculty of the University during the semester.
- iii. He/she should have 75% of the attendance during the respective semester. Twenty five per cent (25%) of attendance relaxation shall account for illness and contingencies of serious and unavoidable nature.
- iv. The Dean of the Faculty of his own or on the recommendation of the HOD shall have the power to give relaxation upto 5% on genuine grounds over the minimum 75% attendance.
- v. Further, the Vice Chancellor of his own or on the recommendation of the Dean shall have the power to give further relaxation upto 5% on genuine grounds over the above mentioned minimum attendance.
- vi. He/she should not be a defaulter in payment of any dues of the SGT University and no disciplinary action is pending against the student.

11. Exemption from Attendance / Shortage of attendance to be condoned:

The shortage of lecture to the maximum limit as under can be condoned by the competent authority:

Sr. No	Exemptable No. of Lecture	Ground of Exemption	Competent Authority
1	All periods of the days of blood donation	Voluntarily blood donation to the Blood Bank.	Dean of the Faculty
2	All periods of the day of Examination	For appearing in the supplementary examinations(Theory /Practical/Viva-voce)	-do-
3	10 days attendance during a semester	For participation in University or Inter- Collegiate Sports Tournaments/ Youth Festivals, NCC/NSS Camps/University Educational Excursions/ Mountaineering Courses	-do-

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4	15days attendance during a	For participation in Inter-	-do-
	semester	University Sports	
		Tournaments/ Youth	
		Festivals	

Provided:

- i. that he/she has obtained prior approval of the Dean, Faculty of Science;
- ii. that credit may be given only for the days on which lectures were delivered or tutorials or practical work done during the period of participation in the aforesaid events.

12. Attendance Shortage Warning:

Attendance shortage warning will be displayed on the Faculty's Notice Board and University Website by 10th day of every month.

13. Detained students

A student, who does not fulfill the criteria prescribed in Clauses10-11, will not be eligible for appearing in the End Term Semester Examination in that particular paper and will be deemed as Detained in that paper. Such stu dent will repeat the course/paper alongwith the regular students of the subsequent batchto fulfill the prescribed conditions to appear in the "End Term" examination of the course/paper.

14. Submission of Examination Forms and Payment of Examination Fee:

The Dean, Faculty of Science shall submit the examination admission forms of thosestudents who satisfy the eligibility criteria to appear in the examinations to the Controller of Examinations as per schedule of examination circulated by him from time to time.

15. University Examinations:

i. End Term Semester Examinations:

The examination for the 1^{st} and 3^{rd} semesters (Odd Semesters) shall ordinarily be held in the month of December and of the 2^{nd} and 4^{th} semesters (Even Semesters) in the month of May/June. The examination dates are fixed by the controller of examination with the approval of Vice Chancellor.

ii. Fail/ Reappear candidates:

Fail / re-appear candidate of the odd semesters $(1^{st}\& 3^{rd})$ will take re-appear exams as an ex-student in the subsequent exams of the odd semesters $(1^{st}\&3^{rd})$. Similarly, for the even semesters $(2^{nd}\&4^{th})$, he/she will take re-appear exams. in the subsequent exams of the even semesters $(2^{nd}\&4^{th})$. However, a candidate appearing in the 4th semester examination (Regular) may appear simultaneously in his/her re-appear paper(s) of lower semesters.

16. Improvement Examination:

The student may be permitted to improve his/her result subject to the following conditions:

mill New Hours

- i. The student will be permitted to appear in improvement examination as an ex-student with regular batches.
- ii. The student will be permitted to improve his/her CGPA in one or all papers in which he/she has obtained CGPA less than 'First Division' in aggregate.
- iii. Only one chance per paper will be given. The chance must be availed within a year of initially passing of every semester examination.
- iv. The candidate will be required to apply and allowed to appear only for theory examinations.
- v. If the status/nature of the student's result does not improve by five (05) or more per cent, his/her improvement result will be declared "PRS" (Previous Result Stands).
- vi. The candidate shall be allowed to appear in the improvement examination(s) along with regular candidates as and when the course is offered. No separate examination will be held for improvement of result. In case of change of syllabi, the student shall have to appear for improvement in accordance with the changed syllabi of the concerned course applicable to the regular students of that exam.

17. Setting of Question Papers:

- i. The Head of the Department/Dean of the Faculty shall supply the panel of internal and external examiners duly approved by the Board of Studies to the Controller of Examinations. The paper(s) will be set by the examiner(s) nominated by the Vice-Chancellor from the panel of examiners.
- ii. An examiner shall be allowed to set not more than two papers in a semester examination.
- iii. The examiner(s) will set the question papers as per criteria laid down in the Scheme of Examinations as approved by the Board of Studies/Academic Council of the University.

18. Evaluation Process – Theory and Practical: Evaluation of Answer Books:

The answer books may be evaluated either by the paper setter or any other internal or external examiner to be nominated by the Controller of Examiners with the approval of the Vice-Chancellor from the panel of examiners approved by the Board of Studies.

Re-evaluation of Answer Books:

Re-evaluation/ rechecking of any paper is allowed. The students can apply for Re-evaluation/ Re-checking of any paper to the Controller of Examinations through the HoD/Dean of the Faculty within 10 days of the declaration of result by paying prescribed fee.

Practical Examinations - Appointment of Examiner:

a. The practical examinations shall be conducted by a Board of two Examiners consisting of one internal and one external examiner to be nominated by the Vice-Chancellor from the panel of examiners.

Marks Distribution:

The distribution of marks in examination of the practical paper will be as per the criteria given below:

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- a. Experimental performance = 60% marks
- b. Viva-Voce = 30% marks
- c. Laboratory work report = 10% marks

19. External Assessment (Summative Assessment):

Sixty per cent marks shall be assigned to each theory and practical paper as Summative Assessment. The distribution of marks in theory as well as practical papers will be in accordance to IQAC guidelines.

20. Internal Assessment(Formative Assessment):

i. (Theory Papers)

a. Based on 40 Marks:

1	Assignment	5 marks			
2	Mid Term Test (10 Marks each) 20 mar				
3	Synergy / Project	10 marks			
4	Attendance	5 marks			
	Marks distribution for Attendance in % age				
Ì	95<=Attendance=100	5 marks			
Ì	90<=Attendance<95	4 marks			
ľ	85<=Attendance<90	3 marks			
	80<=Attendance<85	2 marks			
1	75<=Attendance<80	1 marks			

b. Based on 20 Marks:

1	Assignment	5 marks
2	Mid Term Test	10 marks
3	Attendance	5 marks
	Marks distribution for At	tendance in % age
	95<=Attendance=100	5 marks
	90<=Attendance<95	4 marks
	85<=Attendance<90	3 marks
	80<=Attendance<85	2 marks
	75<=Attendance<80	1 marks

i. (Practical/Project/Dissertation)

i. Based on 40 Marks:

S.no.	40 Marks Internal		60 Marks External
1	Attendance	10 marks	
2	Practical/Project	10 marks	

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	File/Dissertation		30 marks for Practical
3	Internal Viva-Voce	20 marks	examination (Conduction/
	Marks distribution for At	tendance in % age	 Demonstration)/Project File/Dissertation + 30 marks for
	97.5<=Attendance=100	10 marks	Viva-Voce in End-term
	95<=Attendance<97.5	9 marks	Examination by External Experts
	92.5<=Attendance<95	8 marks	1
	90<=Attendance<92.5	7 marks	
	87.5<=Attendance<90	6 marks	1
	85<=Attendance<87.5	5 marks	7
	82.5<=Attendance<85	4 marks	7
	80<=Attendance<82.5	3 marks	
	77.5<=Attendance<80	2 marks	
	75<=Attendance<77.5	1 Marks	

ii. Based on 20 Marks:

s.no.	20 Marks I	30 Marks External			
1	Attendance 5 marks				
2	Practical/Project 5 marks File/Dissertation		15 marks for Practical		
3	Internal Viva-Voce	10 marks	examination (Conduction/ Demonstration)/Project		
	Marks distribution for Attendance in % age		file/Dissertation + 15 marks for		
	95<=Attendance=100	5 marks	Viva-Voce in End-term		
	90<=Attendance<95	4 marks	Examination by External Experts.		
	85<=Attendance<90	3 marks			
	80<=Attendance<85	2 marks			
	75<=Attendance<80	1 Marks			

- iii. In case of ex-students, those appearing for re-appear / improvement examination in any semester, their previous Internal Assessment marks will be counted. If there is any change in Scheme of Examination, then Internal Assessment marks will be modified accordingly.
- iv. The concerned teacher shall preserve records on the basis of which the Internal Assessment has been awarded and shall make the same available to the Controller of Examinations whenever required.
- v. The Head of the Department/ Dean of the Faculty shall ensure:
 - a. That the internal assessment marks are displayed for information of the students at least seven (07) days before the commencement of the examinations of each semester
 - b. That the internal assessment marks are submitted to the Controller of Examinations at least seven (07) days before the commencement of the examinations of each semester.

21. Criteria for Promotion to Higher Semester:

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The student shall be promoted to 2^{nd} and 4^{th} semester automatically without any condition of passing minimum number of papers. For promotion from 2^{nd} to 3^{rd} Semester, the student shall have to clear at least 50% papers of 1^{st} and 2^{nd} semesters taken together.

22. Credit Based Grading System:

i. Key Definitions:

Programme	An educational programme leading to award of a Degree, Diploma or Certificate.
Course	Usually referred to as 'paper' is a component of a programme. All courses need not carry the same weight.
Credit	A unit by which the course work is measured. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours for practical work/field work per week. A Research Based Paper /Project is equal to 6 credits.
Credit Point	It is the product of grade point and number of credits for a course i.e. Credit Point = No. of credits in a course X "grade value" of the grade obtained in the course.
Grade Point	There are two types of GPAs as given hereunder:
Average (GPA)	Semester Grade Point Average (SGPA) Cumulative Grade Point Average (CGPA) Every student earns a distinct SGPA and a distinct CGPA at the end of each specified semester.
SGPA	SGPA is a measure for performance of student in a Semester. It is the Point Average ratio of sum of the product of number of credits with the grade points scored by the student in all the courses taken by him/her and the sum of the number of credits of all the Courses undergone by the student i.e. SGPA (Si) = $\sum (CixGi) / \sum Ci$
CGPA	CGPA is a measure of performance up to any Grade Gradespecified semester Point Average beginning from the first Semester. It is also calculated in the same (CGPA) manner as SPGA taking into account all the courses undergone by a student over all the semesters of programme i.e. $CGPA = \sum (Cix Si) / \sum Ci$
Grade Point	It is a numerical weight allotted to each letter grade on a 10-point scale.
Letter Grades	It is an index of the performance of a student in a said course. The Grades are denoted by letters O, A+, A, B+, B, C, P, F and Ab.

ii. Credits, Semesters, Courses and total Credit Points:

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S.No	Course	Semesters	Core Courses	Discipline Specific elective Courses	Skill Enhancement Courses	Total Credi ts
1	M.Sc.(Physics)	4	72	16	12	100
2	M.Sc.(Chemistry)	4	74	12	14	100
3	M.Sc.(Mathematics)	4	78	12	10	100
5	M.Sc.(Forensic Sciences)	4	86	8	6	100
6	M.Sc.(Environmental Science)	4	60	24	16	100

Grading Table

Range of Percentage of Marks	Letter Grade	Grade Points	Range of Grade Points	Classification
90 and above	O (Outstanding)	10	9-10	Outstanding
80 & above but less than 90	A+ (Excellent)	9	8< 9	Excellent
70 & above but less than 80	A (Very Good)	8	7< 8	1 st Div with Distinction
60 & above but less than 70	B+ (Good)	7	6< 7	1 st Division
50 & above but less than 60	B (Above Average)	6	5<6	2 nd Division
Above 40 but less than 50	C (Pass Average)	5	Above 4 <5	3 rd Division
40	P(Pass)	4	4	Pass
Less than 40	F (Fail)	0	-	Fail

Formula for Calculating percentage of marks:

 $CGPA \times 10 \text{ e.g. } 6.53 \times 10 = 65.3$

Formula for Grade Point calculation:

G = (Marks Obtained in Paper/Total marks of paper) x100.

Formula for Computation SGPA & CGPA

- i. The SGPA is the ratio of sum of the product of the number of credits with the grad points scored by a student in all the courses taken by a students and the sum of the number of credits of all the courses taken by the students; i.e SGPA (Si) = $\sum (Ci \times Gi) / \sum Ci$,

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where Ci is the no of credits of the ith course and Gi is the grad point Scored by the student in the ith course

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by the students over all the students over all the semesters of a programme, i.e

$$CGPA = \sum (Ci \times Si) / \sum Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded up to 2 decimal points and reported in the transcripts. Result-Cum-Detailed Marks Card/ Transcript: Based on the above recommendations on letter grades, grade points and SGPA and CGPA, the DMC/ Transcript for each semester and a consolidated transcript in dictating the performance in all semester may be issued

Course	Credit	Grade Letter	Grade Point	Credit Points (Credit × Grad) 3×8 = 24
Course 1	3	A	8	3×8 = 24
Course 2	4	B +	7	4×7 = 28
Course 3	3	В	6	3×6 = 18
Course 4	3	0	10	$3 \times 10 = 30$
Course 5	3	C	5	3×5 = 15
Course 6	4	В	6	4×6 = 24
	20			139

iv. 1. Illustration of Computation of SGPA and CGPA and Format for Transcripts

Thus, SGPA = 139/20 = 6.95

Similarly, Suppose the SGPA for 2^{nd} , 3^{rd} and 4^{th} semester are 7.85, 5.6, and 6.0 with credits 22, 24 and 22, respectively, then for a two-year PG Programme, the CGPA will be computed as followed,

 $CGPA = (20 \times 6.95 + 22 \times 7.85 + 24 \times 5.6 + 22 \times 6.0)/88 = 6.57$

Course	Credits	Grade Letter	Grad Point Block	Range of Grad Points(Actual Grade Value as per marks obtained	Earned Credit Point(Credit × Actual Grade Value)
Course 1	3	0	10	9.2	3×9.2=27.6
Course 2	3	A+	9	8.2	3×8.2=24.6
Course 3	4	А	8	7	4×7=28
Course 4	3	B+	7	6.7	3×6.7=27.6
Course 5	3	В	6	5.6	3×5.6=16.8
Course 6	4	С	5	4.7	4×4.7=18.8
	20				135.9

Thus, SGPA= 135.9/20 = 6.79

Similarly suppose SGPA for 2nd, 3rd, and 4th semester are 7.85, 5.6 and 6.0 with credits 22, 24, and 22 respectively

 $CGPA = (20 \times 6.79 + 22 \times 7.85 + 24 \times 5.6 + 22 \times 6.0)/88 = 6.53$

Calculating percentage of marks

 $CGPA \times 10 E.G.6.53 \times 10 = 65.3$

23. Pass criteria:

The minimum percentage of marks to pass the examination in each subject/paper will be 40% each in theory paper, practical /field work/Research Project etc. examination & internal assessment. The student has to pass in summative and formative (Internal) assessment separately.

24. Declaration of Results:

- i. The Controller of Examinations shall declare the results as early as possible after the conclusion of each examination, but before the start of teaching for the next academic session.
- ii. Each successful student/ the student placed in reappear shall receive a copy of the Detailed Marks Certificate/ Grade Card Sheet of each semester examination.
- iii. The student whose result is declared late without any fault on his/her part may attend classes for the next higher semester provisionally at his /her own risk and responsibility, subject to his /her passing the concerned semester examination. In case, the student fails to pass the concerned semester examination, his/her attendance/internal assessment in the next higher semester in which he / she was allowed to attend classes provisionally will stand cancelled.

25. Other Provisions:

- i. Nothing in the Ordinance shall debar the University from amending the Ordinance and the same shall be applicable to all the students whether old or new.
- ii. Any other provision not contained in the Ordinance shall be governed by the rules and regulations framed by the University from time to time.
- iii. In case of any dispute, the Vice-Chancellor will be competent authority to interpret the rules and his interpretation shall be final.

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			M.Sc.	M.Sc. (Environmental Science)	nmental	Science					
			Course Structure Under Choice Based Credit System (CBCS): 2019-2020	Choice B	ased Credit	System (C	BCS): 2019)-2020			
SEMESTER	COURSE CODE	Core/ AECC/ SEC/ DSE/ GE	COURSE NAME	L	Т	đ	Contact bours/ week	Credits	Max. Marks	Formative Assessment	Summative Assessment
	17090101	(CC)	Ecology	4	0	0	4	4	100	40	60
	17090102	(CC)	Instrumentation and Analytics	4	0	0	4	4	001	40	. 60
	1 7090103	(CC)	Water Chemistry and Pollution	4	0	0	4	4	100	40	98
	1 70901 04	(DSE)	Environmental History & Contemporary Policies	4	0	0	4	4	100	40	99
	1 7090105	(DSE)	Natural resources and Disaster Management	4	0	0	4	4	001	40	99
	17090106	(SEC)	Professional Ethics and Human Values	2	0	0	2	7	50	20	30
I	17090107	(CC)	Ecology -Lab	0	0	4	4	2	50	20	30
	80106021	(CC)	Instrumentation and Analytics- Lab	0	0	4	4	2	50	20	30
	17090109	(cc)	Water Chemistry and Pollution- I ah	0	0	4	4	2	50	20	30
	17090110	(DSE)	Environmental History & Contemporary Policies- Practical & research work	0	0	4	4	2	50	20	30
	111090111	(DSE)	Natural resources and Disaster Management- Practical & research work	0	0	4	4	2	50	20	30
Total Credits				18	0	16	34	26	650	260	390
	17090201	(CC)	Microbial Biotechnology	4	0	0	4	4	100	40	60
	17090202	(CC)	Stress Physiology	4	0	0	4	4	100	40	60
	17090203	(cc)	Atmospheric Chemistry and Pollution	4	0	0	4	4	001	40	60
	17090204	(DSE)	Environmental Geology	4	0	0	4	4	100	40	60
	17090205	(DSE)	Biodiversity Conservation	4	0	0	4	4	100	40	60
П	17090206	(SEC)	Occupational Health & Safety	2	0	0	2	2	50	20	30
-	17090207	(cc)	Microbial Biotechnology - Lab	0	0	4	4	2	50	20	30
	17090208	(CC)	Stress Physiology- Lab	0	0	4	4	2	50	20	30
	17090209	(cc)	Atmospheric Chemistry and Pollution- Lab	0	0	4	4	2	50	20	30
	17090210	(DSE)	Environmental Geology- Practical & research work	0	0	4	4	2	50	20	30
	17090211	(DSE)	Biodiversity Conservation- Practical & research work	0	0	4	4	2	50	20	30
Total Condition											

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	Total Credits					N					Total Credits						HI				
		17090408 17090409	1 7090408	17090407	17090406	17090405	17090404	17090403	1 7090402	17090401		17090310	17090309	17090308	17090307	17090306	17090305	17090304	17090303	17090302	17090301
		(DSE) (SEC)	(DSE)	(DSE)	(cc)	(cc)	(DSE)	(DSE)	(CC)	(cc)		(SEC)	(SEC)	(DSE)	(DSE)	(CC)	(cc)	(DSE)	(DSE)	(cc)	(cc)
Grand Total		Awareness- Practical and Research work Dissertation	Environmental Legislations and Awareness- Practical and	Environmental Economics Practical and Research work	Environmental Toxicologyand Health- Lab	Environmental Impact Assessment and Risk Analysis- Lab	Environmental Legislations and Awareness	Environmental Economics	Environmental Toxicology and Health	Environmental ImpactAssessment and Risk Analysis		Field survey	Industrial Training & Report	Agriculture and Environment- Practical & Research wrok	Social Issues & Environment- Practical & research work	Soil Chemistry and _{Solid} waste Management- Lab	EnvironmentalModeling, Computer andStatistics Lab	Agriculture and Environment	Social Issues & Environment	Soil Chemistry and Solid waste Management	EnvironmentalModeling, Computer andStatistics
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77	24	4 12	4	4	4	4	0	0	0	0	16	2	2	4	4	4	4	0	0	0	0
127	36	4 12	4	4	4	4	4	4	4	4	28	2	2	4	4	4	4	4	4	4	4
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1500	360	8 30	30	30	30	30	- 98	60	69	69	360	30	69	30	30	30	30	60	60	60	60

