GANDHI INSTITUTE OF TECHNOLOGY AND MANAGEMENT (GITAM)
(Deemed to be University, Estd. u/s 3 of UGC Act 1956)
VISAKHAPATNAM ∗HYDERABAD ∗BENGALURU
Accredited by NAAC with 'A^{+}' Grade

REGULATIONS AND SYLLABUS

of

BACHELOR OF ENVIRONMENTAL MANAGEMENT

(W.e.f 2019-20 Admitted batch)

Website: www.gitam.edu

Bachelor of Environmental Management (B E M)

REGULATIONS
(W.e.f. 2019-20 admitted batch)

1. ADMISSION

1.1 Admission into Bachelor of Environmental Management program of GITAM University is governed by GITAM University admission regulations.

2. ELIGIBILITY CRITERIA

2.1. A pass in 10+2 or equivalent examination with a minimum aggregate of 50%.

2.2. Admission into Bachelor of Environmental Management (BEM) program will be based on an All India GITAM Science Admission Test (GSAT) conducted by GITAM University and the rule of reservation, wherever applicable.

3. CHOICE BASED CREDIT SYSTEM

Choice Based Credit System (CBCS) is introduced with effect from the admitted Batch of 2015-16 based on UGC guidelines in order to promote:

- Student Centered Learning
- Cafeteria approach
- Inter-disciplinary learning

Learning goals/ objectives and outcomes are specified leading to what a student should be able to do at the end of the program.

4. STRUCTURE OF THE PROGRAM

4.1 The Program Consists of

i) Foundation Courses (compulsory) which give general exposure to a Student in communication and subject related area.

ii) Core Courses (compulsory).

iii) Discipline centric electives which
   a) are supportive to the discipline
   b) give expanded scope of the subject
   c) give their disciplinary exposure
   d) nurture the student skills

iv) Open electives are of general nature either related or unrelated to the discipline.

v) Practical Proficiency Courses, Laboratory and Project work.

4.2 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

4.3 In general, credits are assigned to the courses based on the following contact hours per week per semester.

- One credit for each Lecture / Tutorial hour per week.

- One credit for two hours of Practical per week.
- Eight credits for project.

4.4 The curriculum of the Six semesters Bachelor of Environmental Management program is designed to have a total of 131 credits for the award of Bachelor of Environmental Management degree.

5 MEDIUM OF INSTRUCTION

The medium of instruction (including examinations and project reports) shall be in English.

6 REGISTRATION

Every student has to register himself / herself for each semester individually at the time specified by the Institute / University.

7. ATTENDANCE REQUIREMENTS

7.1. A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend that end - semester examination and he/she will not be allowed to register for subsequent semester of study. He/she has to repeat the semester along with his / her juniors.

7.2. However, the Vice Chancellor on the recommendation of the Principal / Director of the Institute/School may condone the shortage of attendance to the students whose attendance is between 66% and 74% on genuine grounds and on payment of prescribed fee.

8. EVALUATION

8.1 The assessment of the student's performance in a Theory course shall be based on two components: Continuous Evaluation (40 marks) and Semester-end examination (60 marks).

8.2 A student has to secure an aggregate of 40% in the course in continuous and semester end examinations the two components put together to be declared to have passed the course, subject to the condition that the candidate must have secured a minimum of 24 marks (i.e. 40%) in the theory component at the semester-end examination.

8.3 Practical/ Viva voce etc. course are completely assessed under Continuous Evaluation for a maximum of 100 marks and a student has to obtain a minimum of 40% to secure Pass Grade. Details of Assessment Procedure are furnished below in Table 1.

Table 1: Assessment Procedure

S. No.	Component of assessment	Marks allotted	Type of Assessment	Scheme of Examination
1	Theory	40	Continuous evaluation	(i) Three mid semester examinations shall be conducted for 15 marks each. The performance in best two shall be taken into consideration. (ii) 5 marks are allocated for quiz. (iii) 5 marks are allocated for assignments.
		60	Semester-end examination	The semester-end examination shall be for a maximum of 60 marks.
	Total	100		
2	Practicals	100	Continuous evaluation	60 marks for performance, regularity, record/ and case study. Weightage for each component shall be announced at the beginning of the semester. 40 marks (30 marks for experiment(s) and 10 marks for practical Viva-voce.) for the test conducted at the end of the Semester conducted by the concerned lab Teacher.
	Total	100		
3	Project work	200	Project evaluation	150 marks for evaluation of the project work dissertation submitted by the candidate. 50 marks are allocated for the project Viva-Voce. The project work evaluation and the Viva-Voce shall be conducted by one external examiner outside the University and the internal examiner appointed by the Head of the Department.

9. RETOTALING & REVALUATION

9.1 Retotaling of the theory answer script of the semester-end examination is permitted on request by the student by paying the prescribed fee within one week after the announcement of the results.

9.2 Revaluation of the theory answer scripts of the semester-end examination is permitted on request by the student by paying the prescribed fee within one week after the announcement of the result.

10. PROVISION FOR ANSWER BOOK VERIFICATION & CHALLENGE EVALUATION:

10.1 If a student is not satisfied with his/her grade after revaluation, the student can apply for, answer book verification on payment of prescribed fee for each course within one week after

announcement of revaluation results.

10.2 After verification, if a student is not satisfied with revaluation marks/grade awarded, he/she can apply for challenge valuation within one week after announcement of answer book verification result/ two weeks after the announcement of revaluation results, which will be valued by the two examiners i.e., one Internal and one External examiner in the presence of the student on payment of prescribed fee. The challenge valuation fee will be returned, if the student is succeeded in the appeal with a change for a better grade.

11. SUPPLEMENTARY EXAMINATIONS & SPECIAL EXAMINATIONS:

11.1 The odd semester supplementary examinations will be conducted on daily basis after conducting regular even semester examinations in April/May.

11.2 The even semester supplementary examinations will be conducted on daily basis after conducting regular odd semester examinations during November/December

11.3 A student who has completed his/her period of study and still has "F" grade in final semester courses is eligible to appear for Special Examination normally held during summer vacation.

12. PROMOTION TO THE NEXT YEAR OF STUDY

12.1 A student shall be promoted to the next academic year only if he/she completes the academic requirements of 60% of the credits till the previous academic year.

12.2 Whenever there is a change in syllabus or curriculum he/she has to continue the course with new regulations after detention as per the equivalency established by the BoS to continue his/her further studies.

13. BETTERMENT OF GRADES

13.1 A student who has secured only a pass or second class and desires to improve his/her class can appear for betterment examinations only in 'n' (where 'n' is no.of semesters of the program) theory courses of any semester of his/her choice, conducted in summer vacation along with the Special Examinations.

13.2 Betterment of Grades is permitted 'only once', immediately after completion of the program of study.

14. REPEAT CONTINUOUS EVALUATION:

14.1 A student who has secured 'F' grade in a theory course shall have to reappear at the subsequent examination held in that course. A student who has secured 'F' grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.

14.2 A student who has secured 'F' grade in a practical course shall have to attend Special Instruction classes held during summer.

14.3 A student who has secured 'F' grade in a combined (theory and practical) course shall have to reappear for theory component at the subsequent examination held in that course. A student who has secured 'F' grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.

14.4 The RCE will be conducted during summer vacation for both odd and even semester students. Student can register a maximum of 4 courses. Biometric attendance of these RCE classes has to be maintained. The maximum marks in RCE be limited to 50% of Continuous

Evaluation marks. The RCE marks are considered for the examination held after RCE except for final semester students.

14.5 RCE for the students who completed course work can be conducted during the academic semester. The student can register a maximum of 4 courses at a time in slot of 4 weeks. Additional 4 courses can be registered in the next slot.

14.6 A student is allowed to Special Instruction Classes (RCE) 'only once' per course.

15. GRADING SYSTEM

15.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given sin Table 2.

Table 2: Grades & Grade Points

Sl.No.	Grade	Grade Points	Absolute Marks
1	O (outstanding)	10	90 and above
2	A+ (Excellent)	9	80 to 89
3	A (Very Good)	8	70 to 79
4	B+ (Good)	7	60 to 69
5	B (Above Average)	6	50 to 59
6	C (Average)	5	45 to 49
7	P (Pass)	4	40 to 44
8	F (Fail)	0	Less than 40
9	Ab. (Absent)	0	-

15.2 A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, subject to securing an average GPA (average of all GPAs in all the semesters) of 5 at the end of the Program to declare pass in the program.

Candidates who could not secure an average GPA of 5 at the end of the program shall be permitted to reappear for a course(s) of their choice to secure the same.

16. GRADE POINT AVERAGE

16.1 A Grade Point Average (GPA) for the semester will be calculated according to the formula:

$$GPA = \frac{\Sigma [C * G]}{\Sigma C}$$

Where

C = number of credits for the course,

G = grade points obtained by the student in the course.

16.2 To arrive at Cumulative Grade Point Average (CGPA), a similar formula is used considering the student's performance in all the courses taken, in all the semesters up to the particular point of time.

16.3 CGPA required for classification of class after the successful completion of the program is shown in Table 3.

Table 3: CGPA required for award of Class

Class	CGPA Required
First Class with Distinction	≥ 8.0*
First Class	≥ 6.5
Second Class	≥ 5.5
Pass Class	≥ 5.0

* In addition to the required CGPA of 8.0 or more the student must have necessarily passed all the courses of every semester in first attempt.

17. ELIGIBILITY FOR AWARD OF THE BACHELOR OF ENVIRONMENTAL MANAGEMENT DEGREE

17.1 Duration of the program: A student is ordinarily expected to complete Bachelor of Environmental Management program in six semesters of two years. However a student may complete the program in not more than four years including study period.

17.1 However the above regulation may be relaxed by the Vice Chancellor in individual cases for cogent and sufficient reasons.

17.2 A student shall be eligible for award of the Bachelor of Environmental Management Degree if he / she fulfills all the following conditions.

a) Registered and successfully completed all the courses and projects.
b) Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated time.
c) Has no dues to the Institute, hostels, Libraries, NCC / NSS etc, and
d) No disciplinary action is pending against him / her.

17.3 The degree shall be awarded after approval by the Academic Council.

18. DISCRETIONARY POWER:

Not with standing anything contained in the above sections, the Vice Chancellor may review all exceptional cases, and give his decision, which will be final and binding.

Bachelor of Environmental Management (B.E.M.)
Scheme of Instruction
I SEMESTER

Sl. No.	Course Code	Name of the Course	Category	Credits	Scheme of Instruction		Total	Scheme of Examination		
					Hours per Week			Duration in Hrs.	Maximum Marks	
					L/T	P			Sem. End Exam	Con. Eval
1	SFC 105	Soft Skills	AEC	2	3	0	3	3	--	100
2	SEM 103	Understanding Environment	PC	4	4	0	4	3	60	40
3	SEM 105	Environmental Chemistry	PC	4	4	0	4	3	60	40
4	SEM 107	Mathematics - I	PC	4	4	0	4	3	60	40
PRACTICALS :										
1	SEM 121	Understanding Environment Lab	PP	2	0	3	3	3	--	100
2	SEM 123	Environmental Chemistry Lab	PP	2	0	3	3	3	--	100
3	SEM 125	Mathematics Lab	PP	2	0	3	3	3	--	100
			Total	20	15	09	24	--	180	520

B.E.M. – II SEMESTER

Sl. No.	Course Code	Name of the Course	Category	Credits	Scheme of Instruction		Total	Scheme of Examination		
					Hours per Week			Duration in Hrs.	Maximum Marks	
					L/T	P			Sem. End Exam	Con. Eval
1	SFC 104	Communicative English	AEC	3	4	0	3	3	60	40
2	SEM 102	Elements of Ecology	PC	4	4	0	4	3	60	40
3	SEM 104	Environmental Pollution	PC	4	4	0	4	3	60	40
4	SEM 106	Mathematics – II	PC	4	4	0	4	3	60	40
PRACTICALS :										
1	SEM 122	Elements of Ecology Lab	PP	2	0	3	3	3	--	100
2	SEM 124	Environmental Pollution Lab	PP	2	0	3	3	3	--	100
3	SEM 126	Environmental Diary	PP	2	0	3	3	3	--	100
Choose any one										
1	SSE 172	Fundamentals in Computers	SEC	2	2	0	2	2	--	100
2	SSE 174	Human Wildlife Conflict and Management	SEC							
3	SSE 176	Integrated Organic Farming	SEC							
			Total	23	18	09	26	23	240	560

B.E.M. – III SEMESTER

Sl. No.	Course Code	Name of the Course	Category	Credits	Scheme of Instruction		Total	Scheme of Examination		
					Hours per Week			Duration in Hrs.	Maximum Marks	
					L/T	P			Sem. End Exam	Con. Eval
1	SEM 201	Energy and Environment	PC	4	4	0	4	3	60	40
2	SEM 203	Environmental Microbiology	PC	4	4	0	4	3	60	40
3	SEM 205	Earth Science - System and its resources	PC	4	4	0	4	3	60	40
PRACTICALS:										
1	SEM 221	Energy and Environment Lab	PP	2	0	3	3	3	--	100
2	SEM 223	Environmental Microbiology Lab	PP	2	0	3	3	3	--	100
3	SEM 225	Earth Science - System and its resources Lab	PP	2	0	3	3	3	--	100
Choose any one										
1	SEM 241	Environmental Physics	DSE	4	4	--	4	4	60	40
2	SEM 243	Biodiversity Conservation	DSE							
Choose any one										
1	SSE 261	Renewable Energy Technologies	SEC	2	2	0	2	2	--	100
2	SSE 263	Ecotourism	SEC							
3	SSE 265	Environment and Health	SEC							
			Total	24	18	09	27	--	240	560

B.E.M. – IV SEMESTER

Sl. No.	Course Code	Name of the Course	Category	Credits	Scheme of Instruction		Total	Scheme of Examination		
					Hours per Week			Duration in Hrs.	Maximum Marks	
					L/T	P			Sem. End Exam	Con. Eval
1	SEM 202	Air Pollution	PC	4	4	0	4	3	60	40
2	SEM 204	Water and Wastewater Treatment	PC	4	4	0	4	3	60	40
3	SEM 206	Industrial Waste Management	PC	4	4	0	4	3	60	40
PRACTICALS:										
1	SEM 222	Air Pollution Lab	PP	2	0	3	3	3	--	100
2	SEM 224	Water and Wastewater Treatment Lab	PP	2	0	3	3	3	--	100
3	SEM 226	Industrial Waste Management Lab	PP	2	0	3	3	3	--	100
Choose any one										
1	SEM 242	Environmental Toxicology	DSE	4	4	0	4	3	60	40
2	SEM 244	Environmental Problems in Indian Context	DSE							
Choose any one										
1	SSE 260	Analytical Techniques in Environmental Science	SEC	2	2	0	2	2	--	100
2	SSE 262	Professional Communication Skills Lab	SEC							
3	SSE 264	Biofertilizer Technology	SEC							
			Total	24	18	09	27	--	240	560

B.E.M. – V SEMESTER

Sl. No.	Course Code	Name of the Course	Category	Credits	Scheme of Instruction		Total	Scheme of Examination		
					Hours per Week			Duration in Hrs.	Maximum Marks	
					L/T	P			Sem. End Exam	Con. Eval
1	SEM 301	Solid Waste Management and Soil Pollution	PC	4	4	0	4	3	60	40
2	SEM 303	Environmental Impact Assessment	PC	4	4	0	4	3	60	40
3	SEM 305	Remote sensing and GIS	PC	4	4	0	4	3	60	40
PRACTICALS:										
1	SEM 321	Solid Waste Management and Soil Pollution Lab	PP	2	0	3	3	3	--	100
2	SEM 323	Environmental Impact Assessment Lab	PP	2	0	3	3	3	--	100
3	SEM 325	Remote sensing and GIS Lab	PP	2	0	3	3	3	--	100
Choose any one										
1	SEM 341	Environmental Biotechnology	DSE	4	4	0	4	3	60	40
2	SEM 343	Global warming and climate change	DSE							
Choose any one										
1	SSE 361	Disaster Management	SEC	2	2	0	2	2	--	100
2	SSE 363	Environmental Management	SEC							
3	SSE 365	Composting Technologies	SEC							
			Total	24	18	09	27	--	240	560

B.E.M. – VI SEMESTER

Sl. No.	Course Code	Name of the Course	Category	Credits	Scheme of Instruction		Total	Scheme of Examination		
					Hours per Week			Duration in Hrs.	Maximum Marks	
					L/T	P			Sem. End Exam	Con. Eval
1	SEM 302	Industrial Safety	PC	4	4		4	4	60	40
Choose any one										
2	SEM 342	Green Technologies	DSE	4	4		4	4	60	40
	SEM 344	Environment and Sanitation	DSE							
	SEM 346	Wildlife Management	DSE							
3	SEM 391	Project Work and Viva voce	PP	8	0	--	--	--	50	150
			Total	16	8	--	8	8	170	230

L = Lecture hours **T**= Tutorials **P**= Practical **C** = Credits

Total Credits – 131

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - I SEMESTER
SFC 105: SOFT SKILLS

Hours per week: 3 Continuous Evaluation: 100 Marks
Credits: 2

Preamble:

Soft skills are in the need of the hour in the present scenario. It focuses on overall development of the students with an activity orientation and real time experiences. It helps the students to enhance their creativity, self esteem and confidence. The students will be exposed to real time challenges and get know how to meet the challenges.

Objectives:

To develop inter personal skills and be an effective goal oriented team player, to build confidence and develop leadership skills, to re-engineer attitude and understand its influence on behavior, to inculcate values and ethics, to make the student to realize the importance of goal setting and time management.

UNIT- I

SELF ANALYSIS: SWOT Analysis, Who am I, Attributes, Importance of Self-confidence, Self Esteem, values and ethics. (10)

Learning Outcomes

- Identify individual characteristics with the help of SWOT analysis to improve their standards and to overcome the weaknesses.
- Demonstrate the skills to enhance their level of confidence by different activities.
- Compare the present and past values and ethics so that the best can be implemented and inculcate them in one's life.

UNIT- II

Creativity: Out of box thinking, lateral thinking. (10)

Learning Outcomes

- Explore and describe their experiences in thinking in different way.
- Demonstrate their innovative ideas with co participants of the class.
- Demonstrate the ability to analyse, evaluate the problems and find out the multiple solutions to the problem.

UNIT- III

Attitude: Factors influencing Attitude, Challenges and lessons from Attitude, Etiquette. (10)

Learning Outcomes

- Examine the factors influencing attitude to have better understanding on one's personality
- Find out the major challenges in developing the positive attitude.
- Apply the acceptable manners in day to day life to create the positive impact
- Understand the people and situations around and respond accordingly

UNIT –IV

Motivation: Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators.
Leadership and team work. (10)

Learning Outcomes:

- Understand the importance of motivations in one's life to get success.
- Examine and differentiate different motives and find out the right one to implement.
- Improve and demonstrate the skills required to lead the team
- Compare individual skills with required skills and participate in group activities actively.
- Analyze the situation and respond appropriately while working in the team.