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2. Course Name	tment : Environmental Ecology		L	Т		P
6. Course Code	17090101		4	0		0
. Type of Course (us	se tick mark)	Core (✓)	DSE ()		SEC ()	
5. Pre-requisite	B.Sc.	6. Frequency	Even ()	Odd	Either	Every
(if any)		(use tick		(✓)	Sem ()	Sem (
(11 411)		marks)				
7. Total Number of I	ectures, Tutorials, Prac		weeks of o	ie semeste	er)	
Lectures $= 60$		utorials = Nil		cal = Nil		
8. Course Description						
	f ecosystem. Ecosystem	is the interaction b	etween bio	tic and at	piotic comp	onents o
	e will cover laws contro					
	f organisms to the change	-				
		1-7				
9. Course Objectives The objectives of this co						
5	al and geographical distri	hution of different of	necies			
	man interaction with ecol		Juices.			
	ents with factors responsi		life	•		
	tion growth and character				40	
	nteractions and natural sel					
10. Course Outcomes						
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	etion of this course, the st					
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1. To understand princ them.	iples of ecology, and pro-	edict potentially adv	verse effect	which m	night happe	ns aroun
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- <u>https://www.conserve-energy-future.com/what-is-an-ecosystem.php</u>
 <u>https://www.youtube.com/watch?v=pv-WbXGtkzU</u>

- 1. Fundamentals of Ecology-Eugene P. Odum, Gary W. Barrett 2. Ecology and Environment- PD Sharma
- 3. Animal Ecology and Environmental Biology- H.R. Singh
- 4. Fundamental of Ecology- S.K Aggrawal

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2. Course Name	artment : Environmental S Instrumentation and		L		Т	1.1	Р
3. Course Code	17090102		4		0		0
4. Type of Course (use tick mark)	Core (√)	D	SE ()		SEC 0	
5. Pre-requisite	B.Sc.	6. Frequenc		ven ()	Odd	Either	Every
(if any)			tick	v	(*)	Sem ()	Sem (
	Lectures, Tutorials, Pract					•)	2
Lectures = 60	1	Tutorials = Nil		Practic	cal = Nil		
8. Course Descripti			122.01				1
	Analytics help to understa environmental analysis such						
9. Course Objectiv	es:				-		
The objectives of this							
5	nts with advanced micro ana	lysis techniques					
	tween scanning and Transm		icrosco	pes and	their use.		
	h the most common and adv						
4. To be acquainted v	with chromatography technic	ques.					
5. To be familiar with	h the most common and adv	anced biotechnol	ogies.		and in		
Course Outcomes (COs):						
10. Unit wise detaile Unit-1 Num	hods for quantification of di ed content ber of lectures = 15 Environmental Analysis: 1	S	pectros	error	Principles	and appli	cation (
Spectrophotometry (UV-Visible spectrophotome ar magnetic resonance spectr	etry), Atomic abs	orption	spectro	photomet	ry, Plasma	emissio
	ber of lectures = 15			togrant	W		
			hroma				
Chromatographic chromatography,	techniques, Paper chrom Column chromatography,	natography, thin Gas-liquid	layer chromat	chron ography	natograph /, High	pressure	-
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Chromatographic chromatography, chromatography, C Unit – 3 Nur Electrophoresis, so Colourimetry, auto	techniques, Paper chrom Column chromatography, ytophotometry and flow cyt nber of lectures = 15 lid and liquid scintillation radiography, Microscopy-	hatography, thin Gas-liquid cometry, Ultracen X-ray floresce	layer chromat trifugati Micros nce, X-	chron ography on, Titr copy ray diff	natograph , High imetry, G fraction.	pressure ravimetry, Flame pho	liquid
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Chromatographic chromatography, chromatography, C Unit – 3 Nur Electrophoresis, so Colourimetry, auto Transmission electr Unit – 4 Num Methods for measuri AFLP, RAPD, Seque polymerase chain re	techniques, Paper chrom Column chromatography, Sytophotometry and flow cyt nber of lectures = 15 Id and liquid scintillation radiography, Microscopy- on microscopes. ber of lectures = 15 ing nucleic acid and protein encing of proteins and nucle action).	A constraints of the second se	layer chromat trifugati Micros nce, X- d fluore Bio-Mo	chron ography on, Titr copy ray diff escence lecular er printi	natograph , High imetry, G fraction. microsco <u>Techniqu</u> ng, Moleo	pressure ravimetry, Flame pho pes, Scann ies cular marke	liquid tomtery, ing and ers RFLI
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notes/analytical-chemistry-lecture-notes-lecture-1/493428/view

12. Books Recommended

1. Undergraduates Instrumental Analysis- James W. Robinson

- 2. Modern methods of Chemical analysis- Robert, Shields, Cairns, William.
- 3. Fundamentals of Analytical Chemistry 8th Edition- Skoog, West, Holler and Crouch, Cengage Learning India.
- 4. Principles & techniques of biochemistry and molecular biology- Keith Wilson and John Walker

5. Biophysical chemistry: Principles & techniques- Upadhyay, Upadhyay, Nath

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1. Name of th	e Depa	rtment : Environ	mental Science		Server Mag	1000		
2. Course Na	me		stry and Pollution	1		Т		Р
3. Course Co	de	17090103		4	1	0		0
4. Type of Co	ourse (u	ise tick mark)	Core (✓)		DSE ()	1 4 JA	SEC ()	
5. Pre-requis (if any)	ite	B.Sc.	6. Freque (use tick n		Even ()	Odd (✓)	Either Sem ()	Every Sem
7. Total Num	ber of	Lectures. Tutorial	s, Practical (assumin	g 15 wee	ks of one	semester		
Lectures $= 60$			Tutorials = Nil			ical = Ni		N. S. S. W.
8. Course De	scriptio	n:			1.1		1.1.2.2.2	
associated with	h natura	al and engineered a	nts an understanding o quatic systems. It help quilibrium and kinetic	to develo	op the capa	bility and	d confidence	
9. Course Ol	bjective	s:		10 M				1.1
The objectives								
		e basic concepts of						
		basics of thermodyn		4.3				
			of gaseous and liquid p					
			onate system of water.					
5. 10 know ab 10. Course O		ic properties of wat	ter.	-		-	1	
					at an		Sel land	
			se, the student will be					
			er quality and different			properties	s of water.	
			parameters and their p reatment in both sewa			tmont ne	and and	their
practical opera		lynamics of water i	reatment in bour sewa	ge and er	nuent trea	unent pro	beesses and	meir
		with Indian monsoo	n, water distribution a	nd draina	ae system	e		
11. Unit wise			ii, water distribution a	nu urama	ge system	5.		
		er of lectures = 15	at the state of the state	Therm	odynamic	s of Envi	ronment	
			g of thermodynamics					chemica
			netry, acid base rea					
			ormality, molality and					·
Unit – 2	Numb	er of lectures = 15		Water	Chemistry	v		1
			rameters: Physical, C				meters DC	BOD
			ivity, Oxidation-reduc					
			ystem and watershed					
		droughts, floods an		,				
-		er of lectures = 15		Coasta	l Environ	ment		Market Street
Coastal enviro	onment, vertical	coastal erosion an and horizontal dist	d stabilization, relief ribution of temp and	of the oc	ean floor,	temperat		
		er of lectures = 15	A State of the set	Bioche	mical Asp	ects of V	Vater pollu	tion
industrial and analysis, Mari effluents. Pest	agricul ne polli icides in	tural wastes, their ution: thermal polle water	biochemical aspects effects on water bod ution. Primary, secon	of water lies, chen lidary & t	pollution, nical and	characte bacteriol	eristics of ogical sam	domestic pling and
12. Brief Des	cription	1 of self learning /	E-learning component	nt	Call I.			

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1. https://nptel.ac.in/courses/104103020/21

2. https://nptel.ac.in/courses/114106032/

3. https://nptel.ac.in/courses/114105002/9

13. Books Recommended

Environmental Chemistry-Manahan & Manahan
 Environmental Chemistry-Sharma & Kaur

3. Introduction to Environmental Engineering & Science- Gilbert Masters

4. Environmental Chemistry- A.K. DE

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1. Name of the De	partment : Enviro	nmenta	l Scien	ce				
2. Course Name		History	&	L		Т		P
	Contemporary Pol	icies			_	0	_	0
3. Course Code	17090104		~	4		0		0
4. Type of Course	(use tick mark)		Core	0	DSE (✓)	SEC ()		
5. Pre-requisite	B. Sc.		6. F	requency	Even	Odd	Either	Every
(if any)				se tick marks)	0	(•)	Sem ()	Sem (
7. Total Number of	of Lectures, Tutoria	als, Prac					r)	-
Lectures = 60			Tutor	rials = 0	Prac	tical = 0		
8. Course Descrip The course will help environment. It will also help to un It will help to unders	students to understanderstand different t	rends in	the pas	st related to reso	urce use a	and environm		
 Have knowledge Learn the roodledge To understand Course Outcom Upon successful conditional Understand 	the history of the Ea edge of policies and le of people in the co nd the ancient metho	their im onservat ods of en se, the st e Earth i	pacts of ion and vironn tudent n conto	on the environme d deterioration of nental conservation will be able to: ext of connection	nt. f the envir on.	ronment.		
3. Have kn	owledge of policies he role of people in the	and thei	r impa	cts on the enviro	nment.		t.	
Unit – 1 N	umber of lectures =	= 15	Ancie	nt History				
Introduction to the movements. The Ga relationship with so from other types of I Unit – 2 N	aia theory. History cial and economic l	of the official sectors and the official sectors are also been sectored as the official sectors are also been sectors sectors a	develoj Metho	oment of enviro	nmental of Enviro	history as a	disciplin	e and its
Environmental Histo						ns Environ	mental Hi	story as a
History of Industr								
in <mark>dustrialization in</mark>								
technology.								
	umber of lectures =	= 15	Euro	pean rise and co	lonialism	1		
The Rise of Europe		onseque	nces n	ot only for peop	oles, but	also for pla		
an <mark>imals and landsca unleashing of destru</mark>						atershed'. C	olonialism	n and the
Unit – 3 N	umber of lectures =	= 15	Conte	emporary Ideas				
Ideas of wilderness Environmental Histo Environmental Histo	ory and Marginalized	d People	: Issue	s of castes, ident	ity politic			te policy
	escription of self lea							
Harris			N	mill 6-19	w.	FEIN	PS	

- 1. https://www.eh-resources.org/
- 2. https://enviroliteracy.org/teaching-resources/environmental-history-modules/
- 3. http://www.nea.org/tools/lessons/63302.htm

- 1. Arnold, David & Guha, Ramachandra (Ed.), 1995, Nature, Culture, Imperialism: Essays on the
- 2. Environmental History of South Asia, Oxford University Press, Delhi.
- 3. Baviskar Amita, 2003, 'Tribal Discourse and Indian environmentalism in Greenough, Paul and Anna
- 4. Lowenhapept Tsing (Ed.), Nature in the Global South: Environmental Projects in South and Southern
- 5. Asia, Durham and, London: Duke University Press/Orient Longman.
- 6. Balee William, 1998, Advances in Historical Ecology, Columbia University Press, New York.
- 7. Beinart William and Coates Peter, 1995, Environment and History, London: Routledge.
- 8. Carson, Rachel, 1962, Silent spring. Houghton Miflin, Boston.

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2. Course Name	Natural Resour Management	rces and I	Disaster]	L	Т		P
3. Course Code	17090105	N			4	0		0
4. Type of Course (u	se tick mark)		Core ()	DSE	(\checkmark)	SEC ()		
5. Pre-requisite (if any)	B.Sc.		6. Frequen (use marks)	tick	Even ()	Odd (✓)	Either Sem ()	Every Sem (
7. Total Number of	Lectures, Tutorial	s, Practic	al (assumin	g 15 w	eeks of o	ne semeste	er)	1.5
Lectures = 60		Tute	orials = Nil		Pract	tical = Nil		
8. Course Descripti	on:	4.8. 2.						
Natural Resources an resources. This course preparedness, and mit	e will cover method	s used to j	prevent suff					
9. Course Objectiv	es:			1 2,2	1000			
The objectives of this				1000				
1. To know the basics								
2. To know about the		stics of dif	ferent fossil	fuels.				
3. To understand the t								
4. To understand the a			•			•		
5. To analyse the risk		erent disas	sters and how	w to pre	dict haza	ards.	B. C. Mary	L. S.
10. Course Outcome	a (COs):							
Upon successful comp 1. To understand and a environment, availabi 2. To understand the e mineral reserves.	bletion of this course distinguish among d lity, use and energy environmental impac	lifferent re- generation of exploi	sources with n processes. itation, proc	h their b cessing a	and smel	ting of min	erals; and o	overuse o
Upon successful comp 1. To understand and of environment, availabin 2. To understand the emineral reserves. 3. To understand effect 4. To understand many with forecasting and w	bletion of this course distinguish among d lity, use and energy environmental impac ots of hazards, hazard agement of cyclone, warning system of di	d classifica flood, ear	sources with a processes. itation, proc ation natura	h their b cessing a l hazard	and smel	ting of min	erals; and o hazards.	
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Upon successful comp 1. To understand and a environment, availabit 2. To understand the e mineral reserves. 3. To understand effect 4. To understand many with forecasting and v 11. Unit wise detailed Unit-1 Numb Sun as a source of energy values of different for energy conversion, with	bletion of this course distinguish among d lity, use and energy environmental impact ots of hazards, hazard agement of cyclone, varning system of di d content er of lectures = 15 ergy, solar radiations ossil fuels, principle	ifferent re- generation ct of explo- d classifica , flood, ear isaster. s and its sp s of gener nal energy	sources with n processes. itation, proc ation natura rth quake, dr pectral chara ration of hy	h their b cessing a l hazard rought, a <u>Energ</u> acteristi /droeled ctors, pl	and smel disease, i y Sources, classi- ctric pow	ting of min chnological fire and vol fire and vol e <u>e</u> ification of ver, tidal p aic, solar po	herals; and o hazards. lcanic disas fossil fuels ower, ocea	ters alon
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1. https://nptel.ac.in/courses/122102006/9

2. https://nptel.ac.in/courses/105104183/

13. Books Recommended

1. Natural Resources conservation-Oliver S Owen & Chiras 2. Living in the Environment –T.J.Miller

3. Environmental Science- Cunningham Sai go

4. Ecology of Natural Resources-Ramade 5. Global Biodiversity-W.R.L. IUCN

6. Soils-Miller, W & R.L. Donhau

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2. Course Nam	e Professional	L		T		Р
2. Course Main	ethics and human value					•
3. Course Code		2		0		0
	rse (use tick mark)	Core ()	DSE ()		SEC (✓)	
5. Pre-requisite		6. Frequency	Even ()	Odd (✓)	Either	Every
(if any)		(use tick			Sem ()	Sem ()
•••		marks)		11		
	er of Lectures, Tutorials,			-		
Lectures $= 30$		Tutorials = 0		Practica	l = 0	
8. Course Desc	ription:					
history and day t family.	des students with the know o day life will make the st	tudents more resp	onsible to	owards their	r profession,	, society an
9. Course Obj	ectives:					
1. To develop et	nical and human values in s	tudents				
2. To develop the	e responsibility in students a	at professional and	d societal	levels.		
10. Course Outo	comes (COs):					
1 77	· 11					
		at meatogaianal at	ning and m	oral values	dooply	
	will understand the values of	-				
2. The students	will understand the values of will be able to take st	-				nsibly as o
		-				nsibly as o
 The students professional. 11. Unit wise de 	will be able to take st tailed content	rong decisions a	and perfor	rm their d	uties respor	nsibly as o
 The students professional. 11. Unit wise de Unit-1 	will be able to take st tailed content Number of lectures = 15	rong decisions a	and perfor	m their d	uties respon	
 The students professional. 11. Unit wise de Unit-1 Definition, Historian de Unit-1 	will be able to take st tailed content Number of lectures = 15 ry and Development of Ethi	rong decisions a	nd perfor	m their de and Huma Bioethics,	uties respon	
 The students professional. 11. Unit wise de Unit-1 Definition, Histor Bioethics: Utilita 	tailed content Number of lectures = 15 ry and Development of Ethi rian theory, Deontological t	Title of the unics, Universal dec	nit: Ethics laration of unication	rm their de s and Huma n Bioethics, theory.	an Values ,Theories re	elated to
 The students professional. 11. Unit wise de Unit-1 Definition, Histor Bioethics: Utilita Human Rights an 	will be able to take st tailed content Number of lectures = 15 ry and Development of Ethi	Title of the unics, Universal dec	nit: Ethics laration of unication	rm their de s and Huma n Bioethics, theory.	an Values ,Theories re	elated to
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2. The students professional. 11. Unit wise de Unit-1 Definition, Histor Bioethics: Utilita Human Rights an Integrity Environmental E Unit -2	will be able to take st tailed content Number of lectures = 15 ry and Development of Ethi rian theory, Deontological to d Values : Autonomy, Cons thics, Animal ethics Number of lectures = 15	Title of the un rong decisions a Title of the un rong decisions a rong dec	nit: Ethics laration or unication onfidential nit: Profes	rm their de s and Hums n Bioethics, theory. ity, Vulnera ssional Eth	an Values ,Theories re ability and Palies ics & Responder	elated to ersonal onsibility
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2. The students professional. 11. Unit wise de Unit-1 Definition, Histor Bioethics: Utilita Human Rights an Integrity Environmental Et Unit -2 Need and Importa Religious and Cu Responsibilities t Risk, Benefit Ana Ethics in Media a 12. Brief Descri 1. https://ww	will be able to take st tailed content Number of lectures = 15 Ty and Development of Ethin rian theory, Deontological the d Values : Autonomy, Const thics, Animal ethics Number of lectures = 15 ance of professional ethics, ltural Values, Importance of cowards Safety and Risk, Vo alysis, Accidents. Disaster of and Technology, Research E ption of self learning / E-learning / E-lear	Title of the un ics, Universal dec heory and Comm sent, Equality, Co Title of the un Goals, Dignity o of a Family, Guida oluntary v/s In vo thics, Ethics, Intellectual earning compone cFOZplkRqsk&au	nit: Ethics laration or unication onfidential nit: Profes f Labour, unce to you luntary Ri l Property ent thuser=2	rm their de s and Huma n Bioethics, theory. ity, Vulnera ssional Eth IRB & its fi ungsters, Ge sk, Designi Rights.	an Values ,Theories re ability and Pa ics & Respondence anctions, Au	elated to ersonal onsibility ithorship ty
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- 1. Professional Ethics and Morals by Prof.A.R. Aryasri, Dharanikota Suyodhana Maruthi Publications.
- 2. Professional Ethics and Human Values by A. Alavudeen, R. Kalil Rahman and M. Jayakumaran University Science Press.
- 3. Professional Ethics and Human Values by Prof. D.R. Kiran-Tata McGraw-Hill 2013

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1. Name of the Depa	rtment: Environme	ntal Sciences				
2. Course Name	Ecology- Lab		L	Т		Р
3. Course Code	17090107		0	0		4
4. Type of Course(us	se tick mark)	Core(✓)	DSEO	SEC ₀		
5. Pre-requisite	B.Sc.	6. Frequency	Even ()	Odd	Either	Every
(if any)		(use tickmarks)		(✔)	Sem ()	Sem ()
7. Total Number of L	ectures, Tutorials,	Practical.				
Lectures = Nil		Tutorials = Nil	Practica	l = 60		
9 C						
8. Course Description						
This Course will introd give a platform to deve	luce the students to the					e will also
This Course will introd	luce the students to t lop different method					e will also

The objectives of this course are to

- 1. To study plant community ecology ecosystem
- 2. Learn concepts of biodiversity in field.
- 3. Have knowledge of key methods to study population size.

10. Course Outcomes (COs):

Upon successful completion of this course, the student wil be able to:

- 1. Demonstrate fieldwork skills like species identification and ecological survey
- 2. To explain the distribution and abundance of different plant species in any region.
- 3 To evaluate the relationship/interactions among the different species

11. List of Experiments

- 1 Determination of minimum size of quadrat for community study
- 2 Determination of density frequency abundance, and dominance of plant species using quadrat method
- 3 Calculation of the Importance Value Index (IVI) of species.
- 4. Estimation of chlorophyll content in plant samples
- 5. To determine protein content in plant samples.
- 6. Estimation of biomass of plant sample.

- 1. Basic ecology E. P. Odum
- 2. Ecology and Field biology R.L. Smith
- 3. Ecology P.D. Sharma
- 4. Fundamentals of ecology -E.P. Odum
- 5. Principles of ecology Rickleff

that waters

2.	Course Name	artment: Environmen Instrumentation Lab		Analytics-	L	Т		Р
3.	Course Code	17090108			0	0		4
4.	Type of Course (use tick mark)	Cor	re (✓)	DSE ()		SEC ()	
5.	Pre-requisite (if any)	B.Sc.		Frequency (use tick marks)	Even ()	Odd (*)	Either Sem ()	Every Sem ()
7.	Total Number of	Lectures, Tutorials, I	Practic	al.				
Le	ctures = Nil		Tut	orials = Nil	Practic	cal = 60		

8. Course Description:

Instrumentations and Analytics help to understand the basic and technical aspects of various instruments and techniques used for environmental analysis such as spectrophotometry, chromatography and chemical titrations etc.

9. Objectives

The objectives of this course are to:

1. To acquaint with advanced micro analysis techniques

- 2. To differentiate between scanning and Transmission electron microscopes and their use.
- 3. To be familiar with the most common and advanced analytical techniques.

10. Course Outcomes (COs):

Upon successful completion of this course, the student will be able to

1. To understand different environmental monitoring and analysis techniques to choose according to the field study requirement.

2. To understand methods for quantification of different bio molecules

11. List of Experiments

1. Demonstration of HPLC

- 2. Demonstration of GLC
- 3. Demonstration of AAS.
- 4. Demonstration of Flame Photometer
- 5. Demonstration of UV-VIS Spectrophotometer

12. Books Recommended

1. Undergraduates Instrumental Analysis- James W. Robinson

- 2. Modern methods of Chemical analysis- Robert, Shields, Cairns, William.
- 3. Fundamentals of Analytical Chemistry 8th Edition- Skoog, West, Holler and Crouch, Cengage Learning India.

2. Course Name	Water Chemistr	y and Pollution- Lab	L	Т		Р
3. Course Code	17090109		0	0		4
4. Type of Course (u	se tick mark)	Core (✓)	DSEO	-	SEC ₀	6.00
5. Pre-requisite (if any)	B.Sc.	6. Frequency (use tick marks)	Even ()	Odd (✓)	Either Sem ()	Every Sem

7. Total Number of Lectures, 1 uto	riais, 1 factical.	
Lectures = Nil	Tutorials = Nil	Practical = 60

8. Course Description:

This Course will introduce the students to the basic concept of water pollution and chemistry. This course will also give a platform to develop different methods to study to various samples of water from various sources.

9. Course Objectives:

The objectives of this course are to:

- 1. Use of practical knowledge and instruments
- 2. To determine various physico-chemical behaviors of water samples.
- 3. To measure the residual chlorine present in the water sample

10. Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

- 1. To analyze various parameters for water quality assessment like BOD, COD, turbidity etc.
- 2. To explain the characteristics and relation of different water pollutants.
- 3. Acquainted with different methods of water quality assessment.

11. List of Experiments

- 1. Determination of total dissolved solids (TDS) in water.
- 2. Determination of dissolved oxygen (DO) in water.
- 3. Determination of biological oxygen demand (BOD) of water
- 4. To determine chemical oxygen demand (COD) of water.
- 5. Determination of Total Dissolved Solids (TDS), hardness and alkalinity of water
- 6. To determine most probable number (MPN) in given water sample.

- 1. Environmental Chemistry-Manahan & Manahan
- 2. Environmental Chemistry-Sharma &Kaur
- 3. Introduction to Environmental Engineering & Science- Gilbert Masters
- 4. Environmental Chemistry- A.K. DE

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1. Name of the Depa 2. Course Name	rtment: Environmental	History and	L	Т		Р
2. Course Manie	Contemporary Pol		2		1.12	
3. Course Code	17090110		0	0		4
4. Type of Course (u	se tick mark)	Core ()	DSE ()	SEC 0	
5. Pre-requisite	B.Sc.	6. Frequency	Even ()	Odd	Either	Every
(if any)		(use tick mar	· · · ·	(*)	Sem()	Sem (
7. Total Number of	Lectures, Tutorials,					
Lectures = Nil		Tutorials = Nil	Pract	ical = 60		1.1
8. Course Descriptio	n:					
Environmental history	Lab will help in th	e study of human in	teraction with	the natura	l world o	ver tim
emphasizing the active						
inipitusizing the detive	rolo nataro plajo ni n	intractioning mannant and		er bui		
0 Course Objective						
9. Course Objective The objectives of this of						
1. To know about the r		e in human life				
2. To aware about the h			ourse of huma	n history		
5. To analyse the numa	n and environmental	factors in the creation	of landscapes	10		
		factors in the creation	of landscapes		1	
10. Course Outcomes	(COs):					
10. Course Outcomes Upon successful compl	(COs): etion of this course, t	he student will be able	e to			
10. Course Outcomes Upon successful comp 1. To understand the co	(COs): etion of this course, to prrelation between nat	he student will be able ture and human develo	e to			
10. Course Outcomes Upon successful comp 1. To understand the co	(COs): etion of this course, to prrelation between nat	he student will be able ture and human develo	e to			
10. Course Outcomes Upon successful comp 1. To understand the co 3. To understand mana	(COs): letion of this course, to prrelation between nat gement of human civi	he student will be able ture and human develo	e to			
 10. Course Outcomes Upon successful completion 1. To understand the constant of the	(COs): letion of this course, to prrelation between nation gement of human civit es	he student will be able ture and human develo	e to			
 10. Course Outcomes Upon successful completion 1. To understand the constraint of the constra	(COs): letion of this course, to prrelation between nation gement of human civit es ndia: Case study	he student will be able ture and human develo ilization.	e to opment.			
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 10. Course Outcomes Upon successful complete 1. To understand the constraint of the constrain	(COs): letion of this course, to prelation between nat gement of human civit es ndia: Case study m and Natural Resourtics in India: Case Study in Ancient India: Case Study and techniques in Ancient	he student will be able ture and human develo ilization. rces Exploitation: Indi idy se studies cient Rome	e to opment. ian Case Study			
 10. Course Outcomes Upon successful complete 1. To understand the constraint of the constrain	(COs): letion of this course, to prelation between nat gement of human civit es ndia: Case study m and Natural Resourtics in India: Case Study in Ancient India: Case Study and techniques in Ancient	he student will be able ture and human develo ilization. rces Exploitation: Indi idy se studies cient Rome	e to opment. ian Case Study			
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 10. Course Outcomes Upon successful compl 1. To understand the co 3. To understand mana 11. List of Case Studi 1. Industrialization in I 2. European Colonialis 3. Environment & Poli 4. Water Conservation 5. Sanitation practices 6. Past traditions in Inc. 12. Books Recomment 	(COs): letion of this course, to prrelation between nat gement of human civit es ndia: Case study m and Natural Resour- tics in India: Case Stu- in Ancient India: Case and techniques in Anc- ian culture for enviro	he student will be able ture and human develo ilization. rces Exploitation: Indi idy se studies cient Rome nmental conservation	e to opment. ian Case Study	y	Vew Appr	oaches
 10. Course Outcomes Upon successful compl 1. To understand the co 3. To understand mana 11. List of Case Studi 1. Industrialization in I 2. European Colonialis 3. Environment & Poli 4. Water Conservation 5. Sanitation practices 6. Past traditions in Inc. 12. Books Recomment 1. An Environmental H 	(COs): letion of this course, to prrelation between nat gement of human civit es ndia: Case study m and Natural Resour- tics in India: Case Stu- in Ancient India: Case and techniques in Anc- tian culture for enviro ded listory of India: From	he student will be able ture and human develo ilization. rces Exploitation: Indi idy se studies cient Rome nmental conservation	e to opment. ian Case Study	y	New Appr	oaches
 To understand mana List of Case Studi Industrialization in I European Colonialis Environment & Poli Water Conservation 	(COs): etion of this course, to prelation between nat gement of human civit es ndia: Case study m and Natural Resour- tics in India: Case Stu- in Ancient India: Case and techniques in Anc- ian culture for enviro ded fistory of India: From el H. Fisher	he student will be able ture and human develo ilization. rces Exploitation: Indi idy se studies cient Rome inmental conservation	e to opment. ian Case Study	y	New Appr	oaches

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1.	Name of the Depar	tment: Environment	al Sciences					
2.	Course Name	Natural Resources Management- Lab	s and Disaster		L	Т		Р
3.	Course Code	17090111			0	0		4
4.	Type of Course (us	e tick mark)	Core ()		DSE (✓)		SEC ()	25. 71
5.	Pre-requisite (if any)	B.Sc.	6. Frequency (use tick man	rks)	Even ()	Odd (✓)	Either Sem ()	Every Sem ()
7.	Total Number of L	ectures, Tutorials, Pr	ractical.					
Le	ctures = Nil		Tutorials = Nil		Practic	al = 60	0	

8. Course Description:

Natural Resources and Disaster Management Lab help in the efficient utilization and conservation of natural resources. This course will cover methods used to prevent suffering include hazard and vulnerability analysis, preparedness, and mitigation and prevention measures.

9. Course Objectives:

The objectives of this course are to:

- 1. To know about the chemical characteristics of different fossil fuels.
- 2. To aware about the benefits of renewable energy
- 3. To analyse the risk associated with different disasters and how to predict hazards.
- 4. To aware about role of individuals in hazard control and management.

10. Course Outcomes (COs):

Upon successful completion of this course, the student will be able to

1. To understand effects of hazards, hazard classification natural hazards and technological hazards.

3. To understand management of cyclone, flood, earth quake, drought, disease, fire and volcanic disasters along with forecasting and warning system of disaster.

11. List of Case Studies

1. Uttarkashi earthquake (Implications and lessons),

2. Latur (Killari) earthquake experiences.

- 3. Flood mitigation practices in India
- 4. To identify the locations of renewable and non-renewable resources in India and at global level
- 5. Disaster Management Plan of Flood special reference to Badrinath Disaster
- 6. Fukushima Daiichi nuclear disaster: Case Study

- 1. Natural Resources conservation-Oliver S Owen & Chiras
- 2. Living in the Environment -T.J.Miller
- 3. Environmental Science- Cunningham Saigo
- 4. Ecology of Natural Resources-Ramade
- 5. Global Biodiversity-W.R.L. IUCN
- 6. Soils-Miller, W & R.L. Donhau

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1. Name of th	e Departr	nent : Environment	tal Sc	ience					
2. Course Na		Microbial Biotechno				L	Т		P
3. Course Co	de	17090201			- 1.	4	0		0
4. Type of Co	ourse (use	tick mark)		Core (✓)		DSE ()	A. Destands	SEC ()	
5. Pre-requis	ite	B.Sc.		6. Frequen	cy	Even	Odd ()	Either	Every
(if any)				(use tick ma	arks)	(✔)		Sem ()	Sem
					1.1				0
		tures, Tutorials, Pr			15 we)	1-1-1-1
Lectures = 60			Tu	torials = Nil		Practi	cal = Nil		
8. Course De									
		is based on the inter							
		and their fate in envi							
		biotechnology in					which w	ill include	genetic
		ion, and enzyme tech	nolog	gy and soil m	crobic	ology.			
9. Course O			_						_
The objectives				d the in the					
		ecules, microorganis							
		and describe the fea	tures	of plant orga	ns/tiss	ues/cells/c	organelles a	and the rela	tionships
among maj									
3. To get acc	quainted w	ith various natural	and g	genetically en	ngineer	red micro	bes in wa	ter and sol	id waste
treatment.									
10. Course O	utcomes (COs):							
		ion of this course, the	o stud	ant will be at	leto	-			
		legradation of polluta				obes and	funci		
		iomena of nitrogen fi		vitit the help (n mici	obes and	lungi.		
	-	zymes in different pr	-	tion processes					
		on of contaminants.	ouuc	non processe.					
11. Unit wise									
Unit-1		of lectures = 15			Intro	duction of	f Bio-mole	rules	
		ecules: with special	refe						Nucleic
		logical functions of				and the second	A second s		
		, bio-conversion of p			cal lu		n nucleicie	acius. Dio	enemicai
-	<u>.</u>	· · ·	onuta		-				
Unit – 2		of lectures = 15		fred 1		microbio			
		icrobiology- microb					-		
		n, characteristics, oc			-	-		-	
		otrophs, organo-trop					ronmental	significan	ce. Soil
microorganism	ns and their	r interactions relative	to so	il fertility, mi	crobia	l toxins.			
Unit – 3	Number	of lectures = 15			Envir	onmental	biotechno	ology	
Environmenta	l biotechno	logy: introduction, g	enetio	engineering	and it	s applicati	ions, micro	flora of at	nosphere
-sampling tecl	nniques. Id	entification of aero-a	allerg	ens, airborne	diseas	es and all	lergies, mic	crobes and	pollution
		, Fermentation, Enzy					-		-
U <mark>nit – 4</mark>		of lectures = 15				biology			
Applications	of natural	and genetically e	engine	eered micro-	organi	sms fron	n extreme	environm	ent: like
thermophiles,	alkalophile	es, acidophiles and ha	aloph	iles in waste	treatm	ent of dif	ferent indu	stries. Prod	uction of
	-	proteases amylase							
biodegradation						1			

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12. Brief Description of self learning / E-learning component

- 1. https://youtu.be/ZY8jz1dkFg8
- 2. https://aggie-horticulture.tamu.edu/food-technology/food-processing-entrepreneurs/microbiology-of-food/

- 1. 29th edition Harper,s illustrated Biochemistry Murray RK, Bender DA, Botham KM, Kennelly PJ, Rodwell VW and Weil PA McGraw Hill Publication
- 2. Basic ecology E. P. Odum
- 3. Ecology and field biology R.L. Smith
- 4. Ecology P.D. Sharma
- 5. Fundamentals of ecology -E.P. Odum
- 6. Principles of ecology Rickleff