UNIT –V

Goal Setting: Wish List, SMART Goals, Blue print for Success, Short Term, Long Term, Life Time Goals, **Time Management-** Value of time, Diagnosing Time Management, Weekly Planner To do list, Prioritizing work. (10)

Learning Outcomes:

- Understand the importance of time management in one's life.
- Utilize the time properly and planning the day, the week and the month
- Observe the time wasters in one's day to day life.
- Set the life time, long term and short term goal.

References:

1. Barun K. Mitra. Personality Development and Soft Skills, Oxford University Press, 2018.
2. S P Dhanavel. English and Soft Skills, Orient Blackswan, Hyderabad.
3. Soft Skills, Career Development Centre, Green Pearl Publications, 2015.
4. Hurlock Elizabeth B., Personality Development, Mc Graw Hill Education, India.
5. Swami Vivekananda, Personality Development, Advaita Ashrama.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - I SEMESTER
SEM 103: UNDERSTANDING ENVIRONMENT

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
Understanding Environment mainly focuses on the fundamentals concept. It provides basic knowledge of environment and its components including environmental ethics and current problems. This course also helps in understanding the current environmental problems.

Course Objectives

- To enable the student in understanding environment and its measurements including introduction and scope of Environmental Science and technology and its applications
- It helps in attaining the knowledge on Environmental Ethics, Philosophy of environment for better lifestyle
- The students will acquire basic knowledge on Global and National Environmental Issues and their mitigation measure.

UNIT – I

Introduction to Environmental Science: Definition, principles background and scope of environmental science, Understanding of environment and measurements.
Environmental Science and technology, Media and people, decision making and applications of Environmental Science.

Learning Outcome:

- The student gains theoretical knowledge on environment and its measurements.

UNIT – II

Environmental Ethics: Nature and origin of environmental ethics, ecological consciousness, western and eastern views, philosophy of environment. Environment, community and equity, integrating ethical values and knowledge, self-centered development and Environment.

Learning Outcome:

- The student buildup confidence on Environmental Ethics, Philosophy of environment for better lifestyle

UNIT – III

Environmental Education: Environmental awareness - role of youth, communities, NGO's and professional.
Environmental education at primary and secondary levels, Environmental education for mass - rural and urban communities.

Learning Outcome:

- The students get fascinated towards environmental awareness programs

UNIT – IV

Global and National Environmental Issues: Climate change, ozone depletion, greenhouse effect, Acid rain, sea level rise, Deforestation, Biodiversity loss, desertification, disasters.

Learning Outcome:

- The student understands the Global, National Environmental Issues and can focus on mitigation measure.

UNIT – V

Human impact on environment and its consequences: Hunting and gathering, agriculture societies, industrial societies, impact of cultural change on environment.

Population explosion, degradation of natural resources, urbanization, industrialization, food security, public health, energy crises.

Learning Outcome:

- The ability of the students to understand the environment enhances and makes them think about sustainable development

Reference Books:

1. Chapman J.L. & Reiss M.J. Ecology: Principles and Applications' Cambridge University Press, U.K, 2nd Edition.
2. Cunningham W.P. & Saigo S.W. Environmental Science: A Global Concern' WCB, McGraw Hill, 1st Edition.
3. Environmental Science, S.C. Santra, New Central Book Agency (P) LTD, 3rd Edition.
4. Environment Problems & Solutions by D.K.Asthana and Meera Asthana; S.Chand & Company Ltd.
5. Introduction to Environmental Science by Y.Anjaneyulu. BS Publications. 3rd Edition reprint

Course Outcomes

After reading this paper the student –

- Gains theoretical knowledge on environment and its measurements.
- Improves knowledge on Environmental Ethics, Philosophy of environment for better lifestyle
- Clear visualization on the Global, National Environmental Issues including mitigation measure.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - I SEMESTER
SEM 105: ENVIRONMENTAL CHEMISTRY

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
This course is designed to provide foundation in understanding chemistry of environmental pollution. Students are taught to attain ability to understand the chemical nature of pollutants and their fate.

Course Objectives:

- To prepare students with the knowledge of the chemical properties of elements and compounds existence of the cycling and accumulation of pollutants in the environment.
- The course addresses the chemistry of elements and compounds in the atmosphere, water and soil, and lays special emphasis on the processes that define the connections and the dependence between individual segments of environment.

UNIT – I

Pollution Chemistry – Pollutant, Contaminant, Receptor, Sink, Pathways of a pollutant.
Biospheric chemistry - Bioaccumulation of pollutants - Chemical contaminants and eco-toxicology.

Learning Outcome:
Upon completion of the unit, student will be able to:

- Comprehend pollutant, sink, bioaccumulation and eco-toxicology

UNIT – II

Atmospheric Chemistry: Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain.
Oxygen and ozone chemistry: Catalytic decomposition process of ozone, Concept of atmospheric aerosol chemistry, Greenhouse gases and their effects.

Learning Outcome:
Upon completion of the unit, student will be able to:

- Appreciate atmospheric chemistry, oxygen and ozone chemistry.

UNIT - III

Water Chemistry: Unusual physical properties, water as a solvent and solvent properties, changes in water properties by addition of solute.
Water quality parameters – physical, chemical and biological parameters. Concept of D.O, B.O.D and C.O.D

Learning Outcome:
Upon completion of the unit, student will be able to:

- Apprehend water chemistry and water quality parameters.

UNIT – IV

Soil Chemistry: Soil Composition and Characteristics Physical properties of soil.
Chemical properties – Cation exchange capacity, pH, macro and micro nutrients.

Learning Outcome:
Upon completion of the unit, student will be able to:

- Cognize soil chemistry including its physical and chemical properties.

UNIT - V

Chemistry in day to day life - Food Adulteration: Common adulterants found in food and their effects on human beings
Milk: Chemical composition of milk. Adulteration in milk like Sugar, Urea, Starch.

Learning Outcome:
Upon completion of the unit, student will be able to:

- Gain knowledge on food adulteration and milk adulteration.

Reference Books:

1. Engineering Chemistry by Jain & Jain, Dhanpat Rai Publishing Company. 15th Edition
2. Environmental Chemistry by P. S. Sindhu, New Age International. 2nd Edition.
3. Environmental Chemistry by A. K. De, New Age International Publication, New Delhi 3rd Edition.
4. Chemistry for Environmental Engineering by Sawyer & McCarty, 5th Edition.

Course Outcomes:
Upon completion, student will be able to:

- Establish appreciation of the role of chemistry in environmental science.
- Understand the interconnections between different sectors of the environment (soil, water, atmosphere) and the effect of human activities on the natural chemical processes.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - I SEMESTER
SEM 107: MATHEMATICS – I

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
This course is introduced to learn fundamental topics in mathematics for undergraduate level such as Matrices, numerical methods, interpolation, numerical integration, graphical representation of statistical data, measures of central tendency, and measures of dispersion.

Course Objectives:
- To understand various types of matrices and operations on matrices
- To learn the basic concepts and applications of matrices
- To evaluate root of an equation using numerical techniques
- Ability to interpolate the function value or function within the table values using interpolation formulae
- To understand the concept of numerical integration using various methods
- To understand the difference between primary and secondary data
- To learn the basic concepts in applications of statistics and graphical presentation of data
- To understand the concept of measures of central tendency
- Ability to implement features of measures of dispersion.

UNIT-I

Matrices: Definition, singular, nonsingular, symmetric, skew symmetric matrices, Multiplication of matrices, Transpose, inverse of a matrix, solving system of equations by Crammer‘s rule.

Learning Outcome:
By the end of this Unit, the student will be able to
- List the difference between various types of matrices
- Evaluate Matrix multiplication, transpose of a matrix ,and inverse of a matrix
- Discuss the methods to solve system of equations
- Evaluate the system of equations by Cramer’s rule
- Explain difference between symmetric and skew symmetric matrices

UNIT-II

Numerical methods: Bisection method, method of false position, Gauss elimination method, Jacob‘s iteration method, Gauss-siedel Iteration method.

Learning Outcome:
By the end of this Unit, the student will be able to
- Explain method to find positive root of an equation using bisection method
- Illustrate the concept of finding root of an equation using Method of false position
- Evaluate the problems using Gauss elimination method
- Evaluate the problems using Jacobi’s iteration method
- Evaluate the problems using Gauss –siedal iteration method

UNIT-III

Numerical methods: Interpolation, Newton's forward formula, Newton's backward formula, Lagrange formulae for unequal intervals, Numerical Integration – Simpson's $1/3^{rd}$ rule, Trapezoidal rule, Simpson's $3/8^{th}$ rule (Statements only, no proofs).

Learning Outcome:

By the end of this Unit, the student will be able to

- Apply Newton's forward formula to estimate the function value for equal intervals
- Explain the Newton's backward formula to estimate the function using the tabular values
- Evaluate problems on Lagrange formula for unequal intervals
- Outline the different types of numerical integration methods
- Use simpson's rule and trapezoidal rule to explain numerical integration

UNIT-IV

Statistical methods: Collection, classification of data, Graphical representation, Histogram, frequency polygon, Ogive, Measures of central tendency: Mean median and mode.

Learning Outcome:

By the end of this Unit, the student will be able to

- Explain the need of statistics in real world
- Summarize different types of graphical representation of statistical data
- Explain histogram, frequency polygon , and ogive graphically
- Evaluate mean , median and mode for given ungrouped data and also for grouped data
- Explain difference between mean, median and mode

UNIT-V

Statistical methods: Measures of Dispersion, Range, mean deviation, quartile deviation, standard deviation, introduction of moments, skewness and Kurtosis (definitions only, no proofs).

Learning Outcome:

By the end of this Unit, the student will be able to

- Explain properties of measures of dispersion
- Explain advantages of measures of dispersion
- Evaluate range, mean deviation, quartile deviation for ungrouped data
- Apply standard deviation formula for grouped data
- Evaluate skewness and kurtosis for any given data

Reference Books:

1. Engineering Mathematics by Dr. B. S. Grewal, Khanna Publications, 40^{th} Edition.
2. Engineering Mathematics by B. V. Ramana, Tata Mc.Graw Hill, 1^{st} Edition.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - I SEMESTER
SEM 121: UNDERSTANDING ENVIRONMENT LAB

The student shall takeup atleast 10 assignments in form of hand written records based on the current environmental issues and challenges as per the topics in theory paper, the required information is to be collected from print or electronic media of both national and international standards. Continuous evalution each report carries 10 marks.

Lab Course Outcome:

After completing this lab the student –

- Will get comfortable and gain good exposure to the print or electronic media
- Improves knowledge on latest Environmental Issues
- Develops writing skills.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - I SEMESTER
SEM 123: ENVIRONMENTAL CHEMISTRY LAB

1. Oxidation – Reduction Titrations
    - Estimation of Copper Sulphate using a standard solution of Sodium Thiosulphate.
    - Estimation of Potassium dichromate using a standard solution of Mohr‘s salt.
2. Argentometric titrations - Determination of chloride by Mohr method
3. Iodometric titrations - Determination of available chlorine
4. Complexometric titrations - Determination of calcium and magnesium in the mixture.

Practical Outcome:

Upon completing the laboratory sessions the student will be able to:

- Understand different types of chemical interactions and apply them to the real world environmental problem identification.
- Perform precise tests on environmental samples to understand the chemistry behind them.
- Interpret pathway of a pollutant by testing its chemical nature.

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - I SEMESTER
SEM 125: MATHEMATICS LAB

1. Method to find inverse of a matrix
2. Method to solve system of equations by Crammer's rule.
3. Find a root of an equation using Bisection method, method of false position, and Gauss elimination method
4. Find a root of an equation using Jacob's iteration method and Gauss-siedel Iteration method
5. Problems using Newton's forward formula and Newton's backward formula
6. Problems using Lagrange formulae for unequal intervals
7. Numerical integration using Simpson's $1/3^{rd}$ rule, Trapezoidal rule, Simpson's $3/8^{th}$ rule
8. Problems on Mean, Median, and mode
9. Problems on Quartile Deviation, Mean Deviation
10. Problems on Standard Deviation

Course Outcomes:

- Able to solve inverse of a square matrix using different types of methods
- Evaluate the system of linear equations using Crammer's rule using determinants
- Able to find a root of an equation using Bisection method, method of false position, and Gauss elimination method numerically.
- Able to solve problems on interpolation for equal and unequal intervals
- Able to calculate problems on numerical integration
- Able to apply measures of central tendency and measures of dispersion on various statistical data.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - II SEMESTER
SFC 104: COMMUNICATIVE ENGLISH

Hours per week: 4 End Examination: 60 Marks
Credits: 3 Sessional: 40 Marks

Preamble

The course is a unified approach to enhance language skills of learners with an aim to hone their LSRW skills and to increase their employability. It enables the learners improve their communication skills which are crucial in an academic environment as well as professional and personal lives.

Objectives: To enable students to use English in day-to-day communication, to build up their confidence in the usage of English, to enhance vocabulary, to expose them to prose and poetry and enable them to learn language through simple literature. Also to develop their written communicative competence.

UNIT- I

The Scientific Point of view – J.B.S Haldane
Synonyms & Antonyms, One word substitutes,
Words often confused, Phrasal Verbs. (10)

Learning outcomes:
By the end of the course, the student will be able to:

- Become familiar with formal vocabulary that is common in academic texts
- Demonstrate their understanding of synonyms and antonyms in active learning
- Strengthen their vocabulary base in one word substitution
- Use phrasal verbs in their day to day communication

UNIT- II

I am not that Woman – Kishwar Naheed
To Autum – John Keats
Foreign Phrases, Tenses, Concord (10)

Learning outcomes:
By the end of the course, the student will be able to:

- Attain vocabulary to comprehend academic and social reading and listening texts
- Recognize frequently used foreign words and phrases related to areas of immediate relevance.
- Use present, past and future tenses with appropriate time markers.
- Identify the subject in a sentence and determine the verb that agrees with it.

UNIT –III

The Boy who Broke the Bank – Ruskin Bond
Idiomatic expressions, Proverbs, Correction of sentences (10)

Learning outcomes:
By the end of the course, the student will be able to:

- Learn strategies to understand vocabulary in the text
- Identify appropriate meaning of idiomatic expressions
- Familiarize with commonly used idiomatic expressions and use them correctly
- understand the meanings of proverbs and interpret classic examples of proverbs
- demonstrate the ability to recognize and correct basic sentence faults and grammatical errors.

UNIT -IV

A Marriage Proposal – Anton Chekov
Letter Writing, Paragraph Writing, Essay Writing, Note Making, Precis Writing (10)

Learning outcomes:
By the end of the course, the student will be able to:

- perceive the content in the academic text and recognize the organization and purpose of reading a text
- recognize and demonstrate the use of appropriate vocabulary, style and tone in formal letters.
- Apply principles of clarity and coherence to sentences and paragraphs in writing essays
- Learn to organize, record, review and condense the information

UNIT- V

Dialogue Practice, Reading Comprehension, Notices and Circulars, Minutes of the Meeting, Report Writing, Cover Letter and Curriculum Vitae
(10)

Learning outcomes:
By the end of the course, the student will be able to:

- Structure natural, lucid and spontaneous dialogues
- Identify new vocabulary through contextual clues
- Apply scanning skills to comprehend specific details
- Draft formal notices, circulars and minutes of the meetings
- Write in an appropriate style for an academic report
- Demonstrate an ability to target the cover letter and resume to the presenting purpose

Text Book:
Board of Editors. Engage with English, Orient Blackswan, Hyderabad,2019.
References:
N. Krishna Swamy & T. Sri Raman. Current English for Colleges, Macmillan Margaret Maison, Examine your English, Macmillan.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - II SEMESTER
SEM 102: ELEMENTS OF ECOLOGY

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
This paper proved the basic information on ecology, history, important terminology and concepts of ecology. It mainly focuses on various factors like climatic, light, temperature etc. This paper gives a clear picture of Ecosystem, Ecological succession, population ecology and other important aspects of ecology.

Course Objectives

- To enable the student to better understanding Ecology including various types of ecosystems.
- To create awareness about the species diversity including flora and fauna of India.
- It helps in attaining the knowledge on Population ecology including the population Characteristics and interactions between the species

UNIT – I

Introduction – Scope of Ecology; Its relation to other Sciences; Historical background; Ecology in India. Important terminology of Ecology; Basic concepts of Ecology: its main subdivisions and developmental facets.
Climatic factors; Environmental complex; Interaction of Ecological factors - Light factor, Temperature factor; Precipitation (rainfall); Humidity of air; Atmosphere-gases; wind factor: fire factor, Topographic factors: Height of mountain chains; Direction of mountains and valleys; steepness of slope; Exposure of slope.

Learning Outcome:

- The student gains theoretical knowledge on Ecology and environment including the environment and its components.

UNIT – II

Ecosystem Introduction, types of Ecosystems; structure and function of an ecosystem; Major ecosystems: Pond ecosystem; Ocean (marine) ecosystem, Grassland Ecosystem, Forest Ecosystems, Desert Ecosystem and Cropland Ecosystem.
Functional aspects of an ecosystem; Food web, Food chains; Ecological Pyramids. Ecological energetics. (Brief).

Learning Outcome:

- The knowledge of the students enhances on the various types of ecosystems and their functional aspects.

UNIT – III

Population Ecology: Basic Concept of population Ecology; Describing a population, Population Characteristics – Population Size and Density, Dispersion, Age structure, Natality, Mortality and Life tables.
Relationships among organisms; positive interactions and Negative interactions (Brief).

Learning Outcome:

- The student becomes familiar with various concepts of population ecology and their relationships

UNIT – IV

Ecological Succession: Definition and causes of succession. Trends of Succession; Basic types of succession; general process of succession; Hydrosere or hydrarch; Lithosere – a xerosere on rock; Heterotrophic (microbial) succession; Ecosystem development.

Learning Outcome:

- The student can clearly visualize the process of ecological succession and development.

UNIT – V

Phyto-geographical regions of India. Common flora and fauna of India. Rare and threatened plants; role of Botanical Survey of India in exploration of plant wealth. Major categories of animals, rare and threatened species of India. Role of Zoological Survey of India/Zoo Authority of India in exploration and conservation of faunal wealth.

Learning Outcome:

- The student can visualize the Phytogeographical regions of India including Common flora and fauna.

Reference Books:

1. Fundamentals of Ecology – E.P. Odum and Garry W. Barrett, Thomson-Brooks - cole – distributed by East-West press private limited, New Delhi.4th Edition.
2. Environmental Science S. C. Santra, New Central Book Agency (P) Ltd.3rd Edition.
3. Ecology & Environment – P.D. Sharma 10th edition – Rastogi Publications; Meerut, 10th Edition.
4. Text Book plant Ecology – R.S. Ambasht & N. K. Ambasht, 13th edition, CBS Publishers and distributors.