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	Stress Physiology		L	Т		Р
3. Course Code	17090202		4	0		0
4. Type of Course (us	se tick mark)	Core (✓)	DSE ()		SEC ()	
5. Pre-requisite	B.Sc.	6. Frequency	Even	Odd ()	Either	Every
(if any)		(use tick marks)	(1)		Sem ()	Sem (
7. Total Number of L	ectures, Tutorials, Pract	tical (assuming 15 w	eeks of o	ne semester)	-
Lectures = 60		futorials = Nil	Prac	tical = Nil		
8. Course Description						100
Stress physiology is ba	sed on the concept of Res	ponses of plants and	animals in	n stress and s	strain relat	ed to hig
and low temperature co	onditions and high altitude					
. Course Objectives	št.					
The objectives of this c						
	iological adaptations evol	ved in animals and p	lants in a v	wide variety	of enviror	ments.
	lation of growth and devel					
3. To understand differ	rent ecological systems in	various stress condition	tions.			
0 Course Outcomes	((()))					
10. Course Outcomes						
Jpon successful compl	letion of this course, the st	udent will be able to				
1. To apply the conce	pt of stress and strain in p	lant and animals				
2. Acquaint with the	response of plants to diffe	rent air pollutants				
		fent all ponutants.				
3. Understand about p			al and pla	nts.		
	physical and physiological	adjustments in anim		ints.		
	physical and physiological erent ecological systems in	adjustments in anim		nts.		
4. To understand diffe	physical and physiological erent ecological systems in	adjustments in anim	itions		vsiology	
4. To understand diffe 11. Unit wise detailed Unit-1 Num be	physical and physiological erent ecological systems in content er of lectures = 15	adjustments in anim n various stress cond	itions oduction	of stress phy		ronment
4. To understand diffe 11. Unit wise detailed Unit-1 Num be Concept of stress and s	physical and physiological erent ecological systems in content	adjustments in anim n various stress cond Introduce of stress in plan	oduction on the second	of stress phy celj as a sens	sor of envi	
4. To understand diffe 11. Unit wise detailed Unit-1 Num be Concept of stress and s changes, Stress factors	physical and physiological erent ecological systems in content of lectures = 15 train, Environment as a so biotic and abiotic stress	adjustments in anim n various stress cond Introduce of stress in plan factors, methods of	oduction oduction ots, Plant of measurer	of stress phy cell as a sens nent, Water s	sor of envi	
4. To understand diffe 11. Unit wise detailed Unit-1 Num be Concept of stress and s changes, Stress factors idaptations to drought	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so	adjustments in anim n various stress cond Intro- burce of stress in plan factors, methods of rature and low tempe	oduction oduction ots, Plant of measurer	of stress phy cell as a sens nent, Water s	sor of envi	
4. To understand diffe 11. Unit wise detailed Unit-1 Number Concept of stress and s changes, Stress factors idaptations to drought Unit - 2 Number	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so train, Environment as a so biotic and abiotic stress and flooding, High temper er of lectures = 15	adjustments in anim n various stress cond Intrource of stress in plan factors, methods of rature and low tempe Ioni	itions oduction ots, Plant of measurer rature stre c stress	of stress phy cell as a sens nent, Water s ss,	sor of envi stress resp	onses ar
4. To understand diffe 11. Unit wise detailed Unit-1 Number Concept of stress and s changes, Stress factors idaptations to drought Unit - 2 Number Responses of haloplyte	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so biotic and abiotic stress and flooding, High temper	adjustments in anim n various stress cond Intro- purce of stress in plan factors, methods of rature and low temper Ioni ilt stress, metal toxic	itions oduction on the plant of measurer rature stree c stress ity and me	of stress phy cell as a sens nent, Water s ss, tal tolerance	sor of envi stress resp	onses ar
4. To understand diffe 11. Unit wise detailed Unit-1 Number Concept of stress and s changes, Stress factors idaptations to drought Unit - 2 Number Responses of haloplyte air pollutions SO _x , NO,	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so biotic and abiotic stress and flooding, High temper er of lectures = 15 s and non-haloplytes to sa	adjustments in anim n various stress cond Intr purce of stress in plan factors, methods of ature and low tempe Ioni and osmo-regulation	itions oduction on the plant of measurer rature stree c stress ity and me	of stress phy cell as a sens nent, Water s ss, stal tolerance ance	sor of envi stress resp	onses ar
4. To understand diffe 11. Unit wise detailed Unit-1 Numbe Concept of stress and s changes, Stress factors idaptations to drought Unit - 2 Numbe Responses of haloplyte air pollutions SO _x , NO, Unit - 3 Numbe	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so biotic and abiotic stress and flooding, High temper er of lectures = 15 as and non-haloplytes to sa coone, Ionic regulation er of lectures = 15	adjustments in anim n various stress cond Intrource of stress in plan factors, methods of ature and low tempe Ioni ilt stress, metal toxic and osmo-regulation Env	itions oduction ots, Plant of measurer rature stre c stress ity and me salt tolera ironments	of stress phy cell as a sens nent, Water s ss, tal tolerance ance al Stress	sor of envi stress resp e, Plant res	onses ar
4. To understand different for the second s	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so the biotic and abiotic stress and flooding, High temper er of lectures = 15 strain non-haloplytes to sa so ozone, Ionic regulation er of lectures = 15 ched CO2, environment, r	adjustments in anim n various stress cond Intrource of stress in plan factors, methods of ature and low tempe Ioni ature stress, metal toxic and osmo-regulation Env nodeljing photosynth	itions oduction of nts, Plant of measurer rature stre c stress ity and me salt tolera ironmenta netic respo	of stress phy cell as a sens nent, Water s ss, etal tolerance ance al Stress inses to envi	sor of envi stress resp e, Plant res	onses ar
4. To understand different for the second s	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so the biotic and abiotic stress and flooding, High temper er of lectures = 15 and non-haloplytes to sa so acone, Ionic regulation er of lectures = 15 ched CO2, environment, r at CO2 fixation pathways,	adjustments in anim n various stress cond Intr purce of stress in plan factors, methods of rature and low tempe Ioni att stress, metal toxic and osmo-regulation Env nodel[ing photosynth Circadian rhythms a	itions oduction of nts, Plant of measurer rature stre c stress ity and me salt tolera ironmenta netic respo nd biologio	of stress phy cell as a sens nent, Water s ss, etal tolerance ance al Stress inses to envi	sor of envi stress resp e, Plant res	sponses ar
4. To understand different for the second s	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so biotic and abiotic stress and flooding, High temper er of lectures = 15 strain, Environment, High temper er of lectures = 15 strain, Environment, regulation er of lectures = 15 ched CO2, environment, r at CO2 fixation pathways, er of lectures = 15	adjustments in anim n various stress cond in various stress cond purce of stress in plan factors, methods of ature and low tempe in tempe in tempe in tempe i in tempe in tempe	itions oduction of nts, Plant of measurer rature stre c stress ity and me salt tolera ironmenta netic respo nd biologio er stress	of stress phy cell as a sens nent, Water s ss, tal tolerance ance al Stress onses to envir cal clock.	sor of envi stress resp e, Plant resp ronment, I	onses ar sponses Ecologic
4. To understand different terms of the second stress and second	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so biotic and abiotic stress and flooding, High temper er of lectures = 15 as and non-haloplytes to sa corone, Ionic regulation er of lectures = 15 ched CO2, environment, r at CO2 fixation pathways, er of lectures = 15 desert animals; hibernatio	adjustments in anim n various stress cond Intro- purce of stress in plan factors, methods of rature and low tempe Ioni ilt stress, metal toxic and osmo-regul ation Env nodel[ing photosynth Circadian rhythms a Wat n and aestivation, Os	itions oduction ots, Plant of measurer rature stre c stress ity and me salt tolera ironmenta netic respo nd biologia er stress mo-regula	of stress phy cell as a sense nent, Water s ss, tal tolerance ance al Stress onses to envi cal clock.	sor of envi stress resp e, Plant res ronment, I animal res	onses ar sponses Ecologic
4. To understand different values of the second stress and second	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so the biotic and abiotic stress and flooding, High temper er of lectures = 15 is and non-haloplytes to sa so zone, Ionic regulation er of lectures = 15 ched CO2, environment, r at CO2 fixation pathways, er of lectures = 15 desert animals; hibernatio sea environment, Plant res	adjustments in anim n various stress cond Introverses in plan factors, methods of ature and low temper Ioni ature and low temper Ioni att stress, metal toxic and osmo-regulation Env nodel[ing photosynth Circadian rhythms a Wat n and aestivation, Os ponses to UV radiati	itions oduction ots, Plant of measurer rature stre c stress ity and me salt tolera ironmenta netic respo nd biologia er stress mo-regula	of stress phy cell as a sense nent, Water s ss, tal tolerance ance al Stress onses to envi cal clock.	sor of envi stress resp e, Plant res ronment, I animal res	onses ar sponses Ecologic
4. To understand different for the second s	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so biotic and abiotic stress and flooding, High temper er of lectures = 15 strain, Environment as a so biotic and abiotic stress and flooding, High temper er of lectures = 15 strain, Environment regulation er of lectures = 15 ched CO2, environment, r at CO2 fixation pathways, er of lectures = 15 desert animals; hibernation sea environment, Plant ress of self learning / E-learn	adjustments in anim n various stress cond Introverses in plan factors, methods of ature and low temper Ioni ature and low temper Ioni att stress, metal toxic and osmo-regulation Env nodel[ing photosynth Circadian rhythms a Wat n and aestivation, Os ponses to UV radiati	itions oduction ots, Plant of measurer rature stre c stress ity and me salt tolera ironmenta netic respo nd biologia er stress mo-regula	of stress phy cell as a sense nent, Water s ss, tal tolerance ance al Stress onses to envi cal clock.	sor of envi stress resp e, Plant res ronment, I animal res	onses ar sponses t Ecologica
4. To understand different for the second s	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so biotic and abiotic stress and flooding, High temper er of lectures = 15 strain and non-haloplytes to sa corone, Ionic regulation er of lectures = 15 ched CO2, environment, r at CO2 fixation pathways, er of lectures = 15 desert animals; hibernatio sea environment, Plant res of self learning / E-learn urses/102103015/21	adjustments in anim n various stress cond Introverses in plan factors, methods of ature and low temper Ioni ature and low temper Ioni att stress, metal toxic and osmo-regulation Env nodel[ing photosynth Circadian rhythms a Wat n and aestivation, Os ponses to UV radiati	itions oduction ots, Plant of measurer rature stre c stress ity and me salt tolera ironmenta netic respo nd biologia er stress mo-regula	of stress phy cell as a sense nent, Water s ss, tal tolerance ance al Stress onses to envi cal clock.	sor of envi stress resp e, Plant res ronment, I animal res	onses an sponses t Ecologica
4. To understand different values $\frac{11. \text{ Unit wise detailed}}{\text{Unit-1} \qquad \text{Num be}}$ Concept of stress and schanges, Stress factors adaptations to drought $1000000000000000000000000000000000000$	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so biotic and abiotic stress and flooding, High temper er of lectures = 15 s and non-haloplytes to sa s, ozone, Ionic regulation er of lectures = 15 ched CO2, environment, r at CO2 fixation pathways, er of lectures = 15 desert animals; hibernatio sea environment, Plant res of self learning / E-learn urses/102103015/21 ourses/102104057/7	adjustments in anim n various stress cond Introverses in plan factors, methods of ature and low temper Ioni ature and low temper Ioni att stress, metal toxic and osmo-regulation Env nodel[ing photosynth Circadian rhythms a Wat n and aestivation, Os ponses to UV radiati	itions oduction ots, Plant of measurer rature stre c stress ity and me salt tolera ironmenta netic respo nd biologia er stress mo-regula	of stress phy cell as a sense nent, Water s ss, tal tolerance ance al Stress onses to envi cal clock.	sor of envi stress resp e, Plant res ronment, I animal res	onses ar sponses t Ecologica
4. To understand different for the second s	physical and physiological erent ecological systems in content er of lectures = 15 strain, Environment as a so biotic and abiotic stress and flooding, High temper er of lectures = 15 s and non-haloplytes to sa s, ozone, Ionic regulation er of lectures = 15 ched CO2, environment, r at CO2 fixation pathways, er of lectures = 15 desert animals; hibernatio sea environment, Plant res of self learning / E-learn urses/102103015/21 ourses/102104057/7	adjustments in anim n various stress cond Introverses in plan factors, methods of ature and low temper Ioni ature and low temper Ioni att stress, metal toxic and osmo-regulation Env nodel[ing photosynth Circadian rhythms a Wat n and aestivation, Os ponses to UV radiati	itions oduction ots, Plant of measurer rature stre c stress ity and me salt tolera ironmenta netic respo nd biologia er stress mo-regula	of stress phy cell as a sense nent, Water s ss, tal tolerance ance al Stress onses to envi cal clock.	sor of envi stress resp e, Plant res ronment, I animal res	onses ar sponses Ecologic

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1. Physiological Plant Ecology- Encyclopaedia (Vol. I-IV) Springer Verlag

2. Plant Physiology- Salisbury & Ross

Plant Ecophysiology – Prasad
 Adaptive Animal Physiology – Nelson Schmidt.

5. Stress Physiology: D.P Singh

6. The Physiology of Plants under Stress: Erik T. Nilsen (Author), David M. Orcutt (Author)

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2. Course Name	Atmospheric Chemistry Pollution	cience y and	L	Т		Р
3. Course Code	17090203		4	0		0
4. Type of Course (u	se tick mark)	Core (✓)	DSE ()	1.1.1.1.1	SEC ()	
5. Pre-requisite	B.Sc.	6. Frequence	y Even	Odd ()	Either	Every
(if any)	and the second second	(use tick ma		1	Sem ()	Sem ()
	ectures, Tutorials, Practic)	
Lectures = 60		torials = Nil	Pract	tical = Nil		
8. Course Descriptio		1 1 0	1.00			1.*
chemistry in relation	ry and Pollution is based or to gases. This course will vledge related to effect of hu	cover basic o	oncepts in atr	nospheric c	chemistry a	and detai
9. Course Objective	S:					
1. To apply basic con	ncepts of chemical thermod	lynamics, kine	tics, and photo	ochemistry	to analyze	chemica
processes existing i	n atmosphere.					
2. To understand the c	concepts and unifying feature	es of atmosphe	ric chemistry.			
3. To understand the	interconnections between	different laye	ers of atmospl	here and th	he effect o	of huma
activities on the nat	ural atmospheric constitution	n.		*		
10. Course Outcomes						
Upon successful comp 1. The student will be						
Upon successful comp 1. The student will be 2. The student will be 3. The student will be	letion of this course, able to apply the concepts a able to understand the intero able to understand the effec	connections be	tween differen	t layers of a	tmosphere.	
Upon successful comp 1. The student will be 2. The student will be 3. The student will be 11. Unit wise detailed	letion of this course, able to apply the concepts a able to understand the inter- able to understand the effec I content	connections be at of human act	tween differen ivities on the n	t layers of a atural atmos	tmosphere.	
Upon successful comp 1. The student will be 2. The student will be 3. The student will be 11. Unit wise detailed Unit-1 Numb	letion of this course, able to apply the concepts a able to understand the inter- able to understand the effec l content er of lectures = 15	connections be	tween differen ivities on the n Atmospheric	t layers of a atural atmos	tmosphere.	stitution.
Upon successful comp 1. The student will be 2. The student will be 3. The student will be 11. Unit wise detailed Unit-1 Numb Chemical equilibria, S and radicals in the atm	letion of this course, able to apply the concepts a able to understand the inter- able to understand the effec I content	connections be et of human act ed and saturate s for formation	tween differen ivities on the n Atmospheric of hydrocarbons of inorganic a	t layers of a atural atmos chemistry s, Radio nuc and organic	spheric cor	estitution.
Upon successful comp 1. The student will be 2. The student will be 3. The student will be 11. Unit wise detailed Unit-1 Numb Chemical equilibria, S and radicals in the atm Laws of thermodynam Unit - 2 Numb	letion of this course, able to apply the concepts a able to understand the intero- able to understand the effec I content er of lectures = 15 olubility product, unsaturate osphere. Chemical processe ics, enthalpy, Carnot's cycle er of lectures = 15	connections be et of human act ed and saturate s for formation e, entropy, Adi	tween differen ivities on the n Atmospheric of hydrocarbons of inorganic a abatic transform Dispersion of	t layers of a atural atmos chemistry s, Radio nuc and organic mations. pollutants	tmosphere. spheric cor clides. Parti particulate	stitution. cles, ions matter.
Upon successful comp 1. The student will be 2. The student will be 3. The student will be 11. Unit wise detailed Unit-1 Numb Chemical equilibria, S and radicals in the atm Laws of thermodynam Unit – 2 Numb Atmosphere: Chemica effects of air pollution and analysis of air poll	letion of this course, able to apply the concepts a able to understand the intero- able to understand the effec l content er of lectures = 15 olubility product, unsaturate osphere. Chemical processe ics, enthalpy, Carnot's cycle	connections be et of human act ed and saturate s for formation e, entropy, Adi e, Air Pollution ls, Classificatio	tween differen ivities on the n Atmospheric of hydrocarbons of inorganic a abatic transform Dispersion of Sources, behavion and properti	t layers of a atural atmost chemistry s, Radio nuc and organic mations. pollutants aviour and f es of air pol	tmosphere. spheric cor clides. Parti particulate fate of air p llutants, sar	cles, ions matter. ollutants, npling
Upon successful comp 1. The student will be 2. The student will be 3. The student will be 11. Unit wise detailed Unit-1 Numb Chemical equilibria, S and radicals in the atm Laws of thermodynam Unit – 2 Numb Atmosphere: Chemica effects of air pollution and analysis of air poll Inversion, Lapse rate,	letion of this course, able to apply the concepts a able to understand the intero- able to understand the effect able to understand the effect content er of lectures = 15 olubility product, unsaturate osphere. Chemical processe ics, enthalpy, Carnot's cycle er of lectures = 15 l composition of atmosphere on human health & material lutants, Meteorological aspect	connections be et of human act ed and saturate s for formation e, entropy, Adi e, Air Pollution ls, Classification cts of air pollu	tween differen ivities on the n Atmospheric of hydrocarbons of inorganic a abatic transform Dispersion of Sources, behavior on and properti	t layers of a atural atmost chemistry s, Radio nuc and organic mations. pollutants aviour and f es of air pol , Atmospher	tmosphere. spheric cor clides. Parti particulate fate of air p llutants, san ric stability	cles, ions matter. ollutants npling
Upon successful comp 1. The student will be 2. The student will be 3. The student will be 11. Unit wise detailed Unit-1 Numb Chemical equilibria, S and radicals in the atm Laws of thermodynam Unit – 2 Numb Atmosphere: Chemica effects of air pollution and analysis of air poll Inversion, Lapse rate, Unit – 3 Numb Photo-chemical reacting technologies, control acid); control of NOx	letion of this course, able to apply the concepts a able to understand the intero- able to understand the effec I content er of lectures = 15 olubility product, unsaturate osphere. Chemical processe ics, enthalpy, Carnot's cycle er of lectures = 15 I composition of atmosphere on human health & material lutants, Meteorological aspec Mixing Height, Wind rose	connections be et of human act ed and saturate s for formation e, entropy, Adi e, Air Pollution ls, Classification ets of air pollu Range transp an and rich wa her newer met	tween differen ivities on the n Atmospheric of hydrocarbons of inorganic a abatic transform Dispersion of Sources, behavior on and properti- tant dispersion Air pollution port of air po- aste gases (rec- hods; control	t layers of a atural atmos chemistry s, Radio nuc and organic mations. pollutants aviour and f es of air pol , Atmospher control met ollutants, A overy of su of vehicula	tmosphere. spheric cor clides. Parti particulate fate of air p llutants, san ric stability thods ir pollutio ilphur and r emission	ollutants npling , n contro sulphurio (catalytic
Upon successful comp 1. The student will be 2. The student will be 3. The student will be 11. Unit wise detailed Unit-1 Numb Chemical equilibria, S and radicals in the atm Laws of thermodynam Unit – 2 Numb Atmosphere: Chemica effects of air pollution and analysis of air poll Inversion, Lapse rate, Unit – 3 Numb Photo-chemical reacti technologies, control acid); control of NOx conversion devices). In	letion of this course, able to apply the concepts a able to understand the intero- able to understand the effec I content er of lectures = 15 olubility product, unsaturate osphere. Chemical processe ics, enthalpy, Carnot's cycle er of lectures = 15 I composition of atmosphere on human health & material lutants, Meteorological aspect Mixing Height, Wind rose er of lectures = 15 ions in troposphere, Long of sulphur dioxide from lea through absorption and oth	connections be et of human act ed and saturate s for formation e, entropy, Adi e, Air Pollution ls, Classification cts of air pollu Range transp an and rich wa her newer met ontrol; Hazardo	tween differen ivities on the n Atmospheric of hydrocarbons of inorganic a abatic transform Dispersion of Sources, behavior on and properti- tant dispersion Air pollution port of air po- aste gases (rec- hods; control	t layers of a atural atmost chemistry s, Radio nuc and organic mations. pollutants aviour and f es of air pol , Atmospher control met ollutants, A overy of su of vehicula ts and their	tmosphere. spheric cor clides. Parti particulate fate of air p llutants, san ric stability thods ir pollutio ilphur and r emission	ollutants npling , n contro sulphuri (catalytic
Upon successful comp 1. The student will be 2. The student will be 3. The student will be 11. Unit wise detailed Unit-1 Numb Chemical equilibria, S and radicals in the atm Laws of thermodynam Unit – 2 Numb Atmosphere: Chemica effects of air pollution and analysis of air poll Inversion, Lapse rate, Unit – 3 Numb Photo-chemical reacti technologies, control acid); control of NOx conversion devices). In Unit – 4 Numb Noise Pollution: defininoise pollution, Noise- indices, Frequency we	letion of this course, able to apply the concepts a able to understand the intero- able to understand the effec I content er of lectures = 15 olubility product, unsaturate osphere. Chemical processe ics, enthalpy, Carnot's cycle er of lectures = 15 I composition of atmosphere on human health & material lutants, Meteorological aspect Mixing Height, Wind rose er of lectures = 15 ions in troposphere, Long of sulphur dioxide from lea through absorption and oth ndoor air pollution and its co er of lectures = 15 ition, sound pressure level, m- monitoring, Sound level me	connections be et of human act ed and saturate es for formation e, entropy, Adi e, Air Pollution ls, Classification ets of air pollu cts of air pollu , Range transp an and rich wa her newer met ontrol; Hazardo noise-spectra, c	tween differen ivities on the n Atmospheric of d hydrocarbons of inorganic a abatic transform Dispersion of abatic transform Dispersion of a Sources, beha on and properti- tant dispersion. Air pollution port of air po- aste gases (rec hods; control ous air pollutan Noise pollution octave bands, co continuous no	t layers of a atural atmost chemistry s, Radio nuc and organic mations. pollutants aviour and f es of air pol , Atmospher control met ollutants, A overy of su of vehicula ts and their n ombining do	tmosphere. spheric cor clides. Parti particulate fate of air p llutants, sar ric stability thods ir pollutio alphur and r emission manageme ecibels, Eff	estitution cles, ion matter. ollutants npling , n contro sulphuri (catalyti nt. ects of

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1. http://acmg.seas.harvard.edu/people/faculty/djj/book/powerpoints/index.html

2. https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-84j-atmospheric-chemistry-fall-

2013/lecture-notes/ 13. Books Recommended

1. Industrial Noise Control- Bell & Bell

2. Introduction to Environmental Engineering & Science- Gilbert Masters

3. Geo-environment- An Introduction - V. Aswathanarayan

4. Soil Chemistry- Bolt & Buggenwert.

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2. Course Name	ment : Environmental Second		L		Т		Р
3. Course Code	17090204	y	4	-	0		0
		Core ()		C (✓)	0		U
4. Type of Course (use 5. Pre-requisite	B.Sc.	6. Frequency			Odd ()	SEC () Either	Every
CONTRACT IN CONTRACT OF A DECISION OF A DECISIONO OF A DEC	B.SC.				Oud		Sem ()
(if any)	t T to inly Drug stin	(use tick mar				Sem()	Sem ()
	ctures, Tutorials, Practic)	_
Lectures = 60		torials = Nil	P	actic	al = Nil		
8. Course Description:		1 11.00		·			
0 01	is based on the information						
	and toxicity. This course v		concepts	n geo	ology and	detail unde	erstanding
of knowledge related to	oceanic phenomenon and	currents.					
9. Course Objectives:							
1. To provide knowledg	ge to students about fundan	nental concepts	in geolog	y, viz	. Geologic	cal Time So	cale, Plate
Tectonics, Continenta							
	on about different element	ts in Earth's cru	ist in relat	ion to	their ava	ilability, es	ssentiality
and toxicity.						,, ,, ,	
	related to oceanic phenon	nenon and curre	ants: and a	eo_mi	icrobiolog	RV.	
5. To impart knowledge	related to became phenom		and g	co-m	CIODIOIOE	.y.	
10. Course Outcomes ((COs):						
Upon successful comple		1				4.0	
	ble to have detail understan					its.	
	detail understanding abou						
	ble to understand Earth's c	crust in relation	to their ava	allabi	lity, essen	tiality and	toxicity.
11. Unit wise detailed							
	of lectures= 15		Basics ofg			0 1	11
Geology as a disciplin	e, Planet Earth. differentia	ation of the ear	th into cor	e, ma	ntle, crus	t, Special p	broblems
	geology, Complexity in r						
	ry of geology. Concept						
	, Basic concepts of plate			r cor	ntinental of	drift, type	of plate
	nics and rockcycle, Physic			10			
	of lectures= 15		Classificat				
	ore and soil forming mine						
	ical cycles (N. C, S and P)		of trace e	leme	nts, trace	elements a	nd health
	alance of some trace eleme					1.1.1.1	
	of lectures= 15		ceanogra	<u> </u>			
	, minerals and population						
associated with formati	on of mineral deposits, n	novements of o	cean wate	r, wa	ives and t	tides, types	s of tides
ocean currents, major oc	cean currents, seal evel cha	anges and its im	pact on co	astal	areas, oce	eans as new	areas for
exploration of mineralre	sources, naturalrecycling	of resources.					
Unit- 4 Number	of lectures = 15	G	eological	haza	rds		
Geobiology/geomicrobic	ology and its applications,					ere and ev	olution o
	e, life before oxygen, co						
	d biologically controlled						
	Process of detecting, loc						
Volcanoes and their env		U	0			5	••
	of self learning / E-learning	og component					
12. DITELLENTING							