Course Outcomes

After reading this paper the student –

- Adds theoretical knowledge on Ecology and environment including the environment and its components.
- Knowledge enhances on climatic factors, ecosystems and ecological succession.
- Obvious visualization of Phytogeographical regions of India including Common flora and fauna.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - II SEMESTER
SEM 104: ENVIRONMENTAL POLLUTION

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
This course examines impacts of air, water, soil, noise pollution among others. Sources of pollutants are examined along with their control methods.

Course Objectives

- To identify sources of air, water and land pollution associated with major industries, understand the impacts to the environment.
- To devise strategies for control and prevention of pollution.

UNIT – I

Introduction to Environmental Pollution: Definitions of pollution and pollutant; Types of Pollutants and their classification.
Air Pollution: Types and sources of air pollutants; Effects of air pollutants on human beings, plants, animals and materials, Control of air pollution

Learning Outcomes:
Upon completion of this unit, the student should be able to:

- Understand impacts of air pollution on human health and environment.
- Gain knowledge on control of air pollution.

UNIT – II

Water Pollution:
Point and Non-point Source of Pollution, Major Pollutants of Water, Water borne diseases, Water Quality standards.
Effects of water pollution - Eutrophication, Control of water pollution.

Learning Outcomes:
Upon completion of this unit, the student should be able to:

- Comprehend sources and impacts of water pollution, its effect on environment and human health.
- Achieve awareness on control of water pollution.

UNIT – III

Soil Pollution: Sources, effects and control of soil pollution.
Pollution and residual toxicity from the application of pesticides and fertilizers.

Learning Outcomes:
Upon completion of this unit, the student should be able to:

- Comprehend sources and impacts of soil pollution, its effect on environment and soil.
- Illustrate effects of pesticides and fertilizers on soil.

UNIT – IV

Noise Pollution: Noise pollution – source, measurement, effects and control;
Thermal pollution: Definition and sources, Chemical and biological effects of thermal pollution, Effect on marine life, bacteria and water quality and other aquatic biota; Thermal pollution from power plants and their control.

Learning Outcomes:
Upon completion of this unit, the student should be able to:

- Comprehend sources and impacts of noise pollution, its effect on human health.
- Realize sources and impacts of thermal pollution, its effect on water quality.

UNIT – V

Electronic waste (E-waste): Sources and types, constituents of E-wastes, recycling of e-waste and its environmental consequences, Management of e-wastes, Basel convention.
Radiation Pollution: Biological impact and health hazards associated with radiation, Protection against ionizing isotopes; Radioactive waste disposal.

Learning Outcomes:
Upon completion of this unit, the student should be able to:

- Recognize sources and impacts of e-waste and its effect on human health.
- Apprehend radiation pollution and its biological hazards.

Reference Books:

1. Environmental Science by S. C. Santra, New Central Book Agency (P) Ltd. 3rd Edition.
2. Introduction to Environmental Science by Y.Anjaneyulu; B.S. Publications
3. Environmental Pollution B.K. Sharma S.H. Kaur Goel Publishing House.

Course Outcomes:
Upon completion of this Course, the student should be able to:

- Develop skill on identifying sources and effects of environmental pollution.
- Synthesize means and methods for control of environmental pollution.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - II SEMESTER
SEM 106: MATHEMATICS - II

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
Environment statistics is the application of statistical methods to environmental science. In this course applications of correlation and regression, probability and probability distributions, Sampling techniques, and testing of hypothesis for large and small samples are introduced.

Course Objectives:
- To understand the difference between discrete and continuous random variables and probability
- To evaluate problems on discrete and continuous probability distributions
- To learn the basic concept and applications of correlation and regression
- Ability to implement various sampling techniques.
- To understand the concept of testing of hypothesis for large and small samples
- Ability to explore certain statistical concepts in practical applications of environmental science areas.

UNIT-I

Probability: Definition, Addition theorem, Multiplication theorem, Conditional probability, Bayee‘s theorem (definitions only, no proofs).

Learning Outcome:
By the end of this Unit, the student will be able to
- Define probability
- Describe the basic concepts of probabilitiy
- Evaluate problems on Addition theorem of probability
- Evaluate problems on Multiplication theorem of probability
- Evaluate problems on Baye’s theorem

UNIT-II

Theoretical distributions: Random variables, Mean and variance, Binomial distribution. Poisson distribution, Normal distribution (simple problems on the above topics).

Learning Outcome:
By the end of this Unit, the student will be able to
- Compare discrete random variables and continuous random variables
- Illustrate the concept of Binomial distribution
- Explain the properties of binomial distribution
- Evaluate problems on poisson distribution
- Explain normal distribution and its properties

UNIT-III

Correlation and regression, rank correlation, curve fitting, method of least squares**,** fitting of other curves straight line, parabola, $y=ax^b$, $y=ae^{bx}$

Learning Outcome:

By the end of this Unit, the student will be able to

- Evaluate correlation coefficient and rank correlation coefficient for the given data
- Explain the need of correlation and regression
- Explain curve fitting with the help of method of least squares
- Evaluate fitting of straight line
- Explain fitting of parabola and other curves

UNIT-IV

Sampling: objectives of sampling, sampling distribution, testing of hypothesis, null hypothesis, level of significance,Test of significance for large samples, comparison of large samples. Test of significance of means of two large samples.

Learning Outcome:

By the end of this Unit, the student will be able to

- Explain the various types of sampling procedures
- Summarize different types of samplings
- Explain test of significance for large samples
- Evaluate problems on testing of hypothesis
- Evaluate of test the significance of means of two large samples

UNIT-V

Sampling of variables – small samples, students t'distribution, properties of t-distribution. Significance test of sample mean, significance test of difference between sample means. Chi –square test – properties of Chi square distribution – F'distribution, ANOVA (one way classification)

Learning Outcome:

By the end of this Unit, the student will be able to

- Explain the method of small samples
- Explain the properties of t-distribution
- Evaluate problems on Chi-square test
- Explain the properties of chi-square distribution
- Explain the concept of ANOVA for one way classification

Reference Text Books:

1. Engineering Maths by Dr. B. S. Grewal, Khanna Publications, 40th Edition.
2. Engineering Mathematics by B. V. Ramana, Third Edition**,** Tata Mc.Graw Hill
3. S. C. Gupta and V. K. Kapoor, S. Chand and Company.

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - II SEMESTER
SEM 122: ELEMENTS OF ECOLOGY LAB

1. Estimation of the following parameters in soil and water
    a. pH
    b. Conductivity
2. Determining moisture content of soil
3. Study of pond Ecosystem
4. Determination Dissolved Oxygen
5. Determination minimum size of quadrate by species – area curve method
6. Determination the minimum number of quadrates to be laid down in the fields
7. Study the community by Quadrate Method by determining frequency, density and abundance of different species present in the community
8. Line – Transect Method
9. Determination of leaf area by Kemp‘s constant
10. Estimation of chlorophyll in algae and leaves of higher plants

Course Outcome

The students will gain hands on experience and be familiar with vegetation analysis, chlorophyll estimation in algae and leaves of higher plants including basic soil and water analysis.

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - II SEMESTER
SEM 124: ENVIRONMENTAL POLLUTION LAB

1. 2 case studies on Air Pollution (1 National; 1 International)
2. 2 case studies on Water Pollution (1 National; 1 International)
3. 2 case studies on Soil Pollution (1 National; 1 International)
4. 2 case studies on Thermal/Noise Pollution (1 National; 1 International)
5. 2 case studies on Radiation Pollution/E-Waste (1 National; 1 International)

Practical Outcomes:

After completion of the practical sessions, students will be able to:

- Gain precise knowledge on the national and international episodes of pollution and will develop skill to study present scenario.
- Compile and draft reports on issues of environmental pollution.

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - II SEMESTER
SEM 126: ENVIRONMENTAL DIARY

Students appearing for BEM Environmental Sciences shall maintain Environmental Diary covering at least 10 assignments for the semester. The dairy should be submitted at the end of semester. The Environmental Diary shall be evaluated for 100 Marks at the end of the Semester.

Practical Outcomes:
After completion of the practical sessions, students will be able to:

- Be updated on environmental issues at local and global level.
- Search and compile reports on environmental issues.

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - II SEMESTER
SSE 172: FUNDAMENTALS IN COMPUTERS

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble: C is most popular and widely used language for developing computer programs. C language provides a maximum control and efficiency. C is a widely accepted and used language such that the learning provides a strong back ground which is a worthy skill set.

UNIT - I

Introduction: Characteristics of Computer, Evolution of Computers, Computer Generations. **Basic Computer Organization:** Input Unit, Output Unit, Storage Unit, Arithmetic Logic Unit, Control Unit, Central Processing Unit, The System Concept. Secondary Storage Devices: Magnetic Tape, Magnetic Disk, Optical Disk.

Learning Outcome:
The student is able to learn the characteristics of a computer and evolution of computer as well as the organization of various components and working of secondary storage devices.

UNIT - II

Computer Languages: Machine Language, Assembly Language, High Level Language, Characteristics of good Programming Language, Object Oriented Programming Languages.
Operating Systems: What is an Operating System, Process Management, memory management, IO Management, Security, Some Popular Operating Systems.

Learning Outcome:
The student is able to summarize the development of computer languages.
Able to understand the translation from machine language to object oriented languages.
Interpret about the operating system, Process Management, Memory management and IO management.

UNIT -III

Algorithm and Flowchart, Over View of C, constants, variables, data types, operators and expressions, Managing Input – output operations.

Learning Outcome:
The student will be able to develop the logic in solving the problem and infer the steps in descriptive form in terms of an algorithm and summarize the logic in diagrammatic form in terms of a flowchart.
Also will identify the data types that are supported in the language.

UNIT - IV

Decision making and Branching, Decision Making and Looping, Arrays.

Learning Outcome:
The student will learn about the choice of conducting logical tests at different points with in a program.
The student will learn in illustrating the action in-terms of the outcome of the test.

Also will know how arrays are defined, declared, initialized, accessed.

UNIT - V

Character Arrays, String handling, User defied functions.

Learning Outcome:

To classify the library functions and User defined functions
To illustrate the coding of User dedined functions
To build the character Arrays and explain the string handling procedures.

Reference Text Books:

1. Mastering C by K R Venugopal, S R Prasad, Tata McGraw Hill, 1st Edition.
2. Computer fundamentals by Pradeep K. Sinha, BPB Publications, 4th Edition, Revised. (Unit I, Unit II).
3. Programming in ANSI C by E Balgurusamy, Tata McGraw Hill, 5th Edition.

Course Outcomes:

The course provides a sound understanding of the fundamentals of C language and how to apply the efficiently.
It makes the student to acquaint with the techniques and applications in the area.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - II SEMESTER
SSE 174: HUMAN-WILDLIFE CONFLICT AND MANAGEMENT

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble
Human-Wildlife Conflict and Management gives a scope to understand the importance of wildlife, focuses on human wildlife conflicts. It gives a detailed picture on the Journey of mankind from predator to conservator. Brief introduction to various Act like Wildlife Protection Act of 1972, Forest Act 1927, Environmental Protection Act 1986, and Forest conservation Act 1920 are detailed.

Course Objectives
- To enable the student to better understand the need of environmental management and necessary to worry about human wildlife conflicts
- To create awareness about the Evolution of the concept of wildlife management**.**
- It helps in attaining the knowledge on Human wildlife coexistence

UNIT – I

Introduction to wildlife management: Need of environmental management; wildlife conservation: moral obligation? Philosophy of wildlife management; Necessary to worry about human wildlife conflicts.
Role of government, wildlife biologists and social scientists, concept of deep and shallow ecology.

Learning Outcome:
- The attention of the student increases on the need of environmental management and wildlife conservation.

UNIT – II

Evolution of the concept of wildlife management: Journey of mankind from predator to conservator; prehistoric association between wildlife and humans: records from Bhimbetka wall paintings; conservation of wildlife in the reign of king Ashoka.
Understanding wildlife management, conservation and policies regarding protected areas in 21st century; positive values provided by wildlife conservation (monetary, recreational, scientific and ecological benefits).

Learning Outcome:
- The thinking ability increases on conservation of wildlife and policies regarding protected areas in 21st century

UNIT – III

Wildlife conservation laws in India
Types of protected areas (Wildlife Sanctuaries, National Parks, Biosphere Reserves); IUCN categories of protected areas, Natural World Heritage sites; concept of core and buffer area in a protected range.

Brief introduction to Wildlife Protection Act of 1972, Forest Act 1927, Environmental Protection Act 1986, and Forest conservation Act 1920; Introduction of Tiger task force, Status of current protected areas in India.

Learning Outcome:

- The student gains information on concept of core and buffer area in a protected range and also on the various acts for the protection of environmental resources

UNIT – IV

Wildlife conflicts

Insight into the important conflicts: Keoladeo National park conflict of Bharatpur, Human and elephant conflicts of Kerala.

Fisherman and tiger conflict of Sundarbans forest, shifting cultivation in North east India.

Learning Outcome:

- The student achieves basic knowledge on Wildlife conflicts with few case studies

UNIT – V

Human wildlife coexistence

Symbiotic relationship between tribals and forest, forest and development, focus on the inclusive growth of tribes: community participation in forest management, case study of Chipko movement, sacred groves forests, India's Bishnoi community and their conservation practices.

Ecological economic welfare and development: conservation of indigenous culture and traditions, role of international organizations: Man and biosphere programmes; concept of conservation reserves and community reserves, importance of wildlife corridors in minimizing the conflicts and conservation.

Learning Outcome:

- The attention of the student increases on Human wildlife coexistence and Man and biosphere programmes

Reference Books:

1. Reidinger, R. F. and J. E. Miller. Wildlife Damage Management: Prevention, Problem Solving and Conflict Resolution. The John Hopkins University Press.
2. Conover, M. R. Resolving Human-Wildlife Conflicts: The Science of Wildlife Damage Management. CRC Press.
3. Woodroffe, R. People and Wildlife, Conflict or Co-existence? Cambridge University Press.
4. Anthony R.E. Sinclair, John M. Fryxell and Graeme Caughly. Wildlife Ecology, Conservation and Management. Blackwell Publishing, U.S.A.

Course Outcome

After reading this paper the student –

- Become acquainted with concept of deep and shallow ecology.
- Be familiar with prehistoric association between wildlife and humans.
- Knowledge enhances on Human wildlife coexistence and Man and biosphere programmes

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - II SEMESTER
SSE 176: INTEGRATED ORGANIC FARMING

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble:

Integrated Organic Farming is one of the upcoming areas to protect the environment from toxic and harmful chemicals entering through agriculture activities. This paper mainly focuses on the latest methods of organic farming, green manure, Biofertilizers, Biopesticides, compost application, Soil quality and its management etc which results in sustainable agriculture.

Course Objectives

- To make the students understand the definition, principle, basic concept of organic farming.
- To make the students familiar with soil environment, role of microorganisms, biogeochemical cycles, Biofertilizers and Biopesticides.
- To gain theoretical and hands-on experience on the preparation of compost, compost application to soil and crops.

Unit – I

Introduction of organic farming, Concepts, Principle of Organic Farming, Organic Farming verses Chemical Farming, Basic Concept of Organic Farming, Green Manuring: A Basic Component of Organic Farming.

Learning Outcome:

- The student becomes acquainted with integrated organic farming concept and principle, advantages of organic farming, disadvantages of chemical farming.

UNIT – II

Soil quality and its management: Soil environment - soil profile. Physico-chemical conditions, sampling techniques, role of microorganisms in organic matter decomposition (cellulose, hemicellulose, lignins), biogeochemical cycles – nitrogen cycle, sulphur and phosphorous cycles. Rhizosphere, biochelators (siderophores).

Learning Outcome:

- The student becomes familiar with soil environment including nitrogen fixing microbes, symbiosis.

Unit – III

Biofertilizers - Introduction, nitrogen fixing microbes- Rhizobium, Azotobacter, Azospirillum, Azolla-Anabena symbiosis, blue-green algae, Phosphate solubilizing microorganisms. Mycorrhiza. Biopesticides - Bacillus thuringiensis, Pseudomonas syringae and Beauveria bassiana.

Learning Outcome:

- The students gain basic knowledge on Biofertilizers, Biopesticides.

Unit – IV

Compost: Characteristics, types(aerobic, anaerobic and vermi compost) and compost application to soil and crops, Composting of Agricultural and Industrial Wastes, Weed Management in Organic Farming, Pest Management in Organic Farming, Crop Residue Management, Integrated Nutrient Management towards Sustainable Agriculture.

Learning Outcome:

- The student gains knowledge on compost and its applications along with weed and pest management

Unit – V

Integrated Farming Systems. Management of farm and household waste, Harvesting and storage of Organic products. Economic viability of Organic Farming. Practical Training on Friend and Enemy Insects/Pests. Visit to organic farmer's fields & Vermin-compost unit.

Learning Outcome:

- The students are comprehend by visit to organic farmer's fields & Vermi-compost unit

Reference Books:

1. SP. Palaniappan, K. Annadurai, Scientific Publishers (India), 7th Edition.
2. Soil Microbiology (4th edition) by N. S. Subba Rao.
3. Agricultural Microbiology by P.K. Biswas.
4. Soil Microbiology (2nd edition) by A. Martin
5. Environmental Soil Science (3rd edition) K. H. Tan.
6. Introduction to Soil and Agricultural Microbiology, G. Prabhakaran.

Course Outcomes

After reading this paper the student –

- Become acquainted with integrated organic farming concept and principle, advantages of organic farming, disadvantages of chemical farming.
- Be familiar with soil environment including nitrogen fixing microbes, symbiosis, Biofertilizers and Biopesticides and gain knowledge on weed and pest management.
- Comprehend by visit to organic farmer's fields & Vermi-compost unit

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - III SEMESTER
SEM 201: ENERGY AND ENVIRONMENT

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
Energy is considered to be an important factor for the development, since development of a country is dependent on its energy consumption. Owing to enormous environmental degradation and unavailability of skilled people to tackle environment related problems, this course is aimed to provide knowledge to individuals in energy and environment aspect so that they can cater the needs of varied professions industry.

Course Objectives:
- To describe physical principles underlying energy production and usage.
- Appreciate energy resources, technologies and their effects on the environment.

UNIT I
Sun as source of energy, nature of its radiation, heat budget of earth, earth temperature and atmosphere. Energy forms, laws of conservation of energy, energy resources classification. Cultural changes and energy consumption patterns.

Learning Outcome:
By the end of this unit, the student will be able to:
- Understand the source of energy on earth, laws of energy and energy consumption patterns.

UNIT II
Conventional Energy Resources: Coal-sources, formation, properties and conversion; Petroleum-sources, genesis, properties and uses; Natural gas-sources, genesis, properties and uses
Renewable Energy Resources: Renewable energy systems - Economics of renewable energy conversion systems.

Learning Outcome:
By the end of this unit, the student will be able to:
- Appreciate conventional energy sources and renewable energy economics.

UNIT III
Environment concerns of energy extraction: Environment effects of energy extraction, conversion and use - Sources of pollution; primary and secondary pollutants - Consequences of pollution and pollution control methods - Environmental laws on pollution control.

Learning Outcome:
By the end of this unit, the student will be able to:
- Apprehend environmental concerns in extracting energy and pollution control methods.