71.6115

Mind profile

- <u>https://www.youtube.com/watch?v=QDqskltCixA</u>
 <u>https://www.uvm.edu/~gdrusche/295%20-%20Geomicrobiology.html</u>
- 3. https://en.wikipedia.org/wiki/Geologic_time_scale

13. Books Recommended

- 1. Kurt Konhauser: Introduction to Geomicrobiology
- 2. Alan P. Trujillo, Harold V. Thurman Essentials of Oceanography

lind

Ken 26/19

Rom

 Name of the Depart Course Name 	Biodiversity Conser			L	Т		Р
3. Course Code	17090205			4	0		0
4. Type of Course (use	tick mark)	Core ()		DSE (V		SEC 0	
5. Pre-requisite	B.Sc.	6. Freque	-	Even	Odd ()	Either	Ever
(if any)		(use	tick	(✓)		Sem ()	Sen
		marks)					0
7. Total Number of Le	ectures, Tutorials, Pr	actical (assumi	ng 15 v	veeks of	one semeste	er)	
Lectures = 60		Tutorials = Ni	1	Pract	ical = Nil		
8. Course Description:		of his dimension		and the		-hinal dist	-
This course will cover	detail understanding	of blodiversit	y patter	in and un	ere geogra	princar disi	Induic
patterns especially in In	ndian scenario. It will	help in underst	tanding	Biodiver	sity Act, IP	'Rs and pr	ovision
for enforcement in prese	erving the species of di	ifferent values.					
9. Course Objectives:							
1. To understand biodiv	• •						
2. To know about variou					on.		
3. To know the common							
4. To know about the w	orking of organization	is for wildlife c	onserva	tion.			
		1.1					
10. Course Outcomes ((COs):						
Upon successful comple			e able to)			
1. To know about geogr	raphical pattern of biod	diversity.					
To Imousthe offerst a							
2. TO KNOW the effect of	f human civilization an	nd industrialization	tion on	biodivers	ity.		
			tion on	biodivers	ity.		
3. To know In-situ and	Ex-situ conservation p	oractices.				national w	ildlife.
 To know In-situ and To know about the ro 	Ex-situ conservation p ble of wildlife and grou	oractices.				national w	ildlife.
3. To know In-situ and 4. To know about the ro 11. Unit wise detailed	Ex-situ conservation p ble of wildlife and grou content	oractices.	the pro	otection o	f local and		ildlife.
3. To know In-situ and 4. To know about the ro 11. Unit wise detailed of Unit-1 Number	Ex-situ conservation p ble of wildlife and grou content • of lectures = 15	oractices. and problems in	the pro	otection o	f local and	sity	
3. To know In-situ and4. To know about the ro11. Unit wise detailed ofUnit-1Biodiversity:Richness	Ex-situ conservation p ble of wildlife and grou content • of lectures = 15 and evenness, Histo	oractices. and problems in prical and geo	the pro	duction o al patter	f local and f biodivers n of biodi	ity versity; T	ypes
3. To know In-situ and 4. To know about the ro 11. Unit wise detailed of Unit-1 Number Biodiversity: Richness biodiversity, species ext	Ex-situ conservation p ole of wildlife and grou content of lectures = 15 and evenness, Histo tinction, values and sig	practices. and problems in prical and geo gnificance of b	Intro graphic	duction o al patter	f local and f biodivers n of biodi	ity versity; T	ypes
3. To know In-situ and4. To know about the ro11. Unit wise detailed ofUnit-1NumberBiodiversity: Richnessbiodiversity, species extgradients of biodiversity	Ex-situ conservation p ole of wildlife and grou content of lectures = 15 and evenness, Histo tinction, values and sig by Evolution and latest	practices. and problems in prical and geo gnificance of b	Intro graphic iodivers	duction o duction o al patter sity. Thre	f local and f biodivers n of biodi ats to biodi	ity versity; T versity _, je	ypes of
3. To know In-situ and4. To know about the ro11. Unit wise detailed ofUnit-1NumberBiodiversity: Richnessbiodiversity, species extgradients of biodiversityUnit - 2Number	Ex-situ conservation p ole of wildlife and grou content of lectures = 15 and evenness, Histo tinction, values and si by Evolution and latest of lectures = 15	oractices. and problems in prical and geo gnificance of b theories of evo	Intro graphic iodivers lution.	duction o duction o al patter sity. Thre ention on	f local and f biodivers n of biodi ats to biodi	ity versity; T versity, je	ypes vels ar
3. To know In-situ and4. To know about the ro11. Unit wise detailed ofUnit-1NumberBiodiversity: Richnessbiodiversity, species extgradients of biodiversityUnit - 2NumberInternational conventior	Ex-situ conservation p ole of wildlife and grou content of lectures = 15 and evenness, Histo tinction, values and si by Evolution and latest of lectures = 15 ns, treaties and protoco	practices. and problems in prical and geo gnificance of b theories of evo	Intro graphic jodivers lution. Conversity Co	duction o al patter sity. Thre ention or	f local and f biodivers n of biodi ats to biodi biodivers n, Biodivers	ity versity; T versity, je ity rsity in the	ypes vels ar
3. To know In-situ and 4. To know about the ro 11. Unit wise detailed of Unit-1 Number Biodiversity: Richness biodiversity, species ext gradients of biodiversity Unit – 2 Number International conventior of mankind. Species con	Ex-situ conservation p ole of wildlife and grou content of lectures = 15 and evenness, Histo tinction, values and sig by Evolution and latest of lectures = 15 ns, treaties and protocon ncept, Biological nome	practices. and problems in prical and geo gnificance of b theories of evo	Intro graphic iodivers lution. Conversity Corries of b	duction of al patter sity. Three ention or onservation	f local and f biodivers n of biodi ats to biodi biodivers n, Biodiver classification	ity versity; T iversity, je ity rsity in the on.	ypes ovels ar
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3. To know In-situ and 4. To know about the ro 11. Unit wise detailed of Unit-1 Number Biodiversity: Richness biodiversity: Richness biodiversity; species ext gradients of biodiversity Unit - 2 Number International convention of mankind. Species con Unit - 3 Number Hot spots and cold sp	Ex-situ conservation p ole of wildlife and grou content of lectures = 15 and evenness, Histo tinction, values and si by Evolution and latest of lectures = 15 ns, treaties and protocon heept, Biological nome of lectures = 15 pots of Biodiversity,	oractices. and problems in prical and geo gnificance of b theories of evo ols for Biodiver enclature. Theor	Intro graphic jodivers lution. Conversity Conversity Conversity Conversity Conversity Conversion of Biodiverse Converse Converse Converse Converse	duction o al patter sity. Thre ention on onservatio viological versity C	f local and f biodivers n of biodi ats to biodi biodivers n, Biodiver classification onservation	sity versity; T versity, Je ity rsity in the on. 1-I n, Nationa	ypes vels ar welfa
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measurement-of-biodiversity/

Books Recommended
 Global Biodiversity - W.R. L.IUCN
 Ecology of natural resource - Ramade
 Ecology - P.D. Sharma

TCIN

Mul Negion

ROU

1. Name of the De	partment : Enviro	nmental Science				Sec.		
2. Course Name	Occupational He	alth & Safety	L		Т	2		Р
3. Course Code	17090206		2	RIC IT P	0	12.26		0
4. Type of Course	(use tick mark)	Core ()	DSE (0	C. Santa	SEC ((\checkmark)	The Park
5. Pre-requisite	B.Sc.	6. Frequence	ey	Even	Odd	Either	•	Every
(if any)		(use tick man	rks)	(*)	0	Seme	ester	Semester
						0	11.1	0
7. Total Number	of Lectures, Tutori		uming 15 v				199 P	
Lectures = 30		Tutorials = Nil		Prace	tical = Ni	1		the state
8. Course Descrip		and the second	Tax and	and a	No.112.	14-1-1-1		1.2.1.1.1.
The course includes	•							
diseases and their ef								
It also includes bas	ic human physiolog	y and pathology in	n relation t	o work,	working	environ	ment,	stress factor,
fatigue-meaning an	d causes of fatig	ue. Elements of	working o	condition	s i.e. no	oise, ve	ntilati	on, lighting,
temperature, humidi								
The course also inc			pational dis	seases- en	nvironme	ntal, per	rsonal	and medical
control, responsibili		ment.		1.				
9. Course Obje			1	h mail in	o upi n	11-1-1-1-		
The objectives of th				F				
	occupational health							
	Industrial and Enviro							
	sics occupational hea		nent and m	ethodolog	gy to redu	ice the h	ealth	issues.
	necessity of industria							
5. To know the im	pacts of occupationa	al environment and	stress on t	he humar	n body an	d psych	ology	
10. Course Outco	omes (COs):	DAY DE RECEDENCE .						
1. To understand a	nd maintain the phy	sical, mental and se	ocial well-	being of v	workers.		1.5	No. 1991
	infavorable effects o	and the second se		-				
	bout Industrial and			•		duce he	alth e	ffects
	ics of occupational l						aiui c	110013.
	•							
	e to know the respon	isionnes of safety	officers an	ia nead o	r departir	lent for j	person	i working in
the premises of			1. L. 1. W.		_		1	
11. Unit wise det		-			10.00			
	ber of lectures = 1							and safety
Introduction, Defini								
their effects. Princi			n and Env	Ironmen	tal Safet	y Manag	gemen	nt. Need and
importance of Indus	trial and Environme	ntal Safety.						
Unit – 2 Nun	ber of lectures = 1	5	We	ork envir	onment	and stre	SS	the state
Basic human Physic	ology and Patholog	y in relation to wo	rk, Work	environm	ent, Stre	ss factor	r, Fat	igue-meaning
and causes of fatig								
temperature, humid								
work.	The second second	a la contra da contra	West and the	Science .				
	ber of lectures = 1							al diseases
Prevention and cont	rol of occupational	diseases- environm	ental, pers	onal and	medical	control,	Resp	onsibilities of
Safety department.	Responsionnes of	Medical departme					1001112	, department.
Responsibilities of p							1001112	department.
Responsibilities of p Unit – 4 Nun	blant managers, super ber of lectures = 1	ervisors. 5	Ru	le and re	gulation	s for oc	cupat	ional safety
Responsibilities of p	blant managers, super ber of lectures = 1	ervisors. 5	Ru	le and re	gulation	s for oc	cupat	ional safety

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12.	Brief Description of self learning / E-learning component	
1.	https://en.wikipedia.org/wiki/Occupational safety and health	
2.	https://www.who.int/topics/occupational health/en/	
3.	https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture notes/	

13. Books Recommended

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1. Environmental Hazards and Human Health - R.B. Phillip

2. Toxicology - Principles and Applications- Niesink, John de Vries & Holligner

3. Hand book of "Occupational Safety and Health", National Safety Council, Chicago, 1982

4. Occupational Health Hazards and Remedies. (2002). Mohapatra, R.Jaypee Brothers Medical Publishers Pvt. Ltd. India.

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2. Course Name	Microbial Biote	chnology - Lab	L	Т		Р
3. Course Code	17090207	8,	0	0		4
4. Type of Course (use tick mark)	Core (✓)	DSE ()		SEC 0	
5. Pre-requisite	B.Sc.	6. Frequency	Even	Odd ()	Either	Every
(if any)		(use tick marks)	(*)		Sem ()	Sem
7. Total Number of	Lectures, Tutorial	s, Practical.	20 C			
Lectures = Nil		Tutorials = Nil	Pract	ical = 60		1.1
8. Course Description	on:	interaction of Proteins, Nu				
). Course Objectiv	es:					
1. To provide in	nformation about d	lifferent elements in Earth	n's crust in	n relation to	o their av	ailabilit
essentiality an						
		arth structure and constituer	nts.			
10. Course Outcome	s (COs):				-	198
Upon successful com	oletion of this course	e, the student will be able to)		-	
		n of pollutants with the help		es and fungi	i.	
2. To know bio-	remediation of conta	aminants.				
11. List of Case Stud	lies / Experiments					
	n of Gel Electrophon	resis		8 8	1	
2. Autoclaving c	of microbial culture/	media				
3. Demonstratio	n of Fermentation p	rocess in Laboratory				
4. DNA isolation	n					
5. Demonstrate	anaerobic respiration	n.				
6. Microbial cul	ture in laboratory					
12. Books Recomme			5-24			
	,	emistry Murray RK, Bende	r DA, Both	nam KM, K	ennelly PJ	Rodwe
VW and Weil PA	McGraw Hill Public	ation				
2. Basic ecology - E.	P. Odum					
3. Ecology and field	biology - R.L. Smith	1				
4 Ecology - PD Sha	arma					

- 5. Fundamentals of ecology -E.P. Odum
- 6. Principles of ecology Rickleff

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7. Total Number of Lectures, Tutorials, Practical. Lectures = Nil Tutorials = 8. Course Description: This Course will introduce the students to understand the various stress conditions. To know about the 'importance pollutants from waste water and soil. 9. Course Objectives: The objectives of this course are to: 1. To know about the molecular content of the plants 2. To know about the impacts of air pollution on the plant 3. To know about the impacts of air pollution on the plant	= Nil e effects and e of difference cells.	nd adaptatio			
5.Pre-requisite (if any) B.Sc. 6.Frequen (use tid (use tid 7. Total Number of Lectures, Tutorials, Practical. 1. Lectures = Nil Tutorials = 8.Course Description: This Course will introduce the students to understand the various stress conditions. To know about the importance pollutants from waste water and soil. 9.Course Objectives: The objectives of this course are to: 1. To know about the molecular content of the plants 2. To know about water movement through the plant 3. To know about the impacts of air pollution on the 4. To make student understand impacts of different st	= Nil e effects and e of difference cells.	Even (✓) Practind adaptatio	cal = 60	Either Sem() on plant s	Sem ()
(if any)(use tide7. Total Number of Lectures, Tutorials, Practical.Lectures = Nil8. Course Description:This Course will introduce the students to understand the various stress conditions. To know about the 'importance pollutants from waste water and soil.9. Course Objectives: The objectives of this course are to: 1. To know about the molecular content of the plants 2. To know about the impacts of air pollution on the 4. To make student understand impacts of different standing	ek marks) = Nil e effects and e of difference cells.	Practi	cal = 60	Sem()	Sem ()
7. Total Number of Lectures, Tutorials, Practical. Lectures = Nil Tutorials = 8. Course Description: This Course will introduce the students to understand the various stress conditions. To know about the 'importance pollutants from waste water and soil. 9. Course Objectives: The objectives of this course are to: 1. To know about the molecular content of the plants 2. To know about water movement through the plant 3. To know about the impacts of air pollution on the plant 4. To make student understand impacts of different standing 1. Standard S	= Nil e effects an e of difference cells.	Practing adaptation	on evolved	on plant s	species in
Lectures = Nil Tutorials = 8.Course Description: This Course will introduce the students to understand the various stress conditions. To know about the 'importance pollutants from waste water and soil. 9.Course Objectives: The objectives of this course are to: 1. To know about the molecular content of the plants 2. To know about water movement through the plant 3. To know about the impacts of air pollution on the plant student understand impacts of different student student understand impacts of different student student understand impacts	e effects an e of difference cells.	nd adaptatio	on evolved		
 8.Course Description: This Course will introduce the students to understand the various stress conditions. To know about the importance pollutants from waste water and soil. 9.Course Objectives: The objectives of this course are to: 1. To know about the molecular content of the plants 2. To know about water movement through the plant 3. To know about the impacts of air pollution on the plant 4. To make student understand impacts of different statement of the plant statement of the plant statement water and so is a student statement of the plant statement of the plant statement statement water and statement of the plant statement statement water and statement statement statement statement water statement water statement statement statement water and statement statement statement statement water and statement statement statement water and statement statement statement statement water and statement and statement statement statement water and statement and statement statement statement statement water and statement and statement statement and statement statement and statement statement water and statement and statement statement and statement statement statement statement and statement and statement statement and statement and statement statement and statement and statement and statement statement and statement and statement and statement and statement and statement statement and stateme	e effects an e of difference cells.	nd adaptatio	on evolved		
 This Course will introduce the students to understand the various stress conditions. To know about the importance pollutants from waste water and soil. 9.Course Objectives: The objectives of this course are to: To know about the molecular content of the plants To know about water movement through the plant To know about the impacts of air pollution on the plant To make student understand impacts of different standing and student an	e of differe				
 various stress conditions. To know about the importance pollutants from waste water and soil. 9.Course Objectives: The objectives of this course are to: To know about the molecular content of the plants To know about water movement through the plant To know about the impacts of air pollution on the plant To make student understand impacts of different statement statement. 	e of differe				
 The objectives of this course are to: To know about the molecular content of the plants To know about water movement through the plant To know about the impacts of air pollution on the plant To make student understand impacts of different statement 					
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 To know about water movement through the plant To know about the impacts of air pollution on the To make student understand impacts of different st 					
 To know about the impacts of air pollution on the To make student understand impacts of different st 					
4. To make student understand impacts of different st	olants				
	ress mecha	anisms.			
10.Course Outcomes (COs):					
Upon successful completion of this course, the student will	be able to:				
1: Students will be able to analyze various parameters like.					
2: Students will gets acquainted with use of air pollution	tolerance	index for	selection o	f trees for	differen
regions.					
3: Students will be able to understand and demonstrate the	bioremedia	ation and pl	nytoremedi	ation techr	niques
11.List of Experiments			1		
1. Estimation of proline content in plants.		/ 1			
2. To demonstrate the phenomena of osmosis through		er/parchme	nt paper.		
3. Evaluation of air pollution tolerance index (APTI)					
4. Evaluation of anticipated performance index (API)	of plants.				
5. Estimation of sucrose content in plant sample.					
6. Study of aquatic plant's Aerenchyma.					
12.Books Recommended					

- Physiological Plant Ecology- Encyclopaedia (Vol. I-IV) Springer Verlag
 Plant Physiology- Salisbury & Ross

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2.Course Name	Atmospheric Pollution- Lab	Chemistry and	L	Т		Р
3.Course Code	17090209		0	0		4
4.Type of Course (u		Core(✓)	DSE ()		SEC 0	-
5.Pre-requisite	B.Sc.	6.Frequency	Even	Odd ()	Either	Every
(if any)		(use tick marks)	(1)		Sem()	Sem (
	Lectures, Tutorials, P					
Lectures = Nil	,,,,,	Tutorials = Nil	Pract	ical = 60		1
8. Course Description	n:					
		inderstand the principle	and workin	g of differe	nt instrum	ents use
		rties of different pollut				
	nce and transport of po					
9. Course Objectives						1.1.1
The objectives of this						12.10
	concentration of Partic	ulate Matter in air.				
2. To acquaint	with NO ₂ measurement	procedure.				
	with SO ₂ measurement					
•	ar with stack monitorin					
-	d procedure of noise m					
10.Course Outcome						
Upon successful com	pletion of this course, t	he student will be able to) :			
1. Students will	be able to use different	t instruments for air qual	ity assessm	ent.		
2. Students will	be able to analyze vari	ous parameters for air qu	ality assess	sment like c	oncentratio	on of
NO_2 , SO_2 , CO_2	O, PM etc.					
3. Students will	also be able to explain	the sources of different	types air po	llutants.		
11.List of Experime	nts			11.1	1	
		ed particulate matter (RS	SPM) in am	bient air qu	ality.	
2. Determination	on of NO ₂ concentration	in ambient air quality.				
3. Determinatio	on of SO ₂ concentration	in ambient air quality.				
4. Stack monito	oring and analysis of dif	ferent pollutants.				
5. Determination	on of O_3 concentration in	n ambient air quality				
	pient noise level.	1				
	ndad		1.	_		
12.Books Recomme	lueu					
	by Rao & Rao					

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2.	Course Name	Environmental and research wo	0.	L	1	Т		Р
3.	Course Code	17090210		0		0		4
4.	Type of Course(use tick mark)	Core ()	D	SE (✓))	SEC ()	
5.	Pre-requisite (if any)	B.Sc.	6. Frequency (use tick mar		ven ()	Odd ()	Either Sem()	Every Sem ()
7.	Total Number of	Lectures, Tutorials	, Practical.	1				
Le	ctures = Nil		Tutorials = Nil		Practi	ical = 60		

8. Course Description:

Environmental geology Lab is helpful for understanding the different elements in Earth's crust in relation to their availability, essentiality and toxicity. This course will enhance basic skills in geology.