UNIT IV

Energy use and climate change: Global warming - Greenhouse gas emission, impacts, mitigation - Causes of global, regional and local climate change.

Emissions and control methods: Sources of emissions - Effect of operating and design parameters on emission - Control methods; exhaust emission test procedures.

Learning Outcome:

By the end of this unit, the student will be able to:

- Elucidate climate change issues due to energy use and emission control methods.

UNIT V

Socio-Economic aspects of Energy resources: General concepts - Socio-economic impacts - Security of supply and use - Environmental and ethical concerns.

International treaties and convention on environmental mitigation - United Nations Frameworks Convention on climate change (UNFCCC) - Various convention and treaties at international level aiming at CO_2 mitigation.

Learning Outcome:

By the end of this unit, the student will be able to:

- Comprehend socio-economic aspects of energy resources.
- Cognize treaties for mitigation of CO_2 at international level.

Reference Books:

1. Encyclopedia of Environmental Sciences – Environmental Energy Resources, R.P. Trivedi and Gurudeepraju, Vol 7.
2. Living in the environment, G. Tyler Miller, Jr.Wadsworth publishing company, California
3. Renewable Energy Sources and their Environmental Impact, S. A. Abbasi and N. Abbasi. Prentice Hall of India, New Delhi.

Course Outcome:

After studying this course, the student will be able to:

- Illustrate potentials, problems and limitations associated with different forms of energy (e.g. fossil fuel-based, solar, wind, tide, wave, geothermal, nuclear fission, nuclear fusion etc.)
- Apprehend environmental concerns in extracting energy and pollution control methods.
- Cognize environmental legislations for mitigation of CO_2 and various environmental pollutants released during energy consumption.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - III SEMESTER
SEM 203: ENVIRONMENTAL MICROBIOLOGY

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
This course focuses on Fundamentals of microbiology, microbial ecology and microbial relationships. This course also describes how microbes are friends as well as foes to human beings.

Course Objectives:
This course will introduce history of microbiology, microbial interactions, and microbial processes that are relevant for sustainable environmental applications (e.g. sewage treatment, biofertilizers and biogeocycling of essential elements).

UNIT-I

Microbiology: Meaning, definition and history. Contributions of Antony Van Leeuwenhoek, Louis Pasteur, Alexander Fleming and Robert Koch. Importance and application of Environmental Microbiology.

Outline classification of living organisms: Binominal nomenclature, two kingdom, three kingdom, four kingdom and five kingdom. Place of microorganisms in the living world. Differences between Prokaryotes and Eukaryotes.

Learning Outcomes:
Student will get knowledge on

- History of microbiology, structure of prokaryotes & eukaryotes

UNIT-II

Microorganisms – General characteristics and economic importance of Bacteria, Algae and Fungi. Salient features of Viruses and Protozoa.

Ultra-structure of bacterial cell -size, shape and arrangement. Structure, lytic and lysogenic cycles of Bacteriophage.

Learning Outcomes:
Student will get knowledge on

- Characteristics of micro-organisms.

UNIT-III

Air Microbiology: Air-borne microbes, impact of Air-borne microorganisms on living beings, sampling of air -borne microorganisms and control of air-borne microorganisms. Aquatic microbiology: Water-micro flora, sampling of water-microorganisms. Soil microbiology; Soil components and microorganisms, sampling of soil-microorganisms. Humus and its significance.
Epidemiology of Tuberculosis, AIDS and Malaria

Learning Outcomes:
Student will get knowledge on

- Air microbiology and epidemiology.

UNIT-IV

Microbial relationships: Mutualism (Rhizobium-legume association, Mycorrhizae and lichens), Commensalism, Amensalism, Parasitism and Antagonism.

Microorganisms in Agriculture: Biological Nitrogen fixation, Biofertilizers (Bacteria and Algae) and microbial insecticides (BT).Microbes in sewage treatment.

Learning Outcomes:

Student will get knowledge on

- Microbial relationships and microbial uses in agriculture.

UNIT-V

Food Microbiology: Role of Microorganisms in Food Spoilage (contamination of Plant Food Products, Animal Food Products and Processed Foods). Food Preservation processes.

Milk Microbiology: Sources of Microorganisms in milk, Micro flora of Milk, Microbiological examination of milk. Pasteurization, Types of Pasteurization.

Learning Outcomes:

Student will get knowledge on

- Food microbiology and milk microbiology.

Reference Books:

1. Microbiology by M. J. Pelczar, M.A. Reid and Chan E.C.S. The McGraw-Hill Companies, Inc.,7th edition
2. Microbiology by Prescott, Harley and Klein's. The McGraw-Hill Companies, Inc.,5th edition
3. Environmental Sanitation (Social & Preventive Medicine) Dr. P. V. Rama Raju & KVSG Murali Krishna, (1st Edition), Environmental Protection Society.
4. Text Book of Microbiology. R. Anathanarayan and C K J Paniker. Orient Longman Publishers.8th edition

Course Outcomes:

Student will get knowledge on

- History of microbiology, structure of prokaryotes & eukaryotes
- Role of microorganisms in protection of Environment and pollution control
- Methods for protection of food from microbial contamination.

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - III SEMESTER
SEM 205: EARTH SCIENCE – SYSTEMS AND ITS RESOURCES

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:

Description of Rocks & Minerals is an inclusive course covers integrated approach of Geological studies and earth sciences. The course begins with the structure and composition of earth, waste lands and its management, management and conservation of natural resources- Land water, minerals & Energy. Mineral resources, Water Resources, Energy Resources

Course Outline:

Application of rocks and minerals is an important aspect in teaching Geology. Lectures and assignments were design to provide basic knowledge in geology and its principles. The objective of the course is to make students to understand basics of rocks and minerals and management concepts of conservation of resources. The use of Geological concepts in management of natural resources to make students to understand integrated nature of Geological sciences.

UNIT- I

Resources: Types of Resources, Renewable & Non Renewable Resources.
Mineral Resources: Silicate Minerals and Non Silicate Minerals, Description of Minerals like Pyroxenes, Amphiboles, Feldspar.

Learning outcome:

By the end of the unit a student will gain knowledge on the types of renewable and non-renewable resources and mineral resources.

UNIT- II

Land Topography and Resources: Types of Rocks, Sedimentary Rocks and Metamorphic Rocks. Description, Land Hazards Like Earthquakes and Volcanoes.
Land Degradation: Land Degradation, land use pattern, Wasteland types and their management.

Learning outcome:

By the end of the unit a student will be able to understand the type of rocks, land degradation, land use pattern and wasteland management.

UNIT -III

Water Resources: Types of Water sources, Ground Water, Surface Water etc, Water Conservation, Watershed Management, Cloud seeding for artificial rains.

Learning outcome:

By the end of the unit a student will be able to understand the type of water resources and their conservation practices.

UNIT -IV

Energy Resources: Fossil fuels. Nuclear energy, Hydel power, Geothermal and Tidal Energy, Wind Energy and Solar Energy.
Economic Minerals like Gold, Copper, Aluminum, Iron, Manganese, Chromium, Coal, Petroleum, Lead and Zinc.

Learning outcome:
By the end of the unit a student will be able to understand the types of energy resources and economic minerals.

UNIT- V

Structure of Atmosphere, Green House Effect, Ozone depletion, Climate change and its consequences.

Learning outcome:
By the end of the unit a student will be able to understand the structure of atmosphere, greenhouse effect, ozone depletion and its consequences.

Reference Text Books:

1. Rutlys Elements of Mineralogy By HH Read, Blackie and Son Publishers Pvt. Limited
2. A text book of Geology by PK Mukerjee, Madison Wisconsin Publishers.
3. An Introduction to the rock forming minerals by WA Deen, RA Howie & J Zusman Longman Group Limited, Long Man House.
4. Energy Resources G. D. Rai
5. Environmental Problems & Its solutions D.K. Asthana & Meera Asthana S. Chand &Co.

Course Outcomes:
Student will get knowledge on

- Renewable and non-renewable resources, types of rocks, land degradation and waste land management.
- Types of water resources and its conservation practices, types of energy resource.
- Structure of atmosphere, greenhouse effect, ozone depletion and its consequences.

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - III SEMESTER
SEM 221: ENERGY AND ENVIRONMENT LAB

1. 2 case studies on Fossil Fuels (1 National; 1 International)
2. 2 case studies on Energy use and climate change (1 National; 1 International)
3. 2 case studies on Energy resources and socio-economic impacts (1 National; 1 International)
4. Reports on International treaties and convention on environmental mitigation.

Learning Outcomes:

After completion of the practical sessions, students will be able to:

- Gain precise knowledge on the issues of conventional energy and renewable energy.
- Will develop skill on usage and forecast of energy requirement for a particular process and design means and methods for conservation of energy.

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - III SEMESTER
SEM 223: ENVIRONMENTAL MICROBIOLOGY LAB

1. Introduction to Apparatus of Microbiology Lab: Auto Clave, Hot air Oven, Laminar air flow chamber, Inoculation loop, Petri dish, Quebec colony counter
2. Precautions & Care to be taken in Microbiology Lab: Sterilization before experiment, Cotton plugging, Autoclaving after experiment, Hand wash with spirit, wearing gloves, apron, masks. etc.
3. Staining techniques – Gram Staining
4. Culture Media: Solid Media: Nutrient Agar, EMB Agar
5. Liquid Media: Nutrient Broth, Lactose Broth
6. Plating Techniques: Streak Plate Technique, Spread Plate Technique, Pour Plate Technique
7. Hanging –drop technique,
8. Spots

Learning Outcomes:

After completion of the practical sessions, students will be able to:

- Gain knowledge on different equipment used for microbiological experiments, staining techniques and preparation of culture media.
- Different plating techniques and identification of spots.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - III SEMESTER

SEM 225: EARTH SCIENCE – SYSTEMS AND ITS RESOURCES LAB

1. Identification of Rocks (Mega scopic)

- Igneous Rocks

Intrusive (Plutonic)	Extrusive (volcanic)
Granite	Rhyolite
Gabbro	Basalt
Diorite	Andesite
Peridotite	Komatiite

- Sedimentary Rocks
- Sand Stone, Lime Stone, Conglomerate, Coal, Brescia, Arkose.
- Metamorphic Rocks
- Marble, Schist, Quartzite, Gneiss, Amphibolite.

2. Identification of Minerals (Mega Scopic)

- Pyroxenes, Amphiboles, Feldspars

3. Identification of Economic Minerals (Mega Scopic)

- Bauxite, Manganese, Chromium, Iron

4. Estimation of Heavy Metals content in Ores.

Learning Outcomes:

After completion of the practical sessions, students will be able to:

- Identification of rocks and minerals and economic minerals.
- Estimation of different heavy metals in ores.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - III SEMESTER
SEM 241: ENVIRONMENTAL PHYSICS

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
To provide inquisitive ideas related to human environment, transfer of energy, pollution, importance of water and physics of soil.

Course Objectives:
Aquire basic knowledge within selected environmental topics like human environment, thermodynamics of human body, pollution ,ionizing radiation, radioactivity, UV-radiation, atmospheric ozone, and climate and related biological effect.)

UNIT-I

The human environment: Laws of Thermodynamics, First law of Thermodynamics, Second law of Thermodynamics, Third law of Thermodynamics, Energy and metabolism.

Learning outcomes:
1. Laws of thermodynamics and its relevance to human
2. Attribution of energy with process in human body

UNIT-II

Thermodynamics and the human body: First law of thermodynamics and the human body, Second law of thermodynamics and the human body
Energy transfers: Conduction, Convection; Newton‘s law of cooling, Radiation,
Evaporation, Survival in cold climates, Survival in hot climates

Learning outcomes:
1. Energy transfer in human body and its relevance to nature
2. Survival of human in hot and cold climates

UNIT-III

Noise pollution: Domestic noise and the design of partitions
Radiation Physics-concept, types of electromagnetic radiation, radioactivity and biological effects of radiation, radioisotopes.

Learning outcomes:
1. Pollution levels with its ranges its measurement and reduction
2. Influence of radiation on human body further with classification of radiation

UNIT-IV

Water: Hydrosphere, Hydrologic cycle, Water in the atmosphere, Clouds, Physics of cloud formation, growing droplets in cloud, Thunderstorms
Wind: Measuring the wind, Physics of wind creation, Principal forces acting on air masses, Gravitational

force, Pressure gradient, Cyclones and anticyclones, Global convection, Global wind patterns.

Learning outcomes:
1. Designated ranges of winds and thunderstorms
2. Formation of clouds and the importance relevant to flow of wind

UNIT-V

Physics of ground: Soils, Soil and hydrologic cycle, Surface tension and soils, Water flow, Water evaporation, Soil temperature
Environmental Biophysics -Energy budget concept, radiation energy fluxes, energy equilibrium between biotic and abiotic environmental components.

Learning outcomes:
1. Importance of soil and how hydrological cycle takes place with relevance to surface
2. Energy fluxes measurement, Biotic and abiotic components of energy

Reference Text Books:

1. E. Boeker & R. Van Grondelle, Environmental Physics. John Wiley & sons, 2nd Edtion,1995.
2. Beiser, Concepts of Modern Physics, McGraw Hill, 5thedition, 1995.
3. Brady, N.C. 1990. The nature and properties of Soils, 10th Edition. Mac Millan Publishing Co., New York.
4. Botkin, D.B and Kodler E.A., 2000, Environmental Studies: The earth as a living planet. John Wiley and Sons Inc.3rd Edition.
5. Nigel Mason and Peter Hughes: Introduction to Environmental Physics: Planet Earth, Life and Climate, Taylor and Francis, 2001. Online edition

Course outcomes

On completion of course the student gains the importance of laws of thermodynamics and how energy is obtained in human body. Further how energy is transferred to in various regions of atmosphere.
The limits of pollution, winds and thunderstorm and importance of cloud formation for flow of wind and finally measurement of energy flux.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - III SEMESTER
SEM 243: BIODIVERSITY CONSERVATION

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble

Biodiversity conservation gives a scope to understand the importance of Biodiversity, focuses on levels of biodiversity, value of Biodiversity, Biogeographical Classification of India, major threat to biodiversity and conservation strategies.

Course Objectives

- To enable the student to better understand the definition of Biodiversity, components and levels of biodiversity.
- To create awareness about the Biogeographical Classification of India including major biomes, hotspots.
- It helps in attaining the knowledge on threat to biodiversity, endangered and endemic species of India, finally concluding with biodiversity conservation.

UNIT – I

Biodiversity: Definition; Concepts and components of biodiversity, Levels of Biodiversity: Genetic, Species, Ecological. Types of Biodiversity: (Diversity Indices)-

Alpha (α), Beta (β), Gamma (γ) Diversity; Biodiversity as an important resource, value of biodiversity: Consumptive value, Productive Value, Social value, Ethical value, Aesthetic value, optional value.

Learning outcomes:

- The student achieves basic knowledge on the concept and components of biodiversity including its Consumptive value, Productive Value etc

UNIT – II

Biogeographical Classification of India: Geography and major biomes, climate, wetlands, forests. Biodiversity at Global, National Levels, India as a mega diversity nation, Hot spots of biodiversity in the world.

Learning outcomes:

- The student gains information on Biogeographical Classification of India, India as a mega diversity nation, major biomes and hotspots

UNIT – III

Threat to Biodiversity – Habitat loss, Wild life conservation and Poaching of wild life, Man – wild life Conflicts, Threat to Indian Biodiversity Endangered Flora and Fauna of India – Reasons for Loss of Biodiversity, Endangered and Endemic species of India.

Learning outcomes:

- The student gets familiar with important concepts like threat to biodiversity, poaching of wildlife etc.

UNIT – IV

Conservation of biodiversity: Biodiversity Conservation Strategies, In-situ and Ex-situ conservation. Wildlife reserves in India, Protected Areas Network of India, National Parks and Sanctuaries, Management of Germplasm collection, Biopiracy of Indian flora, Eco planning Responsibilities.

Learning outcomes:

- The attention of the student increases on the conservation of biodiversity, types of conservation namely In-situ and Ex-situ conservation and protected area network

UNIT – V

Endangered Wildlife – Special Projects for Endangered Wildlife, Biosphere Reserves, Mangroove Conservation. Biological Diversity Act (2002 in force), National Biodiversity Authority, Biopiracy, Convention on Biological Diversity (CBD) and its milestones.

Learning outcomes:

- The thinking ability increases on the conservation of biodiversity, wildlife, Biosphere reserves and finally mangrove conservation.

Reference Books:

1. Environmental Science by S. C. Santra. New Central Book Agency (P) Ltd.,
2. Ecology & Environment by P.D. Sharma. 10th edition – Rastogi Publications; Meerut
3. Environment Problems & Solutions by D.K.Asthana and Meera Asthana; S.Chand & Company Ltd.
4. Introduction to Environmental Science by Y.Anjaneyulu. BS Publications.3rd Edition reprint

Course Outcomes

After reading this paper the student –

- Adds theoretical knowledge on biodiversity conservation including general importance, type's levels and value of biodiversity.
- Knowledge enhances on Values and ethics in biodiversity conservation, protected area networks.
- The thinking ability increases on the conservation of biodiversity, wildlife, Biosphere reserves and finally mangrove conservation.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - III SEMESTER
SSE 261: RENEWABLE ENERGY TECHNOLOGIES

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble:
Technologies in Renewable energy have broad range starting from solar power, wind power, hydroelectricity, biofuels and biomass energy. This course on Renewable Energy Technologies train students in theoretical and practical aspects of renewable energy technologies and its implementation, energy conservation.

Course Objectives:

- To familiarize and train with the tools and techniques used to assess the various renewable energy resources and its potential.
- To prepare for the challenges of designing, promoting and implementing renewable energy solutions within society's rapidly-changing energy-related sector.

UNIT – I

Introduction: World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Andhra Pradesh, India and around the World – Potentials – Achievements / Applications – Economics of renewable energy systems.

Learning Outcomes
Upon completion of the unit the student will be able to:

- Appreciate energy utilization worldwide and available reserves of energy.

UNIT – II

Solar Energy: Solar Radiation – Measurements of Solar Radiation – Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation – Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

Learning Outcomes
Upon completion of the unit the student will be able to:

- Realize solar energy applications and ways and means to tap solar energy.

UNIT – III

Wind Energy: Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects.

Learning Outcomes
Upon completion of the unit the student will be able to:

- Recognize types of wind energy systems, their generation and environmental aspects.

UNIT – IV

Bio – Energy: Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration – Biomass Applications.

Learning Outcomes

Upon completion of the unit the student will be able to:

- Cognize biomass energy, its production and generation.

UNIT – V

Other Renewable Energy Sources: Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage – Fuel Cell Systems – Hybrid Systems.

Learning Outcomes

Upon completion of the unit the student will be able to:

- Recognize energy from tides, OTEC, Hydrogen and hybrid systems.

TEXT BOOKS:

1. Rai. G.D., "Non Conventional Energy Sources", Khanna Publishers, New Delhi.
2. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K.
3. Tiwari. G.N., Solar Energy – "Fundamentals Design, Modelling & Applications", Narosa Publishing House, New Delhi.
4. David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor & Francis Group, USA.
5. Chetan Singh Solanki, Solar Photovoltaics, "Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi.

Course Outcomes

Upon completion of the course, students will be able to:

- Have ability to recognize the need of renewable energy technologies and their role in the energy demand.
- Gain knowledge of the operating principles of renewable energy production from various renewable sources.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - III SEMESTER
SSE 263: FUNDAMENTALS OF TOURISM AND ECOTOURISM

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble

Ecotourism is one of the tools for sustainable environment. Ecotourism plays an important role in conservation of the natural environment and its resources. This paper provides the set of information on National Tourism Policy, major tourism acts and regulations.

Course Objectives

- To enable the student to better understand the concept and definition of Ecotourism.
- To create awareness about the environment and need for conservation of environmental resources.
- It helps in attaining the knowledge on benefits of sustainable tourism.

UNIT - I

Tourism – Introduction, concept and significance. Tourism types and future trends, tourism impacts. Tourism and environment- Economic, social, political and environmental impacts. Threats and obstacles in tourism.

Learning Outcomes

- The student becomes attentive on understanding the concept and definition of Ecotourism

UNIT - II

Concept and definition of Ecotourism, evolution and characteristics of ecotourism, future trends and types of ecotourism – ecolodging, agrotourism, community development, eco-trecks. Special Interest Tourism – definition and scope, Importance of developing special interest tourism. Tourism potential at hill stations, islands, beaches, caves and deserts of India.

Learning Outcomes

- The student can visualize on major environmental acts and regulations, Tourism policy and planning.

UNIT - III

Wildlife tourism – introduction and significance, potential of wildlife tourism in India, National parks, sanctuaries and biosphere reserves in India. Gir Lion Project and Tiger Project. Wildlife Protection Act, 1972.

Learning Outcomes

- The Knowledge of the student enhances on Innovations and recent trends in ecotourism.

UNIT - IV

Environment & Conservation - Introduction and definition of ecosystem, concept and components of ecosystem. Biomes - major biomes of the world and India, Biodiversity and ecological balance. Hotspots, endangered species, conservation of biodiversity. Ecotourism as a tool for conservation.

Learning Outcomes

- The students build up confidence on the role of ecotourism as a tool for conservation.

UNIT - V

Sustainable tourism- principles and practices and benefits. Ecotourism and natural resource management, National Tourism Policy, major tourism acts and regulations.

Learning Outcomes

- The student's confident level increases on ecotourism, the thinking ability, skills for planning and innovations in ecotourism are buildup.

Reference Book:

1. J Swarbrooke, Sustainable Tourism Management, Rawat Publications, New Delhi.
2. Bala Krishnamurthy, Environmental Management, PHI Learning, New Delhi.
3. Andrew Holden, Environment and Tourism, Routledge, London.
4. Dipankar Dey, Sustainable Development – Perspectives and Initiatives, The ICFAI University Press, Hyderabad.
5. Shashi Prabha Sharma, Tourism and Environment, Kanishka, New Delhi.

Course Outcomes

After reading this paper the student –

- Adds theoretical knowledge on general concept of Ecotourism and the role of ecotourism as a tool for conservation.
- Knowledge enhances on Innovations and recent trends in ecotourism.
- Obvious visualization of major environmental acts and regulations, Tourism policy and planning.

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - III SEMESTER
SSE 265: ENVIRONMENT AND HEALTH

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble:
Interactions between environment and human health are highly complex and difficult to assess. This course helps in examining health issues, scientific understanding of causes and symptoms arising from interaction with environmental components.

Course Outline:
To enable the student understand

- The relationship between different types of diseases and their effect on human health.
- Importance of Personal hygiene, food and milk sanitation
- Importance of solid waste management

UNIT – I

Epidemiology and Community Health: Introduction: Epidemiology, Types of Diseases, Natural History of Disease, Definitions of Health, components of Health, Ecology of Health, Spectrum of health, Determinants of health, Primary health Services, Concepts of Disease, Phases of Disease, The Disease Causative Agents, Host Factors of Disease, Modes of Transmission of Disease, Disease Prevention and Control, Glossary of Terms Related.

Learning outcome:
By the end of the unit a student will be able to understand the types of diseases, sources, causative agents and mode of transmission.

UNIT – II

Water Borne (Intestinal) Diseases: Introduction: Cholera, Typhoid, Dysentery, Hepatitis (Jaundice) Poliomyelitis, Dracunculosis, Amoebiasis, Food Poisoning, Hookworm Disease, Diarrhea.

Learning outcome:
By the end of the unit a student will be able to understand the types of different water borne diseases.

UNIT – III

Personal Hygiene: Personal Habits, Home Sanitation, cigarette Smoking, Alcoholism, Mental Health, Smoke Tips on Keeping healthy, Disease and Symptoms, Daily Allowance of Nutrients.

Learning outcome:
By the end of the unit a student will be able to understand the concept and importance of personal hygiene.

UNIT – IV

Food and Health: Fats and Health, Carbohydrates and Health, Balanced Diet, Food Adulteration
Milk Sanitation: the Dairy, Milk as Vehicle of Infection, Essentials of Milk Sanitation, Milk and Bacteria, Legal Responsibility for Quality control of Milk, Sanitary Measures, Cleaning Process, Milk Handling, Pasteurization.

Learning outcome:
By the end of the unit a student will be able to understand the concept of food and health and Milk sanitation.

UNIT – V

Solid Waste Management: Introduction, Characteristics of Refuse, Disposal of Refuse by Dumping, Hog Feeding, Incineration, Sanitary Land Filling, Composting, Discharge to Sewers and Salvaging

Learning outcome:
By the end of the unit a student will be able to gain knowledge on the concept of Solid waste management.

Reference Text Books:

1. K.V.S.G.Murali Krishna, P.V.Rama Raju, Reem Publications, Pvt.Ltd, New Delhi-110002
2. Indian Academy of Paediatrics. *Guidebook on Immunization.* mfc bulletin.
3. Nandini N, Sunitha N. and Sucharita Tandon. Environmental Studies, Sapna Book House, Bangalore.
4. UNDP. The Human Development Report. The Rise of the South: Human Progress in Diverse World. New York: UNDP.
5. Public Health Nutrition in Developing Countries Part-2). Wood head Publishing India.

E – Resources:

1	www.moef.nic.in	4	www.who.int
2	www.iucn.org/india/	5	www.unep.org
3	www.wwfindia.org		

Course Outcomes
Upon the completion of this course a student will be able to Understand

- Different types of diseases, water borne diseases and the concept of personal hygiene.
- The concept of food and health and milk sanitation.
- The concept of Solid waste management.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - IV SEMESTER
SEM 202: AIR POLLUTION

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
The main objective of this course is to make student understand the problems, effects and the scenario of air pollution in the present world, air pollutants and available control technologies for air pollution.

Course Objective:
This paper explains the different types of air pollutants, sources, effects, classification of pollutants and control technologies for air pollution.

UNIT - I

Introduction – Definition, Sources, classification of air pollutants, Natural contaminants, Gases, Primary and secondary air pollutants. Stationary and mobile sources. Meteorology: Meteorology and air pollution, primary parameters – Wind direction and speed, temperature, atmospheric stability, mixing height, secondary parameters – precipitation, Humidity, solar radiation, visibility. Methods of measurement of meteorological variables.

Learning Outcomes:
Upon completion of the unit the student will be able to:

- Know different types of air pollutants, its sources and factors affecting air pollution

UNIT - II

Industrial plant location and city planning: Introduction, Factors to be considered for industrial plant location, Existing levels of air contaminants, Potential effects on surrounding area, meteorological factors and climate, topographical features, planning and zoning, City planning.

Learning Outcomes:
Upon completion of the unit the student will be able to:

- Understand the concept of city planning and factors to be considered during the location of an industrial plant.

UNIT - III

Plume behaviour: Single stack and multiple source pollution, wind rose, Stack effluent dispersion theories, effect of dilution, plume rise. Dispersion model: wind tunnel method. Stack height. Effects of air pollution on human health, plants, animals, and properties. Major air pollution disasters: Meuse valley (Belgium), Donora (USA), London, Bhopal gas tragedy.

Learning Outcomes:
Upon completion of the unit the student will be able to:

- Understand Plume behavior, stack effluent dispersion and effects of air pollution on living beings with relevant case studies.

UNIT - IV

Sampling procedures: classification of sampling methods, instruments for sampling waste gases and for atmospheric sampling, duration and sampling sites, sampling methods, high volume sampler and respirable dust sampler.

Learning Outcomes:

Upon completion of the unit the student will be able to:

- Understand the procedures of air sampling, equipment used for sampling and air pollution control equipment.

UNIT - V

Air pollution due to automobiles: exhaust emissions; crank case emission, evaporative emissions, air-fuel ratio. Spark timing, control of exhaust emissions.

Air quality and emission standards, air pollution legislations and regulations.

Learning Outcomes:

Upon completion of the unit the student will be able to:

- Understand emission standards for air quality, legislations and regulations for the control of air pollution.

Reference Books:

1. Air pollution MN Rao & HVN Rao. Tata McGraw-Hill Publishing Company Limited. New Delhi
2. Text book of Air Pollution and control Technologies. Y. Anjaneyulu, Allied Publishers (P) Limited, New Delhi.
3. Air Pollution Control Technology Handbook Karl B. Schnelle, Jr., Charles A. Brown, CRC Press
4. Environmental Pollution Control Engineering, CS Rao, New Age International publishers
5. Air Pollution & Control KVSG Murali Krishna Published by Kaushal & Co.

Course outcomes:

- Student will acquire knowledge on the classification of air pollutants, sources and factors effecting air pollution.
- Student will be able to understand the concept of locating an industrial plant, city planning, plume behavior and effect of air pollution on living beings.
- Student will be able to understand the procedures of air sampling, equipment used for sampling and control equipment for air pollution.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - IV SEMESTER
SEM 204: WATER AND WASTEWATER TREATMENT

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
Providing safe, reliable source of potable water is an ever growing challenge for governmental and professional agencies, where daily demand is growing and yet more complex issues are evolving with the daily use of more chemicals and materials. In order to ensure that the public at large are receiving healthy water for daily use a fundamental understanding of processes and technology used in water and wastewater treatment becomes very important. This course is developed to provide precise understanding of providing safe water and also treating wastewater.

Course Objectives:
1. To characterize water from various sources and wastewater.
2. To describe the purpose and operational steps of water and wastewater treatment processes.

UNIT-I
Hydrological cycle. Sources of Water – Surface sources & Ground Water Sources - suitability of surface and ground water with regard to quantity & quality.
Quantity of Water – Types of demands - Fluctuation in demand of water – Factors affecting the water demand.

Learning Outcomes
Upon completion of the unit the student will be able to:
- Familiarize with hydrological cycle, sources of water and demand of water in a community.

UNIT –II
Quality of Water – Classification of impurities – Examination of water – Collection of water samples – Water analysis – Physical tests- Chemical tests- Living organisms in water- Biological tests- Standard of water quality.
Intakes - Classification of intakes. Objectives of treatment of water – Plain sedimentation – types of sedimentation tanks - Sedimentation with coagulation.

Learning Outcomes
Upon completion of the unit the student will be able to:
- Gain vital understanding of aquatic chemistry and testing.

UNIT – III
Filtration – Classification of filters- Slow Sand Filter- Rapid Sand Filter - Disinfection of water - Methods of disinfection – Chlorination.
Sewage- Physical, Chemical & biological characteristics, analysis of sewage. Need for treatment, criteria for selection of site for sewage treatment plant.

Learning Outcomes

Upon completion of the unit the student will be able to:

- Acquaint with various steps involved in treatment of drinking water.

UNIT-IV

Sewage Treatment - Objectives of treatment- Classification of treatment- Flow diagram of conventional treatment plant.

Preliminary Treatment- Screenings, Grit chamber, Skimming tanks - Only description (design not required). Primary Treatment- Primary sedimentation – Description & working (Design not required).

Learning Outcomes

Upon completion of the unit the student will be able to:

- Comprehend wastewater treatment in a sequential and systematic way.

UNIT- V

Secondary Treatment – Trickling filters, Contact beds, intermittent sand filters, Activated Sludge process (Only description, design not required). Sludge Treatment & disposal-Sludge digestion, Sludge drying, Sludge Disposal.

Low cost waste treatment: Oxidation ponds, Oxidation ditches, Activated Lagoon, Anaerobic lagoons. Miscellaneous: Septic tank, Imhoff tank.

Learning Outcomes

Upon completion of the unit the student will be able to:

- Appreciate low cost waste treatment methods.

Reference Text Books:

1. Environmental Engineering by M. Ramachandraiah, Radiant Publishing House, Hyderabad.
2. Water Supply & Sanitary Engineering by G. S. Birdie & J. S. Birdie, Dhanapat Rai Publishing Company.
3. Environmental Engineering by P. Venugopal Rao, Publications.
4. Elements of Environmental Engineering by K. N. Duggal, S. Chand & Company Ltd.

Outcomes:

After studying this course, the student will be able to:

- List and describe the major physical, chemical and biological characteristics of fresh water and wastewater.
- Understand the processes of water and wastewater treatment.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - IV SEMESTER
SEM 206: INDUSTRIAL WASTE MANAGEMENT

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
Industrial waste management is an important tool to cut off the entry of toxic pollutants and hazardous substance into environment. This paper provides basic information on various processes within each of the industries and characteristics of effluences. Implementation of latest technology and safe disposal of toxic chemicals from various industries is the main target, with ultimate outcome of Pollution reduction at source.

Course Objectives

- To enable the student to gain theoretical knowledge on the objective and principles of Industrial waste management.
- To makes the student to well understands characterization waste water, advances techniques.
- In the practical sessions the students will have an exposure to the analysis of physical and chemical parameters from the selected industries and characterize the effluents and compare the data with effluents discharge standards.

UNIT – I

Principles of Industrial Waste Treatment: Introduction, Principles of industrial waste management, sources of pollution, physical, chemical, organic and biological properties, effects of waste water on streams, land environment and human health, water and waste water treatment plants.

Learning Outcomes

- The student achieves basic knowledge on principals of industrial waste management, sources of pollution and their effects.

UNIT – II

Waste reduction, alternatives for raw materials, process changes, housekeeping – pretreatment of wastes, collection of wastes, segregation – equalization – reduction in volume and strength by other methods – theories of neutralization – equalizations and proportioning.

Learning Outcomes

- The student gains theoretical knowledge on waste reduction methods and pretreatment techniques.

UNIT – III

A review of the methods adopted for the removal of suspended colloidal and dissolved organic solids, removal of inorganic dissolved solids – disposal of sludge solids – selection of site for the plant.

Learning Outcomes

- The student will be spotlighted with various methods adopted for removal of solids.

UNIT – IV

Manufacturing processes, flow sheets, characteristics and composition of wastes including waste reduction, treatment and disposal methods of Material Industries: Paper, Steel plant, Metal Plating and Food Industries: Sugar, Dairy.

Learning Outcomes

- The students will have a theoretical exposure to industrial process up to the level of disposal of waste for material and food industries.

UNIT – V

Manufacturing processes, flow sheets, characteristics and composition of wastes including waste reduction, treatment and disposal methods of Miscellaneous Industries: Textile, Tanning, Fertilizers and Atomic energy plants.

Learning Outcomes

- The students will have a theoretical exposure to industrial process up to the level of disposal of waste for miscellaneous industries.

Reference Books:

1. Waste and waste water technology, Mark, JH. John Wiley and Sons, New York.
2. Water and waste water analysis, B.B. Sundaresan, NEERI, Nagpur.
3. Standard methods for examination of Water and waste water, APHA, American Water work Association, Water pollution control federation, New York.
4. Industrial Waste Management, M.N. Rao and A.K. Datta.

Course Outcomes

After reading the subject the student learning outcomes makes them

- Familiar about how the industrial waste is generated, its sources including physical, chemical and biological properties of the effluents.
- Acquired theoretical skills on safe disposal techniques that can be implemented to protect the environment from being polluted.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - IV SEMESTER
SEM 242: AIR POLLUTION LAB

1. Introduction to Ambient air quality standards.
2. Meteorology parameters – Wind direction and speed, temperature, precipitation, Humidity, solar radiation
3. Demonstration of High volume sampler
4. Demonstration of Respirable dust sampler
5. Dust fall jar experiment
6. Estimation of Particulate matter in ambient air by using respirable dust Sampler.

Practical Outcomes:

After the completion of practical sessions the student will be able to:

- Identify the factors affecting air pollutants and demonstration of different samplers used for sampling of air.
- Estimation of particulate matter with the collection of ambient air samples.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - IV SEMESTER
SEM 244: WATER AND WASTEWATER ANALYSIS LAB

1. Sampling Techniques
2. Estimation of Temperature, pH, Conductivity and Turbidity of provided water sample
3. Estimation of Alkalinity of provided water sample.
4. Determination of Residual chlorine from provided water sample.
5. Estimation of hardness from water sample by E. D. T. A. method.
6. Determination of Solids in the given water sample.
7. Estimation of chlorides from water sample by Argentometric method.
8. Estimation of Dissolved oxygen from water by Winkler‘s method.
9. Determination of Biological Oxygen Demand of the given wastewater.
10. Determination of Chemical Oxygen Demand of the given wastewater.
11. Determination of Sulphate concentration of the given wastewater.
12. Determination of Nitrate concentration of the given wastewater.
13. Determination of Coagulant dose using Jar Test Apparatus.

Practical Outcomes:

After completing the practical sessions the student will be able to:

- Measure concentration of the constituents in quantity for characterisation of water for different uses.
- Get acquaintance with water and wastewater quality characterisation and will be able to select parameters to be measured based on experience and intuition.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - IV SEMESTER
SEM 246: INDUSTRIAL WASTE MANAGEMENT LAB

1. Sampling Procedure for Industrial Effluents.
2. Sampling and Analysis of Material Industries
3. Sampling and Analysis of Food Industries
4. Sampling and Analysis of Metallurgical Industries
5. Sampling and Analysis of Miscellaneous Industries
6. Sampling and Analysis of Chemical Industries

Course Outcome
Students gain hand on experience with the estimation of physico-chemical parameters in various industrial effluents and its comparison with the effluent discharge standards given by central pollution control board.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - IV SEMESTER
SEM 241: ENVIRONMENTAL TOXICOLOGY

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
This paper highlights the concept of Toxicology, its history, its disciplines, toxicology texts. Exposure of toxicant, heavy metals in the environment, radiation and health.

Course Objectives:
The main objectives of this paper is to make student aware of the concept of toxicology, history, toxicology tests, exposure to toxicants, bioaccumulation and biomagnification, heavy metals in the environment, radiation and its health effects.

UNIT – I

Basic concepts of Eco-toxicology: Introduction to Ecotoxicology, Principles of toxicology, scope of toxicology. Types of toxic substances - degradable and non-degradable. Factors influencing toxicity, drug toxicity. Acute and chronic toxicity. Influence of ecological factors on the effects of toxicity.