9. Course Objectives:

- 1. To provide information about different elements in Earth's crust in relation to their availability, essentiality and toxicity.
- 2. To impart knowledge related to earth structure and constituents.

10. Course Outcomes (COs):

Upon successful completion of this course

- 1. The student will have detail understanding about fundamental concepts in geology.
- 2. The student will be able to understand Earth's crust in relation to their availability of various earth resources.

11. List of Case Studies / Experiments

1. Identification of different types of rocks.

- 2. A Case Study of Bijolia Mining Area in Rajasthan, India
- 3. Reading a geological map and the symbols used.
- 4. Study of physical properties and identification of Mica & Clay minerals.

5. Every student should attend field work for a short duration and submit field diary, geological specimen and a report.

12. Books Recommended

- 1. Ravindrakumar: Fundamentals of Historical Geology and Sratigraphy of India.
- 2. Krishnan: Geology of India and Burma
- 3. Wadia: Geology of India.

4. Deshpande G.G.: Geology of Maharashtra

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2. Course Name	Biodiversity Con and research work	servation- Practical	L	T		P
3. Course Code	17090211		0	0	12	4
4. Type of Course (use tick mark)	Core ()	DSE (V)	SEC ()	Sen State
5. Pre-requisite (if any)	B.Sc.	6. Frequency (use tick marks	Even) (✓)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of	Lectures, Tutorials,	Practical.				5
Lectures = Nil		Tutorials = Nil	Pract	ical = 60	A. Starte	
8. Course Descripti	on:					
9. Course Objectiv						
1. To understand biodi	iversity pattern and va	lue of biodiversity				
			0			
2. To know In-situ an 3. To know about the r	role of wildlife and gro	n practices ound problems in the pro	otection of l	ocal and nat	ional wild	life.
2. To know In-situ an 3. To know about the r 11. List of Case Stud	role of wildlife and gro ies / Experiments Case studies for the c	ound problems in the pro-	Prant	ocal and nat	ional wild	life.
 To know In-situ an To know about the r 11. List of Case Stud Various Project and BanwariSewa Ashr 	role of wildlife and gro ies / Experiments Case studies for the c ram Vs State of U.P. A thod (Waterhole surve ersity present on camp	conservation of Wildlife AIR, 1987, SC 374 ey, point count and line ous.	(any four)	Eost = 6.0		
 To know In-situ an To know about the instant of the second s	role of wildlife and gro ies / Experiments Case studies for the c am Vs State of U.P. A thod (Waterhole surve ersity present on camp ing biology of a mamm raphy: Field work	conservation of Wildlife AIR, 1987, SC 374 ey, point count and line ous.	(any four)	Eost = 6.0		
 To know In-situ an To know about the rest of Case Stud Various Project and BanwariSewa Ashr Wildlife census method) To study the biodiversity 	role of wildlife and gro ies / Experiments Case studies for the c am Vs State of U.P. A thod (Waterhole surve ersity present on camp ing biology of a mamm raphy: Field work	conservation of Wildlife AIR, 1987, SC 374 ey, point count and line ous.	(any four)	Eost = 6.0		

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1. Name of the Depa	rtment : Environmental	Science						
2. Course Name	Environmental Modeling]	L	Т		1	Р
	and Statistics							
3. Course Code	17090301			4	0			0
4. Type of Course (u	se tick mark)	Core (✓)	DSE	0		SEC	0	
5. Pre-requisite	B.Sc.	6. Freque	ncy	Even () Odd	Either	r	Every
(if any)	1 States and the states of the	(use tick ma	rks)		(1)	Sem	0	Sem ()
7. Total Number of	Lectures, Tutorials, Prac	ctical (assumi	ng 15	weeks	of one semes	ter)		
Lectures = 60		torials = Nil		Prac	ctical = Nil			Long h
8. Course Description								
	ng, statistics and comput							
	ring activity, data analysi							
	an integral part of pollu							
	use of computer applicat	ions in mode	el buil	ding an	id analysis v	with us	e of	analytical
software such as SPSS			2					
9. Course Objective		and the second se				100		
The objectives of this c		1: 4: 6						
	basic role of modelling in p			imental	changes.			
	erent stages involved in m							
<u> </u>	h steady state models used	for study of	rivers	and lake	es quality.			
-	h and reaction rates.							
	statistical software in inte	rpretation and	analy	SIS.		_		10000
10. Course Outcomes	(COs):							
 To understand van resources and the e To understand ab analysis methods. 	letion of this course, the st rious computer-based and environment. out remote-sensing techn fferent environmental asp	statistical me niques, physi	thods cal pr	used for	, sampling,	statisti	cs ar	nd image-
11. Unit wise deta	iled content							
Unit-1 Numbe	er of lectures = 15		Intr	oductio	on of environ	nmenta	l mo	leling
Role of modeling in	ling methodology, measur environmental science, M lynamic models. Response	lodel classific	ation:	determ				
Unit – 2 Numbe	er of lectures = 15		Typ	es of er	vironmenta	al mode	ling	
-	ved in model building. S namic balance equations, r		ial gro	wth kir				Methods
	er of lectures = 15				d techniques			
	d, MS-Excel, MS-Power c-Plot, Gaussian Plume M		Rem	ote sens	sing, Global	Positio	oning	System:
Unit-4 Numbe	er of lectures = 15		Stat	tistical	packages			
	ter Science and Enginee tical Product and Service				alysis, use c	of statis	stical	packages
	of self learning / E-learn							
	a.org/wiki/Environmental .edu/courses/introduction-		l-mod	elling				

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3. https://www.powershow.com/view/11ff44 ZDk4Y/Environmental_Modeling_Environmental_Modeling_and_Models_powerpoint_ppt_presentation

13. Books Recommended

1. Dynamics of Environmental Bioprocesses-Modelling and simulation - Snape and Dunn.

2. Environmental Modelling - Jorgensen, S. E.

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	me	Soil chemistry and S	Solid Waste	L		Т		Р
	-	Management						^
6. Course Co		17090302	0	4		0	OF CO.	0
		(use tick mark)	Core (1)	DSE (-	1011	SEC ()	E
5. Pre-requis (if any)	ite	B.Sc.	6. Frequenc (use tick mar		Even ()	Odd (✓)	Either Semester	Every Semester
7. Total Num	ber	of Lectures, Tutorials,	Practical (assur	ning 15 w	eeks of	one seme	ster)	1
Lectures $= 60$		T	utorials = Nil		Prac	tical = Ni	1	
8. Course De								
The course in	clude	es knowledge about we	athering of rocks	s, soil pro	file, inor	ganic and	d organic co	omponents of
soils, major r	ock t	forming minerals, soil/r	normal forming	factors, so	oil prope	rties, che	mical and r	nineralogical
		s. It also includes s						
composting, v	/ermi	n-composting, incineral	tion, energy reco	overy from	n organio	c waste. 7	The course	also includes
waste manage	ment	rules and guidelines wi	ith soil contamina	ation from	pesticid	es and fer	tilizers.	
	1.1.1	and the second			•			
9. Course the objectives								
		e methods of solid wast	e disposal					
		nethods used for recover		of solid	waste to	n minimiz	ze the adve	rse effects o
environmen		lethous used for recover	ery and disposal	or sond	waste to		Le the dave	ise encets .
		1						
$10 \ call \ u$		chanism of compositing	and Vermicompo	osting.				
			and Vermicomponent from bioma					
. To know th	ne tec	hniques of producing er	nergy from bioma	ass.	ve, flamr	nable, exp	plosive and	toxic waste.
 To know th To know at 	he tec	hniques of producing er management of hazardo	nergy from bioma	ass.	ve, flamr	nable, exp	plosive and	toxic waste.
 To know th To know at Course O 	bout putco	hniques of producing er management of hazardo mes (COs):	nergy from bioma	ass. ng corrosiv	ve, flamr	nable, exp	plosive and	toxic waste.
 To know the To know at Course O Jpon successful 	bout i bout i utco	hniques of producing er management of hazardo mes (COs): npletion of this course,	the student will b	ass. ng corrosiv be able to			-	
 To know the constraint of the constrain	ut cor tand	hniques of producing er management of hazardo mes (COs): npletion of this course, the implications of the	the student will b	ass. ng corrosiv be able to			-	
 To know the To know ale Course O Upon successful To underst waste man 	ut contand	hniques of producing er management of hazardo mes (COs): npletion of this course, the implications of the nent.	the student will b production, resource	ass. ng corrosiv be able to urce mana,	gement a	and enviro	onmental in	npact of solid
 To know the To know at the To know at	ut contand	hniques of producing er management of hazardo mes (COs): npletion of this course, the implications of the	the student will b production, resource	ass. ng corrosiv be able to urce mana,	gement a	and enviro	onmental in	npact of solid
 To know the To know all To know all Course O Jpon successful To underst waste man To underst effects. 	ul cortand agentitand	hniques of producing er management of hazardo mes (COs): npletion of this course, the implications of the p nent. components of solid	the student will b production, resource waste managem	ass. ng corrosiv be able to urce mana, aent infras	gement a	and enviro systems	onmental in to minimiz	npact of solid
 To know the To know at the To know at	bout putco ul cor tand agent tand iliar	hniques of producing er management of hazardo mes (COs): npletion of this course, the implications of the nent. components of solid with relationships betw	the student will b production, resource waste managem	ass. ng corrosiv be able to urce mana, aent infras	gement a	and enviro systems	onmental in to minimiz	npact of solic ze the above
 To know the To know at To underst waste man To underst effects. To be fam water, soil 	ul contraction of the technology of	hniques of producing er management of hazardo mes (COs): npletion of this course, i the implications of the p nent. components of solid with relationships betw sediment quality.	the student will b production, resource waste managem veen inappropriat	ass. ng corrosiv be able to urce mana, ment infras te waste m	gement a structure nanageme	and enviro systems ent practio	onmental in to minimiz ces and the	npact of solid ze the above ir impacts or
 To know the To know at the To underst waste man To underst effects. To be fam water, soil To underst 	iliar and and and and and	hniques of producing er management of hazardo mes (COs): npletion of this course, the implications of the nent. components of solid with relationships betw	the student will b production, resource waste managem veen inappropriat	ass. ng corrosiv be able to urce mana, ment infras te waste m	gement a structure nanageme	and enviro systems ent practio	onmental in to minimiz ces and the	npact of solic ze the above ir impacts or
 To know the two the two the two the two two two two two two two two two two	iliar and and and and and and	hniques of producing er management of hazardo mes (COs): npletion of this course, it the implications of the p nent. components of solid with relationships betwo sediment quality. the solid waste and its	the student will b production, resource waste managem veen inappropriat	ass. ng corrosiv be able to urce mana, ment infras te waste m	gement a structure nanageme	and enviro systems ent practio	onmental in to minimiz ces and the	npact of solic ze the above ir impacts or
 To know the two the two the two two two two two two two two two two	iliar and and agent and agent and agent and agent and agent and agent and agent and agent and agent ag	hniques of producing er management of hazardo mes (COs): npletion of this course, if the implications of the p nent. components of solid with relationships betw sediment quality. the solid waste and its ailed content	the student will b production, resource waste managem veen inappropriat	ass. ng corrosiv be able to urce mana, ment infras te waste man nplications	gement a structure nanagement s and to	and enviro systems ent practi- learn abo	onmental in to minimiz ces and the	npact of solic ze the above ir impacts or
 To know the To know all To know all To know all To know all to Course O Upon successful. To underst waste man To underst effects. To be fam water, soil To underst waste disputed to the total set of the total set of the total set. 	iliar and istand osal. e det	hniques of producing er management of hazardo mes (COs): npletion of this course, the implications of the p nent. components of solid with relationships betw sediment quality. the solid waste and its ailed content ber of lectures = 15	hergy from bioma bus waste includin the student will b production, resou waste managem veen inappropriat environmental in	ass. ng corrosiv be able to urce mana, ment infras re waste man nplications Soil	gement a structure nanagement s and to propert	and enviro systems ent praction learn abo	onmental im to minimiz ces and the out safe met	npact of solid ze the above ir impacts or hods of solid
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Control & Treatment, Hospital Waste Management, Hazardous Waste Management & Handling rules, 1989 & 2000 (amendments), Fly-ash generation & utilization.

Unit – 4 Number of lectures = 15

Soil pollution

Soil pollution from use of fertilizers, pesticides, heavy metals, waste disposal, industrial effluents and surfactants, detrimental effects of soil pollutants, remedial measures for soil pollution, soil sediments as pollutant, chemical methods of soil analysis-sample preparation and soil analysis, radioactive pollution.

12. Brief Description of self learning / E-learning component

1. https://www.environmentalpollutioncenters.org/soil/

- 2. https://www.toppr.com/guides/chemistry/environmental-chemistry/soil-pollution/
- 3. https://en.wikipedia.org/wiki/Soil_contamination
- 4. https://www.indiacelebrating.com/environmental-issues/soil-pollution/

13. Books Recommended

- 1. Solid Waste Management CPCB. New Delhi.
- 2. Eco-technology for pollution control & environmental management By R.K. Trivedi & Arvind Kr.
- 3. Basic Environmental Technology J. A. Nathanson

4. Fundamentals of soil science - Henry D. Futh

5. The Nature and Properties of Soils, Brady, N.C. and Weil, R.R. Prentice-Hall, 14th Edition.

Upper Saddle River, NJ, USA, 2007.

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customary lands, Cultural Heritage and its protection.

12. Brief Description of self learning / E-learning component

- 1. http://www.conservationindia.org/topics/human-resettlement
- 2. https://www.tandfonline.com/doi/pdf/10.1080/07349165.1990.9726051
- 3. https://www.toppr.com/bytes/environmental-pollution/
- 4. http://seafoodhaccp.cornell.edu/Intro/blue_pdf/Chap02Blue.pdf

13. Books Recommended

- 1. Environmental Chemistry by A K De by NEW AGE Publishers
- 2. Energy Conservation Guidebook by Dale R. Patrick, Stephen W. Fardo, Ray E. Richardson, Brian W. Fardo. CRC Press
- 3. Elixir: A History of Water and Humankind by Brian Fagan, Bloomsbury Press
- 4. Hazardous Waste Management by Michael D. Lagrega, Waveland Pr Inc
- 5. This Sacred Earth: Religion, Nature and Environment by Roger S Gottlie b, Psychology Press
- 6. Worldviews, Religion, and the Environment: A Global Anthology by <u>Richard C. Foltz.</u>, Wadsworth Publishing.
- 7. Environment and Politics (Routledge Introductions to Environment: Environment and Society Texts) 4th Edition by <u>Timothy Doyle</u>, Routledge Publishers

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environmental implications, NPK fertilizers and their environmental effects.	Correlation	of	crop	growth
with environmental parameters like temperature, sunshine, relative humidity.			-	
12. Brief Description of self learning / E-learning component	11 A.			116
1. https://en.wikipedia.org/wiki/Sustainable agriculture				
2. https://asi.ucdavis.edu/programs/ucsarep/about/what-is-sustainable-agriculture				
3. https://www.nal.usda.gov/afsic/sustainable-agriculture-definitions-and-terms				
13. Books Recommended				
1. Sustainable Agriculture – H.R. Sharma				
2. Global Climate Change – Pary Martin				
3. Allelopathy – S.S. Narwal				
4. Environmental Chemistry – Stanley E. Manahan				
5. Soils – Miller and Donhau				
6. Environment and Agriculture - Dhaliwal, Jairath and Hans	1.1.1	152		10.00

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1.	Name of the Depa	rtment: Environm			1		
2.	Course Name		Environmental Modeling, Computer and Statistics-Lab				Р
3.	Course Code	17090305		0	0		4
4.	Type of Course (use tick mark)	Core (✓)	DSE ()		SEC ()	
5.	Pre-requisite (if any)	B.Sc.	6. Frequency (use tick marks	Even ()	Odd (🗸)	Either Sem()	Every Sem ()
7.	Total Number of	Lectures, Tutorials	, Practical.				
Le	ctures = Nil		Tutorials = Nil	Practi	cal = 60		

8. Course Description:

Environmental modeling, statistics and computer based data management is essential part of any type of environmental monitoring activity, data analysis, risk assessment and risk mitigation

9. Course Objectives:

The objectives of this course are to:

- 1. To learn about the basic role of modelling in prediction of environmental changes.
- 2. To know different type environmental models.
- 3. Learn the basics of computer application.
- 4. To understand the role of modeling in environmental sciences.
- 5. To learn about different stages involved in model building.

10. Course Outcomes (COs):

Upon successful completion of this course, the student will be able to

1. To understand various computer-based and statistical methods used for study and management of natural resources and the environment.

2. To understand different environmental aspects and methodology of formulation of dynamic balance models.

11. List of Case Studies / Experiments

1. Application Basic Microsoft Office Software

- 2. Graphical representation of data
- 3. Use of statistical packages including SPSS (Statistical Product and Service Solutions)
- 4. Application and use ERICA

5. Environmental Modeling softwares and their applications.

12. Books Recommended

- 1. Dynamics of Environmental Bioprocesses-Modelling and simulation Snape and Dunn.
- 2. Environmental Modelling-Jorgensen, S. E.

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1. Name of the Departn	nent: Environmenta	l Science				
2.Course Name	Soil Chemistry an	nd Solid Waste	L	Т		Р
	Management-Lab					
3.Course Code	17090306		0	0		4
4.Type of Course (use t	ick mark)	Core (✓)	DSE ()		SEC 0	
5.Pre-requisite	B.Sc.	6.Frequency	Even ()	Odd	Either	Every
(if any)		(use tick mar	ks)	(✔)	Sem ()	Sem ()
7. Total Number of Lect	tures, Tutorials, Pra	cticals.				
Lectures = Nil		Tutorials = Nil	Practi	cal = 60		
9 Course Descriptions						

8. Course Description:

This Course will introduce the students to understand the basic chemistry of the soil To know the methodology for analysis of basic physico-chemical properties of soil. To understand the solid waste and its environmental implications.

9. Course Objectives:

The objectives of this course are to:

- 1. To know the principle and working of pH and Electrical conductivity meter.
- 2. To learn methodology for analysis of Organic carbon content in soil.
- 3. To learn about the cation exchange capacity of the soil sample.
- 4. To know the methodology for analysis of sodium and potassium content in the soil sample.
- 5. To know the types and management strategies of solid waste.
- 6. To determine Nitrogen and Phosphorus concentration from soil samples.

10.Course Outcomes (COs):

Upon successful completion of this course, the student will be able to:

- 1: Students will also able to understand and use different methods and techniques for soil quality analysis.
- 2: Students will also able to characterize the solid waste on the basis of different properties.
- 3: Students will also be able determine the heavy metals concentration in soil.

11.List of Experiments

- 1. Measurement of pH and electrical conductivity of soil.
- 2. Determination of the organic matter in soil.
- 3. Determination of cation exchange capacity of the soil.
- 4. Estimation of exchangeable Na, K, Ca and Mg in soil.
- 5. Solid waste characterization of the waste in the nearest vicinity.
- 6. Determination of phosphorus and nitrogen from soil samples.

12.Books Recommended

1. The Nature and Properties of Soils, Brady, N.C. and Weil, R.R. Prentice-Hall, 14th Edition.

Upper Saddle River, NJ, USA, 2007.