Learning Outcome:
Upon the completion of the unit a student will be able to understand the basic concepts of Eco-toxicology and influence of ecological factors on the effect of toxicity.

UNIT – II

Toxicants in the Environment: Toxic substances in the environment, their sources and entry routes. Transport of toxicants by air and water: Transport through food chain - bioaccumulation and biomagnification of toxic materials in food chain. Toxicology of major pesticides. Environmental impacts of pesticides, Physiological and metabolic effects on flora and fauna.

Learning Outcome:
Upon the completion of the unit a student will be able to understand the toxic substances, sources, entry and transport of toxic substances through air and water. Environmental impacts of pesticides.

UNIT – III

Environmental Toxicology: Principles in toxicology dose response relationship; Statistical concept concerning toxicology, principles in toxicology dose response relationship statistical concept of LC_{50} and EC_{50} values. Potency vs. toxicology short and long term effect at organisms' synergetic effects eco toxicology of heavy metals to algae and higher plants.

Learning Outcome:
Upon the completion of the unit a student will be able to gain knowledge on dose response relationship and principles of toxicology.

UNIT – IV

Bio magnification and Bio monitoring: Heavy metals pesticides and fertilizers pollution in air water soil – extent accumulation of pollution in organization- biomagnification – Bioindicators – Bioremediation with special reference to microbes and plants.

Learning Outcome:
Upon the completion of the unit a student will be able to gain knowledge on heavy metals, pesticides and fertilizers, their accumulation and biomagnification.

UNIT – V

Evaluation of toxicity: Methods used to assess toxicity, classification of toxic materials. Concepts of Bioassay- types, characteristics. Importance and significance of bioassay, Microbial bioassay for toxicity testing, Bioassay test models and classification.

Learning Outcome:
Upon the completion of the unit a student will be able to understand the methods to assess toxicity, classification of toxic materials and their characteristics.

Reference Books:

1. Principles of Environmental Toxicology: I. C. Shaw and J. Chadwick; Taylor & Francis, ltd
2. Environmental biology and Toxicology, by Sharma P.D. Rastogi and Lamporary.
3. Environmental Toxicology by M.Satake, H.Yasuhisa, M.S. Sethi, Y.Mido, S. Taguchi, S.A. Iqbal; Discovery Publishing House.
4. Introduction to Environmental Science by Y.Anjaneyulu; B.S. Publications
5. Science and Engineering – Meenakshi, Prentice Hall India.

Course Outcomes:

- Student will be able to understand the concepts of ecotoxicology and toxic substances, their entry and environmental impacts.
- Student will be able to understand dose response relationship, heavy metals, pesticides and fertilizers and their biomagnification.
- Student will be able to understand the methods to assess toxicity and classification of toxic materials.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - IV SEMESTER
SEM 243: ENVIRONMENTAL PROBLEMS IN INDIAN CONTEXT

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
The course focusses on various environmental problems in India, means to manage and overcome these problems. It also emphasizes on the environmental laws in India that help in dealing with the problems and their consequences.

Course Objectives:
To enable student understand various environmental problems, their causes and consequences, environmental movements and legislative measures that can be taken to mitigate further consequences are dealt in this paper.

UNIT-I
Land degradation: Land use pattern in India, causes of land degradation, environmental consequences of land degradation: soil erosion, desertification, Salination and water logging. Control of land degradation. Waste Lands: Causes of waste land formation and reclamation of waste lands. Wetlands: Importance and types of wetlands and their management.

Learning Outcome:
Upon the completion of the unit a student will be able to gain knowledge on land degradation and its control along with wastelands and wetlands.

UNIT-II
Forest – Significance of forest. Deforestation: Causes and consequences of deforestation. Dimensions of deforestation in India. Forest Management: Social forestry and joint forest management.
Environmental consequences of Dams. Mining: Types of mining (brief). Environmental consequences of Mining and control methods.

Learning Outcome:
Upon the completion of the unit a student will be able to understand significance of forests and environmental consequences of dams and mining.

UNIT-III
Global Warming and Green House Effect: Greenhouses gases and global climate changes, impact of Global warming. Control measures for Global Warming. Ozone depletion: importance of Ozone, causes for Ozone depletion and ozone depleting substances, consequences of Ozone depletion, Ozone hole, alternate measures to mitigate Ozone depletion. Acid rain: causes of acid rain, impact of acid rain and mitigation of acid rain problems.

Learning Outcome:
Upon the completion of the unit a student will be able to comprehend global warming, greenhouse effect, depletion of ozone layer and acid rain.

UNIT-IV

Environmental movements: Major environmental movements in India. Chipko movement, Silent Valley movement, Appiko movement, Narmada Bachavo Andolan and Tehri Dam conflict. International agreements: Earth Summit, Convention of biodiversity and United convention on climate change.

Learning Outcome:

Upon the completion of the unit a student will be able to gain knowledge on environmental movements in India and international agreements.

UNIT-V

Environmental Legislation: Environmental Laws in India. Objective of the Act, Definition of pollution under the Act and Power and functions of boards of the following Acts: The Wildlife (protection) Act, 1972, amended in 1983, 1986, 1991 and 2010. The Water (Prevention and Control of Pollution) Act, 1974, amended in 1988, The Forest (Conservation) Act, 1980, amended in 1988,The Air (Prevention and Control of Pollution) Act, 1981, amended in 1988, The Environment (Protection)Act, 1986, The Motor Vehicles Act, 1938, amended in 1988 and A Notification on Coastal Regulation Zone, 1991.
Green benches: Structure and functions of green bench.

Learning Outcome:

Upon the completion of the unit a student will be able to recognize environmental laws in India.

Reference Books:

1. Environmental Science, S.C. Santra, New Central Book Agency (P) LTD.
2. Ecology and Environment, P.D. Sharma, 7th edition, Rastogi Publications.
3. Environment Problems & Solutions, D.K. Asthana, Meera Asthana, 2nd revised edition. S. Chand and Company LTD.
4. Text book of Environmental Sciences by Y. Anjaneyulu

Course Outcomes:

Upon the completion of the syllabus the student will be able to

- Gain knowledge on land degradation and its control along with wastelands and wetlands.
- Understand significance of forests and environmental consequences of dams and mining.
- Comprehend global warming, greenhouse effect, depletion of ozone layer and acid rain.
- Gain knowledge on environmental movements in India and international agreements.
- Recognize environmental laws in India.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - IV SEMESTER
SSE 260: ANALYTICAL TECHNIQUES IN ENVIRONMENTAL SCIENCE

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble:
Analytical techniques play an important role in the field of environmental science, it helps in continuous monitoring of various environmental components like air, water, soil and marine for pollution. It focuses on the sources, effects of pollution, common pollutants and its transportation including general approach for analysis

Course Objectives:

- To enable the student to gain theoretical knowledge on Pollution of various environmental components, Sources and effects of pollution, Common Pollutants.
- The students will have a theatrical exposure to the analytical techniques for the estimation of physico-chemical parameters.
- To makes the student to well understands the basic instrumentation used in the field of environment.

Unit – I

Environment - Reason for Concern, Introduction to Environmental Pollution, Sources and effects of pollution, Common Pollutants, Fate and transportation of pollutants, Necessity for chemical analysis, General approach for to analysis.

Learning Outcome:

- The student achieves basic knowledge on the pollutants, its sources, effects of pollution and basic analysis

Unit – II

Air Analysis – introduction, Composition of atmosphere, Structure of atmosphere, Sources of air pollution, Classification of pollutants, causes and effects of Pollution, Ambient air quality standards (WHO), sampling methods, High volume sampler, PM_{10} samplers.

Learning Outcome:

- The student gains theoretical knowledge on composition of atmosphere, sources, classification and effects of air pollution.

Unit – III

Water Analysis – introduction, sampling, major constituents, Drinking water standards (WHO, BIS), water quality measurement – Total solids, organic carbon, pH, EC, Water hardness, dissolved oxygen. Introduction to instrumental techniques for common ions: UV-Visible spectrophotometer, Flame photometer, Ion Chromatography.
Trace pollutants: Gas liquid chromatography, Trace metals: ICP-MS.

Learning Outcome:

- The student will be spotlighted with various methods for water analysis using advance instrumentation.

Unit – IV

Soil Analysis – introduction, sampling, Soil environment - soil profile. Physico-chemical quality of soil, Organic matter decomposition in soils. Soil analysis – pH, EC, Organic carbon, moisture content, water holding capacity, porosity of soil, micro and macro nutrients in soil.

Learning Outcome:

- The student achieves basic knowledge on soil analysis which include physico-chemical analysis

Unit – V

Marine pollution – Definition, introduction, Physical Properties of Seawater: density, viscosity, surface tension, conductivity and their relationship, temperature distribution in the sea-heat budget. Chemical composition of seawater: ionic, major and minor constituents, trace elements their importance.

Learning Outcome:

- The students will have a theoretical exposure on marine pollution including chemical composition of sea water.

Reference Books:

1. Introduction to Environmental Analysis, Roger Reeve, John Wiley & Sons Ltd.
2. Thurman, Harold, Introduction to Oceanography, Prentice Hall Inc. New Jersey.
3. Alexander, M., 2nd Edn, Introduction to Soil Microbiology.
4. Environmental Pollution & Control, N.H. Gopal Dutt, Neelkamal Publisher; First edition
5. Environmental Pollution by RK Khitoliya - S. Chand Publishing.

Course Outcomes

After reading the subject the student learning outcomes makes them

- Familiar about pollution of various environmental components,
- Expert in understanding the physical, chemical and biological pollutants.
- Acquired theoretical skills on instrumental techniques.

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - IV SEMESTER
SSE 262: PROFESSIONAL COMMUNICATION SKILLS LAB

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble:

Objectives: To enhance Pronunciation skills , to help them avoid the mother tongue influence in their speech, to help them use paralinguistic features in their language, to develop vocabulary for competitive examinations, to enable the students to acquire LSRW skills, to instill confidence and speak effectively

1. Phonetics, vowels, consonants & Diphthongs, Phonetic Transcription
2. Stress/ Accent
3. Intonation
4. Describing objects/situations/people
5. Role Play
6. Short extemporaneous presentation
7. Group Discussion
8. Listening and Reporting
9. Just a Minute Sessions
10. Interview Skills

Learning outcomes:

After completion of this course, the students will be able to:

- Describe the structure of speech organs and their function in varying the speech signal, including the voice, and be aware of basic methods of articulation.
- Demonstrate the most important categories of vowels and consonants, and know the signs, and definitions of the most important vowels, consonants and prosodic phenomena.
- Develop their Presentation skills through JAM Sessions and Role Play.
- Speak effectively and try to avoid the influence of their mother tongue.
- Enable to narrate short stories through Short extemporaneous presentation.
- Enhance required skills to face interviews confidently.
- Learn face to face interaction between two or more individuals with a motive or a purpose.

Reference Books:

1. Developing Communication Skills by Krishna Mohan and Meera Benarji , Macmillan Press.
2. Better English Pronunciation by JDO Connor Cubs, Cambridge University Press.
3. Oxford Grammar with answers by John Eastwood, Oxford University Press.
4. Hand Book if English Grammar and Usage by Mark Leaster and Larry Beason, Tata Mc GrawHill Company.
5. A Text book of English Phonetics for Indian Students by T.BalaSubramanian, Macmillan Press.

BACHELOR OF ENVIRONMENTAL MANAGEMENT
BEM - IV SEMESTER
SSE 264: BIOFERTILIZER TECHNOLOGY

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble:
Application of biofertilizers is being advocated by the environment for sustainable agriculture. Hence a clear understanding of essential link between chemistry and fertilizer application is needed. Thus, it is therefore vital to understand biofertilizer technology, for each fertilizer product, its flow diagram for production.

Course Objectives:
- To demonstrate the techno-economic viability of the biofertilizers by know-how training.
- To introduce economically viable & Entrepreneurship on Biofertilizers production.

Unit – I

Biofertilizers -Introduction, scope. A general account of Biofertilizers organisms -Cyanobacteria (BGA), Bacteria and Mycorrhizae -Cyanobacteria (BGA) as biofertilizers -Anabaena, Cylindrospermum, Gloeocapsa, Lyngbya, Nostoc, Plectonema and Tolypothrix. Algalization, Azolla -Anabaena as biofertilizers. Isolation of cyanobacteria. Formation of Fogg's medium.

Learning Outcome:
After completion of the unit, the student will be able to:
- ➲ Appreciate basics of biofertilizers, their environmental sustainability.

Unit – II

A general account of bacterial biofertilizers organisms. Azospirillum, Azotobacter, Frankia, Phosphobacteria and Rhizobium. Isolation -Azotobacter -Ashby's mannitol agar, Azospirillum -Semisolid medium. Rhizolium -Yeast Extract Mannitol Agar medium - Culture characteristics. Mechanism of nitrogen fixation (free-living and symbiotic) -Biochemistry and molecular basis of nitrogen fixation - Phosphate solubilization and mobilization.

Learning Outcome:
After completion of the unit, the student will be able to:
- ➲ Illustrate handling, cultivation, and propagation of quality microbial inoculants

Unit – III

Mycorrhizal fungi as biofertilizers -Introduction, scope. A general account of Ecto, Endo and Arbuscular mycorrhizae (AM). Methods of collection, wet sieving and decanting method and inoculum production. Culture of mycorrhizae in Modified Melin -Norkrans (MMN) agar medium -Cultural characteristics of Ectomycorrhizal fungi. Techniques of Ectomycorrhiza inoculum, Endo mycorrohizae of orchids. Isolation and method of inoculation of Arbuscular mycorrhizae (AM), Legume -AM interactions.

Learning Outcome:
After completion of the unit, the student will be able to:
- ➲ Illustrate handling and production of fungal mycorrhizae.

Unit – IV

Production technology: Strain selection, sterilization, growth and fermentation, mass production of various biofertilizers. Mass production of Azospirillum, Azotobacter and Phosphobacteria. Mass cultivation of Azolla –Cyanobacterial biofertilizers -Field application of Cyanobacterial inoculants.

Learning Outcome:

After completion of the unit, the student will be able to:

- ➲ Gain knowledge on biofertilizer production technology and its application.

Unit – V

Application technology: Standards and quality control, application for field and tree crops, nursery plants and seedlings. Extension, promotion and marketing: Extension strategies, diagnosis for the effectiveness of inoculation, improvement in distribution system. National and Regional Biofertilizers Production and Development Centres.

Learning Outcome:

After completion of the unit, the student will be able to:

- ➲ Gain professional competencies, upgrade knowledge and develop technical skills of biofertilizer production.

Reference Books:

1. Dilworth, M.J. and A.R. Glenn. Biology and Biochemistry of Nitro-gen Fixation. Elsevier, Amsterdam P. 438.
2. Motsara, I. M.R., P. Bhattacharyya and Beena Srivastava. Biofertilizer Technology, Marketing and usage -A source Book -cum-glossary -FDCO, New Delhi.
3. Somasegaran, P and H.J.Hoben. Hand book for Rhizobia; Methods in legume Rhizobium Technology. Springer-Verlag, New York.
4. Subba Rao, N.S. Advances in Agricultural Microbiology, Oxford and IBH Publn. Co., New Delhi.P. 704.
5. Subba Rao, N.S. Biofertilizers in Agriculture and Forestry Oxford and IBH Publ. Co., New Delhi P.242.

Course Outcomes:

After studying this course, the student will be able to:

- Have ability to distinguish the types of biofertilizers.
- Produce and impart ecofriendly agricultural inputs so as to nullify the ill effects of chemical fertilizers.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - V SEMESTER
SEM 301: SOLID WASTE MANAGEMENT AND SOIL POLLUTION

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
The main objective of solid waste management is to make student understand the need of solid waste management, types of solid wastes, hazardous waste management, sources and types of soil pollution.

Course objectives:
This paper explains waste generation in society, types of solid wastes, segregation of materials, hazardous waste management and waste landfills and also soil pollution.

UNIT-I
Municipal solid waste Definition - Sources and types of solid waste- composition and its determinants of Solid waste-factors influencing generation-quantity assessment of solid wastes-methods of sampling and characterization. Collection and transfer of Municipal Solid Waste.

Learning Outcome:
- Upon completion of the unit a student will be able to understand the types and composition of solid wastes and factors influencing the generation of municipal solid waste.

UNIT – II
Disposal of Solid Wastes: Refuse disposal – various methods – incineration – principle features of an incinerator – site selection and plant layout of an incinerator - sanitary landfill- methods of operation – advantages and disadvantages of sanitary land fill - site selection – reactions accruing in completed landfills – gas and leachate movement and control – equipments necessary

Learning Outcome:
- Upon completion of the unit a student will be able to understand the methods and equipment needed disposal of solid wastes.

UNIT –III
Composting: Principle – types- factors affecting compost process- mechanical composting methods.
Reuse and recycling of paper, glass, rubber. Plastic waste status in India. Effect of plastic wastes on environment, management of plastic waste.

Learning Outcome:
- Upon completion of the unit a student will be able to understand the process and methods of composting, recycling and reuse of materials and plastic waste status in India.

UNIT-IV
Hazardous waste Management: Sources and classification of hazardous wastes – Storage and collection of hazardous wastes – Treatment and disposal techniques: Physical, chemical and biological - Protection of public health and the environment. Biomedical wastes – Types – Management and handling and control. Radioactive wastes- sources and types - control and management.

Learning Outcome:
- Upon completion of the unit a student will be able to understand the sources and classification of hazardous wastes and their management practices.

UNIT-V

Soil Pollution – Physical, Chemical, Mineralogical and Biological properties of soil, sources of soil pollution, Pollution and residual toxicity from the application of insecticides, pesticides and fertilizers; Soil erosion and land degradation. Control of Soil pollution.

Learning Outcome:

Upon completion of the unit a student will be able to understand the properties of soil, sources and types of soil pollution and its control methods.

Reference Books:

1. George Techobanoglous and Frank, K**.** Handbook of Solid Waste Management, Second Edition, Mc GRAW-HILL.
2. George Techobanoglous et al, ―Integrated Solid Waste Management‖ Mc Graw - Hill.
3. Techobanoglous Thiesen Ellasen; Solid Waste Engineering Principles and Management, Mc Graw – Hill.
4. Manual on Municipal Solid waste Management, CPHEEO, Ministry of Urban Development, Govt. of. India, New Delhi.
5. Blide A. D. & Sundaresan, B. B, ―Solid Waste Management in Developing Countries, INSDOC.

Course Outcomes:

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

- Types and composition of solid wastes, factors influencing generation of solid wastes and methods for disposal of solid wastes.
- Methods of composting, recycling and reuse of materials, classification of hazardous wastes properties of soil, sources, types of soil pollution and its control methods.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - V SEMESTER
SEM 303: ENVIRONMENTAL IMPACT ASSESSMENT

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
Includes Environmental Impact Assessment definition, concepts, principles along with its origin and development. Guidelines in preparing EIA with different methodologies are detailed along with its merits and demerits. Concepts of Environmental management plan, disaster management plan and Environmental auditing are covered. Environmental management system (EMS) are detailed along with its standards including ISO 14000 series and ISO 14001 were detailed. This course had also focused on the pollution control norms at source, coastal zone regulation restrictions, zoning atlas, medium related standards.