2. Solid Waste Management CPCB. New Delhi.

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Course Description: the course also includes Water Use and Conservation, Land contamination, sources policy, Working conditions and terms of employment, Child labo techol, Tobacco, Narcotics etc. Course Objectives: the objectives of this course are: To know the point and non point sources of different pollutions in environ To know about the harmful effects of excessive use of fertilizers, pesticide To know about the energy conservation methods used in industries. To know about water conservation methods used in industries. To know about water conservation methods in domestic, agriculture and in Ocurse Outcomes (COs): pon successful completion of this course, the student will be able to To learn about the harmful effects of excessive use of fertilizers, pesticide To understand about water conservation methods in domestic, agriculture List of Case Studies /Experiments Survey work on minimum two local environmental problems / environment Epidemiological survey in any local area for Fluoride. Report on Tehri Dam Conflict: Case study 'Old' and 'New' Social Movements in India Report on Famous Environmentalists of India. Field work report on Any village / City/ Town depicting status of environment 2. Books Recommended	0) (√)		Р
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(if any) (use tick marks) Total Number of Lectures, Tutorials, Practical. ectures = Nil Tutorials = Nil Practical. ectures = Nil Tutorials = Nil Practical. Course Description: Tutorials = Nil Practical. ne course also includes Water Use and Conservation, Land contamination, sources policy, Working conditions and terms of employment, Child labo (cohol, Tobacco, Narcotics etc. Course Objectives: ne objectives of this course are: . . . To know the point and non point sources of different pollutions in environ 2. To know about the harmful effects of excessive use of fertilizers, pesticide 3. To know about water conservation methods used in industries. 4. To know about water conservation methods in domestic, agriculture and in 9. Course Outcomes (COs): pon successful completion of this course, the student will be able to . . To learn about the harmful effects of excessive use of fertilizers, pesticide . To learn about the harmful effects of excessive use of fertilizers, pesticide . To understand about water conservation methods in domestic, agriculture I. List of Case Studies / Experiments Survey work on minimum two local en		Either	Every
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Field work report on Any village / City/ Town depicting status of environme 2. Books Recommended			
2. Books Recommended			
	tal Condi	ition.	
 Environmental Chemistry by A K De by NEW AGE Publishers Energy Conservation Guidebook by Dale R. Patrick, Stephen W. Fardo Fardo. CRC Press Elixir: A H story of Water and Humankind by<u>Brian Fagan</u>, Bloomsbury P Hazardous Waste Management by<u>Michael D. Lagrega</u>, Waveland PrInc 		Richardson,	Brian W

5 This Sacred Earth: Religion, Nature and Environmentby Roger S Gottlieb, Psychology Press

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2.Course Name	Agriculture an		L	Т		P
	Practical and resea	arch work				
3.Course Code	17090308		0	0	_	4
A.Type of Course (us		Core ()	DSE (🗸)	1	SEC ()	1 -
5.Pre-requisite	B.Sc.	6.Frequency	Even ()	Odd	Either	Every
(if any)		(use tick marks)		(✔)	Sem()	Sem (
	Lectures, Tutorials, P					
Lectures = Nil		Tutorials = Nil	Practi	cal = 60		
Course Description		understand the agricul				
		out the different types of analyze the basic physi				on on m
Course Objectives	s:		1			
The objectives of this	course are to:		S			
. To know the met	hodology for pesticide	estimation.				
	ct of different pollutant					
	erence in soil quality of	f different fields.				
4. To know the ioni	c exchange in the soil.					
10.Course Outcome	s (COs):					
Inon successful com	nietion of this course t	he student will be able to	D .			
: Students will be ab 2: Students will also electrical conductivity 3: Students will also	ble to determine the con be able to explain the r y.	the student will be able to accentration and type of p relation between soil particular double to be the soil of the solution of the student d use different methods	esticides in s rameters like	e cation ex	change cap	pacity and
: Students will be ab : Students will also dectrical conductivity : Students will also concentration in soil. 1.List of Experiment	ble to determine the con be able to explain the r y. able to understand and nts	centration and type of p relation between soil pa d use different methods	esticides in s rameters like and technic	e cation ex ques for a	change cap nalysis of 1	pacity an
 Students will be ab Students will also electrical conductivity Students will also concentration in soil. List of Experimentation of Am 	The to determine the con be able to explain the r y. able to understand and nts monical nitrogen and r	d use different methods	esticides in s rameters like and technic	e cation ex ques for a	change cap nalysis of 1	pacity an
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 Students will be ab Students will also Electrical conductivity Students will also concentration in soil. II.List of Experiment Estimation of An To study the effect To assess the var 	The to determine the con be able to explain the r y. able to understand and nts monical nitrogen and r cts of effluent on plant iation in soil pH and Ele	ncentration and type of p relation between soil pa d use different methods nitrate concentration in s growth. ectrical conductivity in t	esticides in s rameters like and technic oil and plant soils from di	cation ex ques for an samples.	change cap nalysis of 1	pacity an
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	rtment : Environmenta	al Science	_				
2. Course Name	Environmental Impact			L	Т		Р
	Assessment and Risk A	Analysis					
3. Course Code	17090401			4	0		0
4. Type of Course (us	,	Core (✓)		DSE ()		SEC ()	
5. Pre-requisite	B.Sc.	6. Freque	ency	Even	Odd ()	Either	Every
(if any)		(use	tick	(✓)		Sem ()	Sem
		marks				1.1	0
7. Total Number of L						emester)	
Lectures = 60		torials = Ni	1	Prace	tical = Nil		1.
8. Course Description							
EIA (Environmental							
environmental impacts							
EIA both environment							
treatment cost by makir		in project an	d proc	cesses be	fore imple	mentation	
9. Course Objectives							
The objectives of this c							
1. Describe basic proc							
2. Promote environme			•	nrough ic	dentificatio	n of alter	natives.
	A as per the requirement						
4. Explain various ana							
5. Aware about risks f		roject and th	eir cha	aracteriza	ation		10.0
10. Course Outcomes	(COs):						
Upon successful compl	etion of this course, the	e student will	be ab	le to			
1. Use their knowledg							
2. Avoid serious and i					opmental p	rojects.	
3. Identify key impact	-						ojects on
environment.		0 0		•			
4. Understand various	methods used for risk	assessment.					
5. Understand that how	w to prepare EIA report	t					
11. Unit wise detailed							
Unit-1 Number	of lectures = 15 In	troduction t	o EIA				
EIA: Environmental in	mpact assessment: Intr	roduction, ai	ims, o	bjectives	s, constrain	nts in ELA	A, goals.
principles and significa	-						-
EIA, Strategic Envir		· ·	-		-		
(MOEF)1994, 2006; 1			-				
importance.	1,	0	1 0	,			,
	of lectures = 15 M	ethods of In	nacts	Identifi	cation and	Mitigati	on
Impacts Identification r							and the second se
prediction, models of					•		
evaluation of environm	-		proach	n, mitiga	tion of im	pacts- ap	proaches
and methods in relation	to different developme	ent projects.					
Unit – 3 Number	of lectures = 15 En	vironmenta					

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Public participation in EIA, presentation and review process, methods and role of monitoring in EIA, Environmental auditing, Environmental Management Plan, Principles of Environmental Management System, ISO 22000:201 8, Risk analysis: definition; risk characterization and methods of risk assessment

Unit – 4 Number of lectures = 15 EIA-Guidelines and Case studies

Environmental Impacts of mining industry, nuclear and thermal power plant, textile industry, paper and pulp industry, EIA of a dam (one case study), Environmental clearance of buildings: MOEF guidelines

12. Brief Description of self learning / E-learning component

- 1. https://www.cbd.int/impact/whatis.shtml
- 2. <u>https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-impact-assessment</u>

13. Books Recommended

- 1. Environmental Impact Assessment: Theory and Practice byAnji Reddy Mareddy, Anil Shah, Naresh.
- 2. Environmental Impact Assessment John Glasson
- 3. Methods of Environmental Impact Assessment Morris & Therivel
- 4. Environmental Impact Assessment L.W. Canter
- 5. Chemical Principles of Environmental Pollution Alloway& Ayers
- 6. Industrial Environment Assessment and Strategy S.K. Aggarwal
- 7. Handbook of Environmental Assessment, (Vol.-I & II) Judith Petts

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2. Course	Name	Environmental		l Science ogy and	L		Т		Р
		Health							
3. Course		17090402			4		0		0
		se tick mark)		Core (✓)		DSE ()	0110	SEC ()	-
5. Pre-req (if any)		B.Sc.	-	6. Frequer (use marks)	tick (Even (✔)	Odd ()	Either Sem ()	Every Sem
7. Total N	umber of l	Lectures, Tutor	ials, Pra	actical (assur	ming 1	5 weeks	s of one se	emester)	
Lectures =				torials = Nil			cal = Nil		
8. Course	Descriptio	n:						1000	1
Foxicology	involves t	he study of adv	verse and	harmful eff	ects of	f chemio	cal substa	nces and	physica
agents on li	ving things	s and also on th	e enviror	nment. Pathv	vays o	f entry,	absorption	n, distribu	ition an
excretion of	f toxic subs	tances into the	body pla	y crucial role	e in tor	kicology	. Students	s will focu	us on th
application	of these con	ncepts to the und	derstandi	ing and preve	ention	of expos	sure to the	chemical	s.
9. Course									
		course are to:							
		h hazards associ			~				hem.
		e of biogeochen				-		ants.	
		nt toxic chemica							*
		ent heavy metals				•		1.	
		arces of pesticid	e pollutio	on in water a	nd the	r health	effects.		
10. Course		. ,			1.1				
Unon succe	ssful comp	lation of this cou	suga tha						
	-			student will		to			
1. Underst	and the car	cinogenic effect	of differ	ent pollutant	s.			~ ~	
 Underst Know a 	and the car bout natura	cinogenic effect al and anthropo	of differ	ent pollutant	s.		etry and	effect of	radiatio
 Underst Know a on the p 	and the car bout natura lant and an	cinogenic effect al and anthropo imal body.	of differ genic rac	ent pollutant dioactivity, ra	s. adiatio	n dosim			radiatio
 Underst Know a on the p Underst 	and the car bout natura lant and an and toxicity	cinogenic effect al and anthropogimal body. y mechanism of	of differ genic rac some co	ent pollutant dioactivity, ra mmon pestic	s. adiatio ides ar	n dosim nd their o			radiatio
 Underst Know a on the p Underst Explain 	and the car bout natura lant and an and toxicity the bio-tra	cinogenic effect al and anthropogimal body. y mechanism of nsformation and	of differ genic rac some co detoxifi	ent pollutant dioactivity, ra mmon pestic cation mecha	s. adiatio ides ar misms	n dosim Id their (radiatio
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 Underst Know a on the p Underst Explain Know a Know a Unit-1 	and the car bout natural lant and an and toxicity the bio-tra bout the ha se detailed Number	cinogenic effect al and anthropoy imal body. y mechanism of nsformation and rmful chemicals content of lectures = 1	of differ genic rac some co detoxifi and sub 5 Occ	ent pollutant dioactivity, ra mmon pestic cation mecha stances prese cupational F	s. adiatio ides ar anisms ent in v Iealth	n dosim nd their o vater. Hazard	derivative	S.	
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 Underst Know a on the p Underst Explain Know a Know a Unit-1 Toxicology Arsenic, C fluorosis, an Unit - 2 	and the car bout natural lant and an and toxicity the bio-tra bout the ha se detailed Number : Introducti Cobalt, Iron rsenic poisc	cinogenic effect al and anthropo imal body. y mechanism of nsformation and rmful chemicals content of lectures = 1 on, basic conce and pesticides oning.	of differ genic rac some co detoxifi and sub 5 Occ pts of to), Occup 5 Toy	rent pollutant dioactivity, ra mmon pestic cation mecha stances prese cupational H xicology, to pational heal xicants in Er	s. adiatio ides ar anisms ent in v Iealth kicant th haz	n dosim ad their o vater. Hazard hazards ards, ep ment	derivative s (Lead, M idemiolog	s. ercury, C gical issue	admiun es-goite
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 Underst Know a on the p Underst Explain Know a Know a Unit-1 Toxicology Arsenic, C fluorosis, an Unit - 2 Toxic cher cadmium, Unit - 3 	and the car bout natural lant and an and toxicity the bio-tra bout the ha se detailed Number : Introducti Cobalt, Iron resenic poisco Number nicals in th lead mercu Number	cinogenic effect al and anthropo- imal body. y mechanism of nsformation and rmful chemicals content of lectures = 1 on, basic conce and pesticides oning. of lectures = 1 e environment, p ry, carbon mono	of differ genic rac some cool detoxifi and sub 5 Occup 5 Occup 5 Toy pesticide oxide, oz 5 Toy	rent pollutant dioactivity, ra mmon pestic cation mecha stances prese cupational H xicology, top pational heal xicants in Er s in water an one and PAN xicants Rout	s. adiatio ides ar anisms ent in v lealth kicant i th haz d soil, l pestic e of E	n dosim ad their o vater. Hazards hazards, ep ment bio-che side. ntry and	derivative s (Lead, M idemiolog micals asp d Exposu	s. fercury, C gical issue pects of ar re	admiun es-goite senic,
 Underst Know a on the p Underst Explain Know a Know a 11. Unit wi Unit-1 Toxicology Arsenic, C fluorosis, ar Unit - 2 Toxic cher cadmium, Unit - 3 Mode of en 	and the car bout natural lant and an and toxicity the bio-tra bout the ha se detailed Number : Introducti Cobalt, Iron rsenic poisce Number nicals in th lead mercu Number try of toxic	cinogenic effect al and anthropo- imal body. y mechanism of nsformation and rmful chemicals content of lectures = 1 on, basic conce and pesticides oning. of lectures = 1 e environment, j ry, carbon mone of lectures = 1	of differ genic rac some co detoxifi and sub 5 Occ pts of to), Occup 5 Toy pesticide oxide, oz 5 Toy obiotics	rent pollutant dioactivity, ra mmon pestic cation mecha stances prese cupational Heat xicology, tox pational heat xicology, tox pational heat xicology, tox pational heat xicons in Er s in water an one and PAN xicants Rout (Absorption,	s. adjatio ides ar anisms ent in v lealth kicant th haz viron d soil, <u>ve of En</u> Transp	n dosim ad their o vater. Hazard hazards ards, ep ment bio-che cide. ntry and port and	derivative s (Lead, M idemiolog micals asp d Exposu Execution	s. fercury, C gical issue pects of ar re n of chem	admiun es-goite senic, icals),
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 Underst Know a on the p Underst Explain Know a Know a Unit -1 Toxicology Arsenic, C fluorosis, an Unit - 2 Toxic cher cadmium, Unit - 3 Mode of en Biomagnific 	and the car bout natural lant and an and toxicity the bio-tra bout the ha se detailed Number : Introducti Cobalt, Iron cobalt, Iron rsenic poisco Number nicals in th lead mercu try of toxic cation, Bio city, mecha	cinogenic effect al and anthropoy imal body. y mechanism of nsformation and rmful chemicals content of lectures = 1 on, basic conce and pesticides oning. of lectures = 1 e environment, p ry, carbon mono of lectures = 1 substance, Xene -monitoring of te	of differ genic rac some cool detoxifi and sub 5 Occ pts of to b), Occup 5 Toy pesticide oxide, oz 5 Toy obiotics (oxic cher genicity,	rent pollutant dioactivity, ra mmon pestic cation mecha stances prese cupational H xicology, to pational heal xicology, to pational heal xiconts in Er s in water an one and PAN xicants Rout (Absorption, micals, carcin	s. adiatio ides ar anisms ent in v lealth kicant i th haz viron d soil, le of E Transp tal car	n dosim ad their of vater. Hazards hazards ards, ep ment bio-che cide. ntry and port and in air w cinogeni	derivative s (Lead, M idemiolog micals asp d Exposu Execution vater and s icity testir	s. fercury, C gical issue pects of an re n of chem soil, chem	admiun es-goite senic, icals),
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	https://www.britannica.com/science/environmental-toxicology
2.	https://www.slideshare.net/gauravhtandon1/environmental-toxicology-32480341
8. Bo	oks Recommended
1.	Fundamental concepts of Environmental chemistry_ G S Sodhi
2.	Principals of Environmental Chemistry_ Manahan
3.	Environmental hazards & human health R.B. Philip
	Toxicology_ principles & applications - Niesink& Jon devries
	Parasitology - Chatterjee
	Preventive & Social medicines – Perk

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2.	Course Name	Environmental Econor	nics	1	L	Т		Р
3.	Course Code	17090403			4	0		0
	Type of Course (u	se tick mark)	Core ()		DSE ()	SEC ()	
5.	Pre-requisite (if any)	B.Sc.	6. Freque (use marks)	tick	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
	Total Number of	Lectures, Tutorials, Pr	actical (assu	ming	15 weeks	s of one s	emester)	
	ctures = 60		torials = Ni			cal = Nil	/	1
3.	Course Description	n:						
env and ool 9. Γho 1. 2. 3. 4.	vironmental protection l economical developmental icies and methods. Course Objective e objectives of this of Aware students about the Explain ecosystem Explain convention resources.	course are to: but the development pol relationship between ec stability with material b n, treaties and protoco o manage natural resour	icy. alance approvide for environmental series of the seri	onship on pr vth an oach. onme	d environ	environn of envir mental gra and pro	onmental deg onmental owth. tection of	gradation friendly
2. 3. 4. 5.	Understand the role Know about the rol Use analytical tech Understand concep	hship between economic e of policies in developr e of forest resources in niques for analysis of st ts of sustainable develo	nent and env economics. atistics on th	ironm e ecor	ental prot nomy.	ection.		
1.	Unit wise detailed	content						
_			ology, Envir					
Hin	er-Temporal Effic	systems; Material Balan					• •	
Inte Env and Un	Indicators; Environit – 2 Number	of Economic Growth, Li mental Kuznets' Curve of lectures = 15 Na nent (ES), ES of Govt. c	imits to Grov tural Resou	vth; S rce ai	ustainable nd Econo	Develop	oment — (Concepts
Inte Env and Un Er au de va Tr Un	Indicators; Environit - 2Numbernvironmental Statendit, Guidelines andwelopment and envlue of India's foresading, E cological Fit - 3Number	of Economic Growth, Li mental Kuznets' Curve of lectures = 15 Na nent (ES), ES of Govt. co methodology. Natural r ironmental impact, Irrig t stock and economics of oot Print, carbon seques	imits to Grov of India and i esource acco ation project f forest prod stration. otocols and	vth; S rce and ts con- bunting s and ucts in Treat	ustainable nd Econo tents, Intro g for India Environm i India.Ca ies	e Develop my oduction in condition ental cost rbon Crec	to Environ on; Econo ting:, Econo ting:, Econo ting:, Econo ting: Carb	Concepts imental mic iomic ion

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International convention on the high seas fishing and living resources (1958) and intervention of oil pol lution casualties (1969). United Nations Convention to Combat Desertification (1994).

Unit – 4 Number of lectures = 15 Role of Natural Resources in GDP

Economics of Resource Management Theories of Optional Use of non-renewable and renewable Resources Integrated Environmental and Economic Accounting and the Measurement, Environmentally Corrected GDP, Comprehensive Wealth and Genuine savings; Global Environmental Governance

12. BriefDescription of self learning / E-learning component

- 1. https://www.investopedia.com/terms/e/environmen taleconomics.asp
- 2 https://www.slideshare.net/mccracken/environmental-economics-4790490

13. Books Recommended

- 1. Fisher, A.C. (1981); Resource and Environmental Economics, CUP, Cambridge
- 2. Hanley, Shogren and White (1997): Environmental Economics in Theory and Practice, Macmillan.
- 3. Pearce, D.W. and R. Turner (1991): Economics of Natural Resource Use and Environment, John Hopkins Press, Baltimore.
- 4. Tietenberg, T. (1994): Environmental Economics and Policy, Harper Collins, NY.

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1. Name of the Depa	rtment : Environmenta	al Science					
2. Course Name	Environmental Legisla	tions and		L	Т		Р
	Awareness						
3. Course Code	17090404			4	0		0
4. Type of Course (u	se tick mark)	Core ()		DSE () 	SEC 0	
5. Pre-requisite	B.Sc.	6. Freque	ency	Even	Odd ()	Either	Every
(if any)		(use	tick	(✓)		Sem ()	Sem
		marks)				0
7. Total Number of	Lectures, Tutorials, Pr			15 wee	ks of one se	emester	
Lectures = 60	Tu	torials = Ni	1	Prac	tical = Nil		
8. Course Description	on:						
This course will addr	ess the constitutions ro	le and resp	onsibil	ities of	individual,	state an	nd central
	he environment and sus						
	l of environmental legis						
9. Course Objective							1000
The objectives of this of							
	ws for environmental pro	otection					
	out the scheme of Label		onmen	t-friend	ly products		
	otocol and conventions						
	role of media and NGC				ion.		
and the second s	nd plans for cleaning of			-			
10. Course Outcomes							
	letion of this course, the	etudent will	heah	le to			
	Labels on different inst						
	surance for the purpose		imme	diate re	lief to the n	ersons a	ffected by
	while handling any haz			ulate le	ner to the p	cisons a	needed by
-	of individuals for protect			nt			
	ols and treaties for solut				ntal n rohler	ns	
	ulations for the explorat					110.	
11. Unit wise detailed		ion and abe	or oute	a space.			
		beling of pr	aduat	andL	aws		
	Introduction to inte	ernational e	nviror	mental	law (Sto	ckholm	to Rio)
	nal laws (Constitution				-		
	products (Ecomark),						
	garding environment (a				• not. 15	, 110	vision or
Unit – 2 Number	r of lectures = 15 Er	vironments	l Con	vention	s and Prot	ncols	
	nent, The Stockholm De						ection of
	convention on wetland						
Protocol, Kyoto Protoc		is, outer sp		outj, vi	enna conve		
	of lectures = 15 Pr	evention an	d Con	trol of]	Pollution L	aws	
	gh legislation; with spe						ntrol of
	e Air (Prevention and C						
Protection Act, 1986, I		onn or or r o),>			
Alter	1	June 1		Derd	10119	29	<u>ب</u> ر .

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Unit – 4	Number of lectures = 15 Environmental Awareness
Ganga Actic	on Plan (1986 and 2014), Yamuna Action Plan, Latest Plantation and Tree migration
Technologie	s. Role of media in environmental awareness, role of NGOs in environmental
movements,	Chipko movement, Appiko movement. Case studies to be taken up: M.C. Mehta vs
Union of Ind	ia; Ganga pol lution case of Tanneries, M.C. Ganga pollution (Municipal ities)
12. BriefDe	scription of self-learning /E-learning component
1 1	

1. https://www.slideshare.net/monaverma1/indian-environmental-legislation

2. https://www.slideshare.net/monaverma1/international-environmental-legislation

13. Books Recommended

- 1. Environmental Law in India- P. Leelakrishnan
- 2. Environmental Law Paperback -NishthaJaswal and P.S.Jaswal
- 3. Environmental Planning, Policies & Programmes in India K.D. Saxena
- 4. Land Use and Environment S.M. Mujtava
- 5. Environmental Administration and Law- Paras Diwan.

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	Course Name	Environmental	Toxicology and	L	Т		Р
		Health- Lab					
; <u> </u>	Course Code	17090406		0	0		4
١.	Type of Course (u	se tick mark)	Core (✓)	DSE ()		SEC 0	
	Pre-requisite	B.Sc.	6. Frequency	Even	Odd ()	Either	Every
	(if any)		(use tick marks)	(✔)		Sem ()	Sem (
	Total Number of L	ectures, Tutorials	, Practical.				
Je	ctures = Nil		Tutorials = Nil	Practi	ical = 60		
	Course Description					6	
°0	xicology involves	the study of adve	erse and harmful effect	s of chemi	ical substa	nces and	physica
g	ents on living thing	gs and also on the	e environment. Pathway	s of entry,	absorption	n, distribu	ition an
X	cretion of toxic sub	stances into the be	ody play crucial role in	toxicology			
2	Course Objective						
Th	e objectives of this						
	•		ted with different occup	ations and	the causes	behind th	nem.
2.			nical factors in transfer a				
3.		ent toxic chemica	ls on the basis of their c	hemical na	ture.		
_			ls on the basis of their c	hemical na	ture.		
0	Identify the differ . Course Outcomes	(COs):			ture.		
10 Up	Identify the differ . Course Outcomes oon successful com	(COs): pletion of this cou	urse, the student will be		ture.		
10 Up	Identify the differ . Course Outcomes oon successful com	(COs): pletion of this cou			ture.		
10 Up	Identify the differ Course Outcomes oon successful com Understand the ca	(COs): pletion of this cou arcinogenic effect	urse, the student will be a of different pollutants.	able to		effect of	radiatio
10 Up	Identify the differ Course Outcomes oon successful com Understand the ca Know about natu	(COs): pletion of this cou arcinogenic effect ral and anthropog	urse, the student will be	able to		effect of	radiatio
10 Up	Identify the differ Course Outcomes oon successful com Understand the ca	(COs): pletion of this cou arcinogenic effect ral and anthropog	urse, the student will be a of different pollutants.	able to		effect of	radiatio
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10 Up 1. 2. 11 1. 2.	Identify the differ Course Outcomes oon successful com Understand the ca Know about natu on the plant and a List of Case Studie Case studies of Case Study of Lethal door	(COs): pletion of this cou arcinogenic effect ral and anthropog nimal body. es / Experiments neer in Punjab se LD-50, LD-10	rse, the student will be a of different pollutants. genic radioactivity, rad	able to		effect of	radiatio
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and research work 0 0 4 3. Course Code 17090407 0 0 4 4. Type of Course (use tick mark) Core () DSE (<) SEC () 5. Pre-requisite B.Sc. 6. Frequency Even Odd () Either Every (if any) (if any) Tutorials, Practical. Even Odd () Sem () Sem () 2. Total Number of Lectures, Tutorials, Practical. Even Odd () Either Every 6. Course Description: Tutorials = Nil Practical = 60 Sem () Sem () 3. Course Description: Environmental economics familiarize students with the application of economics to environmenta problems and prepare them for analyzing issues in environmental development and policy for environmental protection. 3. Course Objectives: The objectives of this course are to: 1. Aware students about the development policy. 2. Describe about the relationship between economic growth and environmental growth. 3. Explain convention, treaties and protocols for environmental audit and protection of natura resources. 10. Course Outcomes (COS): Upon successful completion of this course, the student will be able to 1. Understand relationship between economic growth and environmental growth.	2. Course Name	Environmental Econo	omics- Practical	L	Т		Р	
Corre () DSE (*) SEC () 6. Pre-requisite B.Sc. 6. Frequency (use tick marks) Even Odd () Either Every Sem () Sem () 7. Total Number of Lectures, Tutorials, Practical. Intorials = Nil Practical = 60 Sem () Sem () Sem () 8. Course Description: Tutorials = Nil Practical = 60 Sem () Sem () Sem () 9. Course Objectives: Environmental economics familiarize students with the application of economics to environmental protection. Sector		and research work						
 5. Pre-requisite B.Sc. 6. Frequency (use tick marks) 7. Total Number of Lectures, Tutorials, Practical. Lectures = Nil 7. Total Number of Lectures, Tutorials, Practical. Lectures = Nil 8. Course Description: Environmental economics familiarize students with the application of economics to environmenta protection. 9. Course Objectives: 1. Aware students about the development policy. 2. Describe about the relationship between economic growth and environmental growth. 3. Explain ecosystem stability with material balance approach. 4. Explain convention, treaties and protocols for environmental audit and protection of natura resources. 10. Course Outcomes (COs): 11. Understand relationship between economic growth and environmental growth. 2. Understand the role of policies in development and environmental growth. 	8. Course Code	17090407		0	0		4	
(if any) (use tick marks) (✓) Sem () Sem () Sem () Sem () 2. Total Number of Lectures, Tutorials, Practical.	. Type of Course (us	e tick mark)	Core ()	e () DSE (🗸) SEC ()				
 Total Number of Lectures, Tutorials, Practical. Lectures = Nil Tutorials = Nil Practical = 60 Course Description: Environmental economics familiarize students with the application of economics to environmenta problems and prepare them for analyzing issues in environmental development and policy for environmental protection. Course Objectives: Che objectives of this course are to: Aware students about the development policy. Describe about the relationship between economic growth and environmental growth. Explain ecosystem stability with material balance approach. Explain convention, treaties and protocols for environmental audit and protection of natura resources. Don successful completion of this course, the student will be able to Understand relationship between economic growth and environmental growth. 	5. Pre-requisite	B.Sc.	6. Frequency	Even	Odd ()	Either	Every	
Lectures = Nil Tutorials = Nil Practical = 60 R. Course Description: Environmental economics familiarize students with the application of economics to environmental problems and prepare them for analyzing issues in environmental development and policy for environmental protection. P. Course Objectives: Environmental protection. Che objectives of this course are to: 1. Aware students about the development policy. 2. Describe about the relationship between economic growth and environmental growth. 3. Explain ecosystem stability with material balance approach. 4. Explain convention, treaties and protocols for environmental audit and protection of natura resources. ID course Outcomes (COs): Upon successful completion of this course, the student will be able to . Understand relationship between economic growth and environmental growth. 2. Understand the role of policies in development and environmental growth.	(if any)		(use tick marks)) (1)		Sem ()	Sem (
 Course Description: Environmental economics familiarize students with the application of economics to environmental problems and prepare them for analyzing issues in environmental development and policy for environmental protection. Course Objectives: Che objectives of this course are to: Aware students about the development policy. Describe about the relationship between economic growth and environmental growth. Explain ecosystem stability with material balance approach. Explain convention, treaties and protocols for environmental audit and protection of natura resources. Doessful completion of this course, the student will be able to Understand relationship between economic growth and environmental growth. 						1.1		
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 broblems and prepare them for analyzing issues in environmental development and policy for environmental protection. Course Objectives: Course Objectives: The objectives of this course are to: Aware students about the development policy. Describe about the relationship between economic growth and environmental growth. Explain ecosystem stability with material balance approach. Explain convention, treaties and protocols for environmental audit and protection of natura resources. 10. Course Outcomes (COs): Upon successful completion of this course, the student will be able to Understand relationship between economic growth and environmental growth. 								
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	10. Course Outcomes Upon successful comp 1. Understand relation 2. Understand the ro	(COs): oletion of this course, to onship between econor	the student will be mic growth and envo opment and enviror	able to vironmental	growth.		i natura	
1. List of Case Studies / Experiments	 Course Outcomes Upon successful comp Understand relation Understand the rol Know about the rol Know about the rol 	(COs): bletion of this course, to onship between econor le of policies in develo ble of forest resources to / Experiments	the student will be mic growth and envo opment and enviror	able to vironmental	growth.		i natura	
. Estimation of Carbon foot print.	 Course Outcomes Upon successful comp Understand relation Understand the rol Know about the rol Know about the rol Estimation of Carbon 	(COs): pletion of this course, to possip between econor le of policies in develo pole of forest resources to / Experiments pon foot print.	the student will be mic growth and enviror opment and enviror in economics.	able to vironmental mental pro	growth.			
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 Estimation of Carbon foot print. Report on carbon credit and carbon trading of any two industries. Estimation of Cost Benefit analysis. 	 Course Outcomes Upon successful comp Understand relation Understand the rol Know about the rol Know about the rol Estimation of Carbon cr Report on carbon cr Estimation of Cost 	(COs): bletion of this course, to onship between econor le of policies in develo ble of forest resources on foot print. redit and carbon tradin Benefit analysis.	the student will be mic growth and enviror opment and enviror in economics.	able to vironmental mental pro	growth.			
 Estimation of Carbon foot print. Report on carbon credit and carbon trading of any two industries. Estimation of Cost Benefit analysis. Life cycle estimating of any product. 	 Course Outcomes Upon successful compl. Understand relation Understand the role Know about the role Know about the role Estimation of Case Studie Estimation of Cost Estimation of Cost Life cycle estimating 	(COs): pletion of this course, is possip between econor le of policies in develo pole of forest resources as / Experiments on foot print. redit and carbon tradir Benefit analysis. In g of any product.	the student will be mic growth and enviror opment and enviror in economics.	able to vironmental mental pro	growth.			
 Estimation of Carbon foot print. Report on carbon credit and carbon trading of any two industries. Estimation of Cost Benefit analysis. Life cycle estimating of any product. Concept of Demand and Supply. 	 Course Outcomes Upon successful comp Understand relation Understand the rol Know about the rol Know about the rol Estimation of Carbon content Estimation of Cost Life cycle estimation Concept of Demand 	(COs): pletion of this course, to possible between econor le of policies in develo ple of forest resources tes / Experiments pen foot print. redit and carbon tradin Benefit analysis. Ig of any product. 1 and Supply.	the student will be mic growth and enviror opment and enviror in economics.	able to vironmental mental pro	growth.			
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- . and K. Turner (1991): Economics of Natural Resour John Hopkins Press, Baltimore. 4. Tietenberg, T. (1994): Environmental Economics and Policy, Harper Collins, NY.

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	Name of the Depart				-			
2.	Course Name	Environmental I			L	Т		P
		Awareness-Practi	cal and research					
		work			2			
-	Course Code	17090408	1		0	0		4
_	Type of Course (us		Core ()		DSE (SEC ₀	
5.	Pre-requisite	B.Sc.	6. Frequency		Even	Odd ()	Either	Every
-	(if any)		(use tick ma	rks)	(✔)		Sem ()	Sem
	Total Number of L	ectures, Tutorials, P						
	ctures = Nil		Tutorials = Nil		Practi	ical = 60		
	Course Description		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				-4-4	1
	is course will addr							
	vernment towards the					course wi	ll also fai	miliariz
stu	dents with vast field	l of environmental	legislations and po	licies				
9.	Course Objectives				1			
Th	e objectives of this	course are to:						
1.	Explain various lav	ws for environmenta	al protection.					
2.	Aware students abo			nment	t-friendly	y products		
3.	Explain treaties, pr		-					
4.		role of media and				on.		
					•			
10.	. Course Outcomes (COs):			*			
Un	on successful comp	letion of this course	e, the student will	be abl	e to			
	Understand role of							
	Know about the in			immea	diate reli	ef to the p	ersons aff	fected h
2.		while handling any				or to the p	croone an	
3	Understand duties				t			
_			rotection of chivit	Jinnen				
	List of Case Studies							
	Case studies to be ta			ia				
	Case studies of Gan	• •	36and2014).					
3.	Case studies of Yam	una Action Plan.						
4.	Narmada Bachao Ai	ndolan: Case study						
5.	Tehri Dam: Case stu	ldy						
	Books Recommend							
1.	Environmental Lav	v in India- P. Leela	krishnan					
2.		v Paperback – Nisht		Jasu	val			
2. 3.		nning, Policies & P				na		
					.D. Bare	ina		
4.	Land – Use and En Environmental Adu							
5.	Environmental Ad	ministration and La	w- Paras Diwan.					

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SHREE GURUGOBIND SINGH TRICENTENARY UNIVERSITY FACULTY OF SCIENCE DEPARTMENT OF ENVIRONMENTAL SCIENCE Ph.D. ENVIRONMENTAL SCIENCECOURSE WORK W.e.f the academic session Aug 2019

Techniques in Environmental Science

Time: 3 hrs.Max. Marks: 100

Formative Assessment : 20 Summative Assessment : 80

Note: Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Question number 01 will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 02 questions from each unit and the candidates will be required to attempt one question from each unit. All questions will carry equal marks.

UNIT-I

ENVIRONMENTAL BIO-TECHNOLOGY

Introduction, scope and importance of biotechnology, Applications, Genetic engineering, techniques – Electrophoresis, Isolation and purification of DNA, PCR, Biosensors, Bioremediation, Fermentation.

UNIT-II

SOLID WASTE TREATMENT

Treatment processes, Aerobic and anaerobic treatment methods – Role of microbes, methanogens, acetogens, fermentative bacteria, biofilms, and Waste management: Solid waste composting and vermicomposting, Xenobiotic compounds, Biodegradation.

UNIT-III

REMOTE SENSING

Remote sensing, EMR interaction with earth surface materials, Spectral signatures of vegetation, water bodies, ground truth data collection, operational remote sensing satellites. Remote Sensing Applications.

UNIT-IV

ANALYTICAL TECHNIQUES

Spectrophotometer, Flame photometer, Atomic Absorption Spectrophotometer, High pressure Liquid Chromatography, Gas Chromatography, XRD, SEM (Scanning Electron Microscope), TEM(Transmission Electron Microscope).

Reference Books:

- 1. Bruce Rittman, Perry L. McCarty (2000) Environmental Biotechnology: Principles and Applications, 2nd Edition, McGraw-Hill.
- 2. Joseph, George. 2005. Fundamentals of Remote Sensing, 2nd Edition. University Press India.
- 3. Lillisand, Thomas, Ralph W. Kiefer and Jonathan Chipman. 2007. Remote Sensing and Image Interpretation. Wiley India.

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ENVIRONMENTAL HISTORY & CONTEMPORARY POLICIES

Unit-1

Ancient History

A concise history, from ancient to modern times, of the interactions between human societies in relationship to ecosystems. Present day environmental dilemmas, conflicts and choices that have their roots in the past.

Unit-2

Environmental History-I

Introduction to the ideology of environmentalism and environmental history, Modern environmental movements. The Gaia theory.

History of the development of environmental history as a discipline and its relationship with social and economic history. Methods and Sources of Environmental History: Distributions from other types of history.

Unit-3

Environmental History-II

Environmental History as Natural History: In the developed and developing nations. Ideas of wilderness and conservation. Environmental History as a History of Industrialization and Anti-Industrialization: debates on the nature of modernization and industrialization in developed and developing countries. Issues of its links with history of science and technology.

Unit-4

Contemporary Ideas

The Rise of European power and its consequences not only for peoples, but also for plants and pathogens, animals and landscapes.

Nature and Empire: Debate on 'colonialism as a watershed'. Colonialism and the unleashing of destructive forces and the threat of general environmental decline.

Books Recommended:

- 1. Arnold, David &Guha, Ramachandra (Ed.), 1995, Nature, Culture, Imperialism: Essays on the Environmental History of South Asia, Oxford University Press, Delhi.
- 2. BaviskarAmita, 2003, 'Tribal Discourse and Indian environmentalism in Greenough, Paul and Anna.
- 3. LowenhapeptTsing (Ed.), Nature in the Global South: Environmental Projects in South and SouthernAsia, Durham and, London: Duke University Press/Orient Longman.
- 4. Balee William, 1998, Advances in Historical Ecology, Columbia University Press, New York.
- 5. Beinart William and Coates Peter, 1995, Environment and History, London: Routledge. Carson, Rachel, 1962, Silent spring. Houghton Miflin, Boston.

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ENVIRONMENTAL TOXICITY AND HUMAN HEALTH

Unit-1

Occupational Health Hazards

Occupational health hazards, biogeochemical factors in environmental health. epidemiological issues-goiter, fluorosis, arsenic poisoning.

Unit-2

Toxic chemicals

Toxic chemicals in the environment, pesticides in water, bio-chemicals aspects of arsenic, cadmium, lead mercury, carbon monoxide, ozone and PAN pesticide.

Unit-3

Biotransformation

Mode of entry of toxic substance, biotransformation of xenobiotics detoxification, carcinogens in air, chemical carcinogenicity, mechanism of carcinogenicity, environmental carcinogenicity testing.

Unit-4

Insecticides & Dose

Insecticides, MIC effects, pesticide dose, effect and toxicity relationship, environmental radioactivity, radiation dosimetry.

Books Recommended:

- 1. Fundamental concepts of Environmental chemistry G.S Sodhi
- 2. Principals of Environmental Chemistry Manahan
- 3. Environmental hazards & human health R.B. Philip
- 4. Toxicology principles & applications Niesink& Jon devries
- 5. Parasitology Chatterjee Preventive & Social medicines Perk

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INSTRUMENTATIONS AND ANALYTICS

Unit-1

Spectrophotometry

Principles and application of Spectrophotometry (UV-Visible spectrophotometry), Titrimetry, Gravimetry, Colourimetry.

Unit-2

Microscopy

NMR, ESR, Microscopy-phase, light and fluorescence microscopes, Scanning and Transmission electron microscopes.

Unit-3

Chromatography

Chromatographic techniques (Paper chromatography, thin layer chromatography, ion exchange chromatography, Column chromatography), Atomic absorption spectrophotometry, Hydrodynamics methods, Plasma emission spectorocopy.

Unit-4

Other methods use in analytical techniques

Electrophoresis, solid and liquid scintillation, X-ray florescence, X-ray diffraction. Flame photomtery, Gas-liquid chromatography, High pressure liquid chromatography - auto radiography, Ultracentrifugation.

Books Recommended:

1. Undergraduates Instrumental Analysis- James W. Robinson

2. Modern methods of Chemical analysis- Robert, Shields, Cairns, William.

3. Fundamentals of Analytical Chemistry 8th Edition- Skoog, West, Holler and Crouch, Cengage Learning India.

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