Course Outline:
To make the students understand the concept of Environmental Impact Assessment. They become familiar with the Environmental Impact Assessment Methodology and its application. The students also understand the Disaster management plan (on site & offsite). The course is designed to enable the student to learn about Environmental management system (EMS) along with its standards including ISO 14000 series and ISO 14001.

UNIT- I

EIA – Introduction -Definition – Basic concepts and principles of EIA – Origin and development of EIA - Short-term and Long-term objectives – EIA guidelines 2006 (Notification of Government of India) — Merits and Demerits of EIA.

Learning outcome:
Upon completion of the unit a student will gain knowledge on concepts and principles of EIA and EIA notification, 2006.

UNIT -II

Basis for Environment Impact Assessment – Types of impacts (Negative & Positive, Primary & Secondary, Reversible and Irreversible Tangible and Intangible) Components of EIA: Screening of Projects - Public Participation - Preparing environmental impact statements.

Learning outcome:
Upon completion of the unit a student will be able to understand the types of impacts and components of EIA.

UNIT -III

EIA Methodologies: Adhoc Method – Checklist Approach – Matrix Methods – Network Methods - Environmental Management Plan.

Learning outcome:
Upon completion of the unit a student will gain knowledge on the procedures of EIA and Environmental Management Plan.

UNIT -IV

Disaster Management plan on site & off site, Environmental Auditing: Scope, Objectives and Procedures for environmental auditing. Environmental Management System (EMS): EMS standards, The ISO 14000 series, The ISO 14001.

Learning outcome:
Upon completion of the unit a student will be able to understand the process of disaster management and the procedure of environmental auditing an Environmental Management System.

UNIT -V

Pollution control norms at source – Coastal Zone Regulation restrictions – Zoning atlas – Medium related standards (Ambient standards)

Learning outcome:
Upon completion of the unit a student will be able to understand pollution control norms at source and Coastal zone regulation and its management.

Reference Books:

1. Fundamentals of Ecology, E.P. Odum, W.B. Saunders & Co.
2. Das, R.C. and Behera, D.K. Environmental Science – Principles and practice, PHI, New Delhi.
3. Y. Anjaneyulu Environnemental Impact Assessment Methodologies , B. S. Publications
4. Sherman, J. Rosen, Manual for Environmental Impact Evaluation. Prentice Hall, New Jersey.
5. Erickson, P.A. Environmental Impact Assessment Principles and Applications.
6. Canter LW. Environmental Impact Assessment. Mc Graw Hill, New York.

Course outcomes:

- Student will gain knowledge on the concepts and principles of EIA and EIA notification, 2006.
- Student will be able to know the types of impacts, components and procedures of EIA and Environmental Management Plan.
- Student will be able to know about pollution control norms and coastal regulation zone.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - V SEMESTER
SEM 305: REMOTE SENSING AND GIS

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
Remote Sensing is science of acquiring information about an object or a phenomenon kept at a distance. This course provides basic understanding about Remote Sensing and GIS. Remote sensing is a powerful tool to study landscapes, which involves extracting information from spectral images and then analyse them to interpret earth surface processes. On the other hand Geographic Information system (GIS) is software for mapping.

Objectives:
- To describe the fundamental principles of remote sensing and GIS.
- To provide exposure to students in gaining knowledge on concepts and applications of remote sensing for environmental science.

UNIT – I

Fundamental principles of Remote Sensing: Definition and Overview of Remote Sensing History and Evolution of Remote Sensing and Remote Sensing Systems.
Electromagnetic energy and its atmospheric interactions; Remote Sensing Data Acquisition.

Learning Outcome:
On completion of this unit student shall be able to
- Elucidate the process of remote sensing
- List and describe the different types of sensors that are used to detect and record certain parts of the electromagnetic spectrum.

UNIT – II

Elements of Image interpretation. Aerial photo-classification, distortions caused due to flight irregularities, overlaps, scale, relief displacement and its effects.
Different types of photographs.

Learning Outcome:
On completion of this unit student shall be able to
- Identify the components on an aerial photograph
- Become familiar with the history, film type, and angles of aerial photography
- Elucidate Distortions and displacement

UNIT – III

Fundamentals of GIS - Role of information technology in human health. Weather forecasting, Agro meteorology.

Learning Outcome:
On completion of this unit student shall be able to
- Understand the principles of geographic information systems (GIS)

- ➲ Understand application of RS and GIS for Weather forecasting and agrometerology.

UNIT – IV

Applications of Remote Sensing and GIS in Water Resources management. Mining - Urbanization.

Learning Outcome:

On completion of this unit student shall be able to

- ➲ Gain experience in the applications of remote sensing and GIS to solving problems of urbanization and mining.

UNIT – V

Environmental Applications of GIS – Pollution Monitoring – Water – Air – Oil Pollution – Desertification

Learning Outcome:

On completion of this unit student shall be able to

- ➲ Understand the concepts involved in monitoring environmental pollution

Reference Books

1. Sabnis F. Remote Sensing, Principles and interpretation -WH & Freeman & Co. NY.
2. Jensen J. R. Introductory Digital Image Processing -Pentice Hall NZ.
3. Remote Sensing and GIS for Environmental Planning, Muralikrishna, I.V. Tata-McGraw Hill
4. Environmental Monitoring: Applications of Remote Sensing and GIS, Singh, R.B, Geocartho International Centre, Hongkong.

Course Outcomes:

Upon completion of this Course, the student should be able to:

- Explain the way in which electromagnetic radiation interacts with the earth's atmosphere, the earth's surface and the remote sensing system
- Understand the various applications of remote sensing data towards solving problems related to environment.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - V SEMESTER
SEM 341: SOLID WASTE MANAGEMENT AND SOIL POLLUTION LAB

1. Determination of Physical characteristics of solid waste :
   a) Particle size; Temperature; pH; Conductivity and bulk density
2. Determination of Chemical characteristics of solid waste – Nitrogen, Phosphorus, Potassium and Heavy metals (selected).
3. Estimation of organic and Inorganic fraction of solid waste.
4. Determination of moisture in solid wastes.
5. Determination of biological analysis of solid waste.

Practical Outcome:
Upon the completion of laboratory sessions the student will be able to:

- Analysis of physico-chemical characteristics of solid waste.
- Estimation of organic and inorganic fractions of solid waste.
- Biological analysis of solid waste.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - V SEMESTER
SEM 343: ENVIRONMENTAL IMPACT ASSESSMENT LAB

1. Comparative analysis of air sampling from clean and polluted area using key Parameters.
2. Collection and Interpretation of weather data and development of wind roses.
3. Measurement of noise in silent, industrial, residential and commercial areas.
4. Effluent analysis (available effluent)
5. Case Study – At least One Situation – a) Questionnaires; b) Data Collection and Generation; c) Integration of Data and Analysis

Practical Outcome:
Upon completing the laboratory sessions the student will be able to:

- Comparative case studies of different areas using different procedures of EIA.
- Measurement of noise levels and air sampling in different areas.
- Analysis of various effluents from industries.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - V SEMESTER
SEM 345: REMOTE SENSING AND GIS LAB

1. Toposheet Analysis
2. Preparation of Thematic Maps from Toposheets

Practical Outcome:

After completion of laboratory sessions student will be able to:

- Read and interpret toposheet, aerial images and satellite images
- Draw baseline maps, thematic maps, propose legends etc.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - V SEMESTER
SEM 241: ENVIRONMENTAL BIOTECHNOLOGY

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessional: 40 Marks

Preamble:
Environmental biotechnology is essential to society and truly important as a technical discipline. Environmental biotechnology is historic and eminently modern. Microbiological treatment technologies developed at the beginning of the twentieth century, such as trickling filtration, activated sludge and anaerobic digestions remain the mainstays today. In recent years, new technologies are constantly introduced that address very contemporary problems such as detoxification of hazardous chemicals, environmental biomonitoring, and microbial genetic engineering for bioremediation of air, water, and soil.

Course outline:
The course is designed to teach students the scientific and engineering principles of microbiological treatment technologies to clean up contaminated environments and to generate valuable resources for the human society.

UNIT-I

Environmental Biotechnology: Definition, Scope and role of Biotechnology in Environment Protection, Current Status of Biotechnology in Environment Protection, Future.

Biotechnology for air pollution abatement and odor control: Deodorization process - bioscrubbers, biobeds, Biotrickling filters.

Learning outcome:
Upon completion of the unit a student will be able to understand the scope, role and current status of biotechnology and control processes for air pollution.

UNIT-II

Bioreactors for Waste –Water Treatment: Biological processes for Industrial treatment - Aerobic biological Treatments (Activated sludge process, biological filters, Rotating Biological Contactors (RBC), Anaerobic Biological treatment: Contact Digesters, Packed column reactors, Upflow Anaerobic Sludge Reactor (UASB).

Learning outcome:
Upon completion of the unit a student will gain knowledge on the types of biological processes for industrial treatment.

UNIT – III

Biofertilizers: Use of microbes as biofertilizers and bioinsecticides to improve productivity and crop protection. Biopesticides: Bacterial (Bt pesticides), fungal (Trichoderma). Role of symbiotic and asymbiotic nitrogen fixing bacteria in the enrichment of soil, Algal and fungal biofertilizers (VAM). Eutrophication.

Learning outcome:
Upon completion of the unit a student will be able to understand the use of microbes as biofertilizers and biopesticides.

UNIT-IV

Bioremediation: Definition, need and scope of bioremediation: types of bioremediation. Environmental applications of bioremediation, Bioremediation of soil and water contaminated with oil spills, heavy metals and pesticides by soil microorganisms.

Phytoremediation.-Biotechnology in cleaning up the environment by plants. Phytoremediation of heavy metal contaminated soils.

Learning outcome:

Upon completion of the unit a student will be able to understand processes and types of bioremediation and phytoremediation.

UNIT – V

Biomass based energy: Role of microbes in energy production, biogas production (Methanogenic bacteria), microbial hydrogen production, ethyl alcohol production from sugarcane and single cell protein (SCP).

Upon completion of the unit a student will be able to understand the biotechnological methods involved in biotransformation of pollutants and generation of energy

Reference Books:

1. Introduction to Environmental Biotechnology by A.K.Chattarji, 2nd Edition, Prentice Hall Publishers.
2. Environmental Biotechnology – Principles and Applications by Bruce E Rittman, Perry. L. Mc.Carty, Mc Graw Hill Publishers.
3. Microbial Ecology by Ronald. A.Atlas
4. Environmental Biotechnology, SVS Rama, Rastogi Publications.

Course Outcomes:

- Student will gain knowledge on the scope, role and current status of biotechnology.
- Student will be able to know the types of biological processes for industrial treatment and the role of microbes as biofertilizers and biopesticides.
- Student will be able to know about the processes and types of bioremediation, phytoremediation and role of biotechnology in production of energy.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - V SEMESTER
SEM 243: GLOBAL WARMING AND CLIMATE CHANGE

Hours per week: 3 End Examination: 60 Marks
Credits: 3 Sessionals: 40 Marks

Preamble:

To inculcate fundamental knowledge on the causes and consequences of global warming and climate change. Adaptation of mitigations measures for climate change and to develop awareness on the consequences of global warming.

Course Outline:

To strengthen the understanding of student on the causes and consequences of global warming, climate and climate change, policies initiated for mitigation and adaptation strategies.

UNIT-I

Global climate Change – Evidence, causes and consequences, climate of past, present and future scenarios, concept of climate modeling. Impact on climate change on tropical and temperate regions. Impact of climate change on natural resources and health, causes for climate change, climate change mitigation measures, Adaptation to climate change.

Learning outcome:

Upon completion of the unit a student will be able to understand the causes and consequences of global warming and climate change and the concept of climate modeling.

UNIT-II

Causes for climate change: Greenhouse effect, sources and trends of greenhouse gases, warming potential of gases. Impacts of global warming, Photosynthetic mechanism and global climate change – case studies. Impact of climate change on India.

Learning outcome:

Upon completion of the unit a student will be able to understand greenhouse effect, impacts of global warming and climate change on India.

UNIT–III

Carbon Sequestration- concept, global carbon cycle, carbon sequestration potential in terrestrial and marine ecosystems, anthropogenic impact on carbon sequestration. Forest-Sink of Carbon, Measuring of Carbon Dioxide. Role of forests in climate mitigation potential and its evaluation, land use, land use change and forestry, Policy Perspective: UNFCC, Role and Function of IPCC, Kyoto Protocol and its implication on Developed and developing countries.

Learning outcome:

Upon completion of the unit a student will be able to understand the concept of carbon sequestration and the role of forests in climate mitigation potential.

UNIT - IV

CDM (Clean Development Mechanism): Definition and origin of CDM, CDM potential, CDM Market today, Carbon credits under Kyoto, Emission markets. IPCC (Intergovernmental Panel on Climate Change) UNFCC (United Nations Framework Convention on Climate Change). National Action plan on climate change.

Learning Outcome:

- Upon completion of the unit a student will be able to gain knowledge on the concept of Clean Development Mechanism (CDM), IPCC and UNFCC.

UNIT V

Tools to study climate change: Mitigation and adaptation strategies for global warming, carbon capture and storage technologies. National action plan on climate change in India. Indian approach towards climate change in agriculture and food, energy consumption, water availability, environmental pollution and protection of biodiversity.

Learning Outcome:

- Upon completion of the unit a student will be able to understand the mitigation strategies for global warming, carbon capture and storage technologies, National plan on climate change in India.

Reference text books:

1. Aguado, E. and James, E.B. Understanding weather and climate, Prentice Hall, New Delhi.
2. Gupta, K.R. Encyclopedia of environment global warming: problems and policies, Atlantic Publication, New Delhi.
3. Lovejoy, T.E. and Hannah L. Climate change and biodiversity, TERI press.
4. Owen, O.S., Chiras, D. D. and Reganold, J.P. Natural Resource Conservation: Management for Sustainable Future, Prentice Hall.
5. Jamil Ahmad. Climate Change and Sustainable Development in India. New century publications.
6. Stephen Peake. Climate Change: From science to sustainability. OUP Oxford; 2nd Edition.
7. Sushil Kumar Dash, S K Dash. Climate Change: An Indian Perspective (Environment and Development). Foundation books.

Course outcomes:

- Student will gain knowledge on energy and carbon emissions, global climate change and its related effects.
- Student will be able to understand the impacts of global warming and its effect on human health.
- Student will be able to understand the concept of CDM, IPCC and UNFCC and mitigation strategies for global warming and carbon capturing.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - V SEMESTER
SSE 361: DISASTER MANAGEMENT

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble:
The episodes of both natural and man-made disasters have become more repeated, the biggest challenge of the intact world today is the prevent disasters. This paper provides basic information on the concept and definition of disasters, Principles and aspects of disaster prevention, disaster mitigation preparedness and coping with disasters.

Course Objectives

- To enable the student to better understand the concept and definition of disaster including approaches to understand the disaster phenomena.
- To create awareness about the various natural and manmade disasters.
- It helps in attaining the knowledge on Disaster risk reduction, Institutional arrangements, DM Act and policy.

UNIT-I

Understanding Disaster Management: Concept and definition of disaster, approaches to understand disaster phenomena (natural science, applied science, progressive and holistic approaches). Parameters of disaster risk. Levels of disaster as per national guidelines.

Learning Outcome:

- The student achieves basic knowledge on concept of disaster management and holistic to understand disaster.

UNIT-II

Disaster Classification, Causes and Impacts: Overview of Disaster Management in global, national and region level, classification of disasters (Natural and manmade), General characteristics and problem areas of different natural and manmade hazards - floods, earthquake, landslides, cyclones and drought. Response time, frequency forwarding exposure time of different man made hazards.

Learning Outcome:

- The student gains information on classification of disaster, causes and impacts

UNIT-III

Approaches to Disaster risk reduction: Disaster risk assessment (Hazardous – Vulnerability-Capacity analysis), Hazardous mapping and forecasting. Principles and aspects of disaster prevention, disaster mitigation preparedness for damage mitigation and coping with disasters. Role & responsibilities of community local bodies (Panchayat Raj & Urban), states, central and other stake holders.

Learning Outcome:

- The student gets familiar with various approaches of DRR and role and responsibility of various stake holders.

UNIT-IV

Inter-relationship between disaster and development: Factors affecting Vulnerabilities, differential impacts, impact of development projects such as dams, embankments, changes in land use. Climate change adaptation. Relevance of indigenous knowledge, appropriate technology and local resources.

Learning Outcome:

- The attention of the student increases on various aspects of inter-relationships between disaster and development.

UNIT-V

Disaster risk management in India: Hazard and Vulnerability profile of India, components of disaster relief Water, flood, sanitation, shelter, health and Waste Management. Institutional arrangements (mitigation, response and preparedness) DM Act and policy, other related policies plans, programmes and legislation).

Learning Outcome:

- The thinking ability increases on disaster risk management.

Reference Text Books:

1. Disaster Management, M.Sravan Kumar, Himalaya Publishing House, Mumbai
2. Disaster Management, R.B.Singh, Rawat Publications, Jaipur and New Delhi
3. Disaster Management in India, Ministry of Home Affairs, Government of India, New Delhi.
4. National Policy on Disaster Management, NDMA, New Delhi.
5. District Disaster Management Plant-Model Template, NIDM, New Delhi.
6. Natural Hazards and Disaster Management. A Supplementary Textbook in Geography. Central board of secondary education, Preet vihar, New Delhi.
7. http://creativecommons.org/licenses/by-nc/2.5/ca/, Website: www.col.org/vussc

Course Outcomes

After reading this paper the student –

- Adds theoretical knowledge on general concept of Disaster Management and levels disaster as per national guidelines.
- Knowledge enhances on Hazardous mapping and forecasting, mitigation and coping with disasters.
- Obvious visualization of Factors affecting Vulnerabilities, Vulnerability profile of India, mitigation, response and preparedness.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - V SEMESTER
SSE 363: ENVIRONMENTAL MANAGEMENT

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble:
The course attempts to provide various ways and tools in environmental management to study and propose appropriate solutions to a particular environmental issue.

Course Objectives:
The prime objective of this course is to familiarise the student with the need and importance for environmental management, environmental policies and procedures of environmental auditing and impact assessment are dealt.

UNIT I

Environmental Management (EM): Introduction, definition and scope. Need for EM.
Ethics and Environment, Environmental policies and programmes in India.

Learning Outcome:

- Upon the completion of the unit student will gain knowledge on the scope, need and importance of Environmental Management, environmental policies and programmes in India.

UNIT II

Environmental Laws – Need and Importance of Environment Protection Act, Air Act, Water Act, Wildlife Protection act and Forest conservation act.

Learning Outcome:

- Upon the completion of the unit student will be able to understand need and importance of various environmental laws implemented in India.

UNIT – III

Environmental Impact Assessment (EIA): Introduction, purpose and evolution of EIA, steps involved in EIA process. Environmental clearance procedure.
EIA methodologies in brief. Impact prediction, evaluation and mitigation.

Learning Outcome:

- Upon the completion of the unit student will gain knowledge on steps, procedures and methodologies of Environmental Impact Assessment.

UNIT – IV

Environmental Auditing (EA): Introduction, objectives and scope. Types of Environmental audits. Basic structure of EA. General steps in EA. Role of EA in industrial projects.
Life Cycle Assessment (LCA) and its purpose. Procedure for LCA. Different applications of LCA.

Learning Outcome:

- Upon the completion of the unit student will gain knowledge on types and structure of Environmental Auditing and role of auditing in industrial projects.

UNIT – V

Environmental Management Systems (EMS): Significance and core elements of EMS. EMS standards – ISO 14000 – principles and structure, ISO 14001 and OHSAS 18001 certification procedure.

Learning Outcome:

- Upon the completion of the unit student will be able to understand Environmental management systems, its significance and certification procedure.

Reference Books:

1. NPTEL material on Environmental Management – http://nptel.ac.in/courses/120108004/
2. Environmental Impact Analysis by Jain R.K. & Others. New York : Van Nostrand Reinhold Co.
3. Pollution Management in Industries by Trivedi R. K. Environmental Publication.
4. ISO14001 by Schoffman A. &Tordini A. Oxford University Press
5. Environmental Impact Assessment by Canter Larry W. McGraw Hill Higher Education
6. Environmental Auditing by A.K. Srivastava. APH Publishing.
7. Handbook of Environmental Laws, Acts Guidelines, Compliances & Standards Vol-I & VII by R.K. Trivedi. B.S. Publications.

Course Outcomes

After reading this paper the student –

- Student will be able to gain knowledge on Environmental Management, environmental laws in India and their importance.
- Student will be able to understand the importance of Environmental Impact assessment, procedures and importance of environmental audit in industrial projects.
- Student will be able to gain knowledge on Environmental management systems, significance and certification procedure.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - V SEMESTER
SSE 365: COMPOSTING TECHNOLOGIES

Hours per week: 2 Continuous Evaluation: 100 Marks
Credits: 2

Preamble:
Composting is the option that, with few exceptions, best fits within the limited resources available in developing countries. Thus, a defined knowledge of this technology can pave way towards becoming entrepreneurs. This course is designed to train students in preparing compost through various available technologies.

Objectives:

- To introduce the biology of the composting process and the critical elements involved in successful compost production
- Acknowledge with prerequisites of composting technologies and discuss the processes and stages involved in composting, and use appropriate composting technologies.

Unit – I

Types of composting : The aerobic composting process - Factors affecting aerobic composting Aeration, Moisture, Nutrients, Temperature, Lignin content, Polyphenols, pH value.

Learning Outcome:
On completion of this unit student shall be able to

➲ Describe the process of decomposition, types of aerobic composting and governing factors.

Unit – II

Techniques for effective aerobic composting: Improved aeration, Inoculation, Supplemental nutrition, Shredding, Other measures

Learning Outcome:
On completion of this unit student shall be able to

➲ Gain knowledge on techniques for aerobic composting.

Unit – III

Small-Scale Composting: Traditional methods, Anaerobic composting, Aerobic composting through passive aeration, Rapid methods, Aerobic high temperature composting, Aerobic high temperature composting with inoculation, Rapid composting, Compost enrichment.

Learning Outcome:
On completion of this unit student shall be able to

➲ Grasp process of small scale composting.

Unit – IV

Large-Scale Composting: Wind-row composting, Turned wind-rows, Passively aerated wind-rows, Aerated static pile, In-vessel composting, Bin composting, Passively aerated bin composting of municipal waste, Rectangular agitated beds, Silos, Rotating drums, Transportable containers.

Learning Outcome:

On completion of this unit student shall be able to

- ➲ Grasp process of large scale composting.

Unit – V

Vermicomposting: Types of worms, Case studies, Vermicomposting in the Philippines, Vermicomposting in Cuba, Vermiculture in India, Enhancing vermicompost production, Integrating traditional composting and vermicomposting.

Learning Outcome:

On completion of this unit student shall be able to

- ➲ Appreciate vermicomposting and understand various methods adopted for vermicomposting.

Reference Books

1. Satchel, J.E. "Earthworm Ecology" Chapman Hall, London.
2. Wallwork, J.A. "Earthworm Biology" Edward Arnold (Publishers) Ltd. London.
3. Bhatnagar & Patla. Earthworm vermiculture and vermin-composting, Kalyani Publishers, New Delhi.3.Jordan &Verma. Invertebrate Zoology, Chand & Company Ltd
4. Mary Violet Christy. Vermitechnology,MJP Publishers, Chennai
5. Bhatnagar & Patla. Earthworm vermiculture and vermin-composting, Kalyani Publishers, New Delhi

Course Outcomes:

Upon completion of this Course, the student should be able to:

- Develop basic skills and knowledge needed to produce high-quality compost on both field and garden scales.
- Develop an in-depth understanding of various composting technologies and able to weigh their advantages and disadvantages.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - VI SEMESTER
SEM 302: INDUSTRIAL SAFETY

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble:
This course provides you with a through foundation on Industrial safety theory and its applications to the practical problems. The subject will provide to learn skills and confidence to plan and execute and engage about safety measures in Industry.

Course outline:
Through the course content, you will learn more about safety, incident management, risk reduction and crowd management along with other principles that relate to law enforcement and public protection. In the event of any emergency conditions the role of Industrial safety cannot be overemphasized. When major accidents, state of emergency is declared, the public looks to trained individuals for guidance, comfort and a course of action. The priority is always to save lives and ensure public stability at all times.

UNIT – I

Safety: Introduction, importance of the safety, Principles of industrial safety, definition – Accident, Incident, Hazard, explosion, Contamination, Fire, protection, housekeeping, safe measures. Safety training and education.

Learning Outcome:

- Upon completion of the unit a student will be able to gain knowledge on importance of safety, principles of industrial safety and safety education.

UNIT – II

Occupational Health: Concept of health and occupational health, Spectrum of health, Occupational and work related diseases, Levels of prevention, History of occupational health, Characteristics of occupational diseases, Essentials of occupational health service, personal protective equipments (respiratory and non-respiratory).

Learning Outcome:

- Upon completion of the unit a student will be able to know occupational health disorders and protective equipment needed during occupation.

UNIT – III

Hazards in work places – Safety in Process plants: Nature and types of work places, type of Hazards, hazards due to improper housekeeping, workers exposure to hazardous chemicals, Physical and chemical properties of chemical leading to accidents like fire, explosion, ingestion and inhalation – atmospheric pollution, dangers of dusts, fumes, vapors in work spots., Noise and Vibration hazards.
Case studies - Hazards peculiar to the following industries: Thermal Power plants, Steel industry, Mining Industry, Fertilizers.

Learning Outcome:

- Upon completion of the unit a student will be able to gain knowledge hazards in work place and hazards of improper housekeeping and their related case studies.

UNIT – IV

Control of Fire Hazards Factors contributing towards fire. Chemistry of fire. Classification of fires. Common causes of industrial fires. Determination of fire load. Fire resistance of building materials. Design of building plant, exits, etc. for fire safety. Prevention of fire. Portable extinguishers. Water systems, carbon-di-oxide systems. Foam extinguisher system. Dry chemical extinguishing system. Industrial fire detection and alarms. Sprinkle systems.

Learning Outcome:

- Upon completion of the unit a student will be able to gain knowledge on factors contributing fire hazards and equipment used to control fire hazards.

UNIT – V

Safety Management: Management: Concept, definition, nature and importance, Role and functions of a manager, Elements and functions of Management. Management Principles: Authority, responsibility & power of Management, Span of Control. Delegation and decentralization of authority. General principles of Management.

Learning Outcome:

- Upon completion of the unit a student will be able to gain concept of safety management and the gained knowledge will help and general principles of management.

Reference Text Books:

1. R.K.Jain and Sunil S.Rao, Industrial Safety, Health and Environment Management Systems, Khanna publishers, New Delhi.
2. Slote.L.Handbook of Occupational Safety and Health, John Willey and Sons, New York.
3. Frank P. Lees, Loss of prevention in Process Industries, Vol. 1 and 2, Butterworth-Heinemann Ltd., London.
4. Industrial Safety -National Safety Council of India.
5. The Factories Act with amendments 1987, Govt. of India Publications DGFASLI, Mumbai
6. Grimaldi and Simonds, Safety Management, AITBS Publishers, New Delhi.
7. Industrial Safety and pollution control handbook: National Safety Council and Associate publishers Pvt. Ltd, Hyderabad.
8. Handbook of Environmental Health and Safety: Herman Koren and Michel Bisesi, Jaico Publishing House, Delhi.

Course outcome: Upon completion of the course a student will be able to understand the concept and need of safety management. The gained knowledge will help to deal with major accidents, state of emergency. The public also looks to trained individuals for guidance, comfort and a course of action.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - VI SEMESTER
SEM 342: GREEN TECHNOLOGIES

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble:
To provide acquaintance with modern, cleaner and emerging energy technologies and to facilitate understanding of the need and application of green and renewable technologies for sustainable development of the society

Course outline:
The course content includes concepts of green technologies, green chemistry, applications of green technology which help student in understanding the modern and green technologies available.

UNIT- I

Overview, Principle, concepts and tools of Green technology: Overview of green chemistry, chemistry of the atmosphere, principles of sustainable and green chemistry. Basic principles of green technology, concepts of atom economy and carbon trading, tools of green technology.

Learning outcome:
Upon the completion of unit a student will be able to gain knowledge on concept, principle and tools of green technology.

UNIT - II

Waste minimization techniques, waste minimization and climate change, zero emission technology, industrial ecology, greenhouse effect, climate change, photochemical smog.

Learning outcome:
Upon the completion of unit a student will be able to gain knowledge on techniques of waste minimization, climate change, zero emission technology, etc.

UNIT- III

Biological remediation: In situ and Ex situ bioremediation; evaluating Bioremediation; Bioremediation of VOCs. Phytoremediation – concept, types and mechanism involved in phytoremediation.

Learning outcome:
Upon the completion of unit a student will be able to gain knowledge on technique of Bioremediation and types of bioremediation studies.

UNIT- IV

Green Nanotechnology: Introduction to Nano materials and green nanotechnology, fullerene, carbon nanotubes, nanoparticles; green nanoparticle production and characterization, use of nanotechnologies and materials impact on biodiversity, resource conservation, ecosystems and human.

Learning outcome:
Upon the completion of unit a student will be able to understand what nano-materials are, its uses and their impact on biodiversity, ecosystems and humans.

UNIT- V

Green technology applications: energy from alternate sources, solar energy and solar photovoltaic

technology, Biofuel production (bio-ethanol and biodiesel), prevention/minimization of hazardous/toxic products. Concept of green building.

Learning outcome:
Upon the completion of unit a student will be able to gain knowledge on applications of green technology and the concept of green building.

Reference Books:

1. M. H. Fulekar. Nanotechnology Importance and applications, I K international publishing house Pvt.Ltd.
2. Lynn Goldman, Christine Coussens, Implications of nanotechnology for environmental health research, National Academic Press, Washington.
3. Matlack, A. S. Introduction to Green Chemistry. Marcel Dekker: New York.
4. Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice. Oxford Univ. Press: Oxford.
5. Lynn E. Foster: Nanotechnology: Science, Innovation, and Opportunity. Prentice Hall
6. Fei Wang & Akhlesh Lakhtakia (eds). Selected Papers on Nanotechnology—Theory & Modeling (Milestone Volume 182). SPIE Press
7. Caye Drapcho, Nhuan Phú Nghiêm, Terry Walker. Biofuels Engineering Process Technology. [McGraw-Hill].
8. Akhlesh Lakhtakia (ed). The Handbook of Nanotechnology. Nanometer Structures: Theory, Modeling, and Simulation. SPIE Press, Bellingham, WA, USA

Course Outcomes:
Upon completion of this Course, the student will be able to:

- Gain knowledge on principles, tools and applications of green technology and green building.
- Techniques of bioremediation and its types, waste minimization techniques and use of nano materials.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - VI SEMESTER
SEM 344: ENVIRONMENT AND SANITATION

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble:
The importance of environmental conditions and personal sanitation in an individual's health cannot be debated. This course is designed in order to provide student with the knowledge of sanitation at various levels in a community and the measures to be taken up to have good sanitation practices.

Course Outline:
The course objective is to make the student understand

- Importance of health and role of environmental sanitation.
- Types of diseases, water borne diseases and low cost sanitation methods.
- Importance of indoor sanitation and institutional sanitation.

UNIT-I

Public Health: Definition, Health and disease. Components of Epidemiology and health, types of diseases. Determinants of health. Concept of disease: Causative agent, host factor and modes of transmission of disease. Disease Prevention and Control. Environmental Sanitation: History of sanitation. Definition, Concept and importance of Environmental Sanitation. Rural and urban sanitation. Rural sanitation in India. Urban sanitation in India.

Learning outcome:
Upon the completion of unit a student will be able to gain knowledge on types of diseases, importance of rural and urban sanitation and urban sanitation in India.

UNIT-II

Water sanitation: Sources of water. Impurities of water and water quality. Water-borne diseases (intestinal diseases). Protection of water storage in reservoirs, wells and overhead tanks. Purification of water on a small scale (household level and small communities).

Learning outcome:
Upon the completion of unit a student will be able to understand the importance of water sanitation and protection of water resources.

UNIT-III

Low Cost Sanitation: Existing scenario of waste disposal systems. Health and socio-economic criteria for low cost sanitary Privies. Night soil and excreta disposal. Insect vector and rodent control: Mosquitoes, rodent and house fly: habits, life cycle, diseases and their control measures.

Learning outcome:
Upon the completion of unit a student will be able to gain knowledge on low cost sanitation method and disease control measures.

UNIT-IV

Indoor sanitation: Principles of indoor sanitation. Ventilation: type of ventilation and standards for

ventilation. Lighting and illumination: Requirement of good lighting, measurement of light, sources of lighting, types of illumination, standards for illumination. Air disinfection, thermal comfort and Noise control in indoor environments.

Learning outcome:
Upon the completion of unit a student will be able to gain knowledge on importance and principles of indoor sanitation.

UNIT-V

Institutional Sanitation: Sanitation in Schools. Sanitation of hospitals and nursing homes. Sanitation in restaurants and fairs. Sanitation at public bathing places and swimming pool sanitation.

Learning outcome:
Upon the completion of unit a student will be able to gain knowledge on importance of institutional sanitation (schools, hospitals and nursing homes, etc.)

Reference Books:

1. Environmental Sanitation (Social and Preventive Medicine) I edition by K.V.S.G. Murali Krishna and P.V. Rama Raju, Environmental Protection Society, Kakinada
2. Municipal and Rural Sanitation Sixth Edition by Victor M. Ehler and Ernest W. Steel. Tata Mc Graw-Hill Publishing Company.
3. Environmental Sanitation by Baljeet S. Kapoor, S. Chand & Company Limited, 1st Edition
4. Text Book of Environmental Engineering by P. Venugopala Rao, PHI Learning Private Ltd., 7th Edition.

Course Outcomes:
Upon completion of the course the student will

- Gain knowledge on the types of diseases, importance of sanitation.
- Be able to know the importance of water sanitation and low cost sanitation methods.
- Be able to know about the importance of indoor sanitation and institutional sanitation.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - VI SEMESTER
SEM 346: WILDLIFE MANAGEMENT

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

Preamble

Wildlife management gives a scope to understand the importance of wildlife, focuses on various conservation strategies through protected area networks namely wildlife sanctuaries, national parks.

Course Objectives

- To enable the student to better understand the definition of wildlife management including general importance and conservation of wildlife.
- To create awareness about the Status of Wildlife Management in India.
- It helps in attaining the knowledge on Values and ethics in wildlife conservation, protected area networks, Biosphere resources their management

UNIT - I

Wildlife: Definition, introduction to wildlife management. General importance, causes for endangering the species, Indian perspectives, the history of wildlife conservation and how it has shaped conservation today, modern concepts such as IUCN, and CITES.

Learning Outcome:

- The student achieves basic knowledge on wildlife management including general importance and conservation of wildlife.

UNIT - II

Status of Wildlife Management in India: Introduction, Biological diversity, the current status of India‘s wildlife, Floral Wealth, Endemic plant species, History of wildlife management, important zones in India, Protected species of India.

Learning Outcome:

- The student gains information on Status of Wildlife Management in India including important zones of India, endemic and protected species of India

UNIT - III

Extinction of Organisms: Introduction, trends of extinction, endangered species, species characteristics and extinction. Special conservation schemes: Project tiger, Gir lion sanctuary project, Crocodile breeding project.

Learning Outcome:

- The student gets familiar with Extinction of Organisms, trends of extinction and conservation projects in India.

UNIT - IV

Values and ethics in wildlife conservation, Role of Zoos, Parks and Sanctuaries for Conservation of wildlife, Common wild animals in Indian Zoo, National parks and wildlife sanctuaries,

biosphere resources their management outlines, Biogeography regions for wildlife in India, flora and fauna.

Learning Outcome:

- The attention of the student increases on Values and ethics in wildlife conservation, protected area networks, Biosphere resources their management

UNIT - V

Wildlife Crimes: Introduction, Wildlife crime, Prevention of wildlife crimes, How large is wildlife crimes, Agencies to stop wildlife crimes, Laws and regulations of wildlife crimes. Wildlife (Protection) act 1972, its scope importance and objectives.

Learning Outcome:

- The thinking ability increases on prevention of wildlife crime and gains knowledge on prevention of wildlife crime through agencies.

Reference Books:

1. B.B. Hosetti. Concepts in Wildlife Management 3rd revised and enlarged edition, Daya publishing House, Astral International (P) Ltd.
2. Fundamentals of Ecology – E.P. Odum and Garry W.Barrett,Thomson-Brooks-cole – distributed by East-West press private limited, New Delhi.
3. Environmental Science by S.C.Santra, New Central Book Agency (P) Ltd.,
4. Ecology & Environment – P.D. Sharma 10th edition – Rastogi Publications; Meerut

Course Outcomes

After reading this paper the student –

- Adds theoretical knowledge on wildlife management including general importance and conservation of wildlife.
- Knowledge enhances on Values and ethics in wildlife conservation, protected area networks, Biosphere resources their management.
- Obvious visualization and thinking ability increases on prevention of wildlife crime and gains knowledge on prevention of wildlife crimes through agencies.

BACHELOR OF ENVIRONMENTAL MANAGEMENT

BEM - VI SEMESTER
SEM 391: PROJECT AND VIVA VOCE

Students appearing for Bachelor of Environmental Management shall carry out a project in a relevant field, during the sixth semester, in consultation with the faculty –in-charge and submit a dissertation which will be evaluated for 300 marks.