SACRED HEART COLLEGE (AUTONOMOUS), THEVARA KOCHI, KERALA, 682013

CURRICULUM AND SYLLABUS

POST GRADUATE CREDIT AND SEMESTER SYSTEM

(PGCSS)

M Sc. PROGRAMME

INTRODUCED FROM 2016 ADMISSION ONWARDS

BOARD OF STUDIES IN ENVIRONMENTAL SCIENCE

Sacred Heart College, Thevara, Kochi, Kerala

SACRED HEART COLLEGE AUTONOMOUS THEVARA, KOCHI-682013 1944

Dr. Jose John
Principal in Charge
Sacred Heart College (Autonomous)
Thevara, Kochi-682 013

Report of the Board of Studies:

A meeting of the Board comprising the following members was held on

Dr. T.J. James, Chairman,

Dr. C.M. Joy, Member,

Dr. Thommachan Xavier, Member,

Dr. Georgekutty Joseph , Member.

Discussed the syllabus at length and approved as is in the attached format.

CONTENTS

CURRICULUM

1.1 SCOPE AND OBJECTIVES.

The objective of the course is to make the young students conscientious and inspire them and persuade them towards environmental protection and conservation, make them the future guardians of nature. To equip the students to use various tools and techniques for the study of environment. They are also trained to enable to understand, think and evolve strategies for management and conservation of the environment for sustaining life on earth

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1.2 STUDENT ATTRIBUTES

Students with graduation in Botany/ Zoology/ Chemistry/ Aquaculture/ microbiology/ Biotechnology.

1.3 DEFINITION.

1.3.1. ***'Programme'*** means a two year programme of study and examinations spread over four semesters, according to the regulations of the respective programme, the successful completion of which would lead to the award of a degree.

1.3.2. ***'Semester'*** means a term consisting of a minimum of **36** contact hours distributed over 90 working days, inclusive of examination days, within **18** five-day academic weeks.

1.3.3. ***'Academic Week'*** is a unit of five working days in which distribution of work is organized from day-one today-five, with five contact hours of one hour duration on each day. A sequence of 18 such academic weeks constitutes a semester.

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1.3.5. *'**Credit'*** is the numerical value assigned to a course according to the relative importance of the content of the syllabus of the programme**.**

1.3.6. ***'Additional credit '*** *(where ever applicable)* is the numerical value assigned to Club activities, Social service, Internship etc. which is not added with the total academic credits of the students.

1.3.7. *'**Internship'*** is job training for professional careers with 3 credits.

1.3.8.*'College Co-ordinator'* *(where ever applicable)* is a teacher nominated by the College Principal to co-ordinate the continuous evaluation undertaken by various departments within the college.

1.3.9. *'Department'* means any teaching department in a college.

1.3.10. ***'Parent Department'*** means the department which offers core courses within a degree programme.

1.3.11. *'Department Council'* means the body of all teachers of a department in a college.

1.3.12.*'Department Co-ordinator'* is a teacher nominated by a Department Council to co-ordinate the continuous evaluation undertaken in that department.

1.3.13. *'Faculty Advisor'* *(where ever applicable*)means a teacher from the parent department nominated by the Department Council, who will advise the student in the choice of his/her courses and other
academic matters.

1.3.14. Grace Marks shall be awarded to candidates as per the College Orders issued from time to time.

1.3.15. 'Grade' means a letter symbol (e.g., A, B, C, etc.), which indicates the broad level of performance of a student in a course/ semester/programme.

1.3.16. 'Grade point'(GP) is the numerical indicator of the percentage of marks awarded to a student in a course. Words and expressions used and not defined in this regulation shall have the same meaning assigned to them in the Act and Statutes.

1.4. DURATION

The duration of P.G. programme shall be ***4 semesters***

The duration of odd semesters shall be from **June to October** and that of even semesters from **November to March.**

1.5. REGISTRATION

The strength of students for each course shall remain as per existing regulations.

Those students who possess the required minimum attendance and progress during a semester and could not register for the semester examination are permitted to apply for Notional Registration to the examinations concerned enabling them to get promoted to the next semester.

1.6. SCHEME AND COURSES

The M. Sc. programme is spread over four semesters. It comprises of four different components viz: I) Teaching II) Lab Work III) Field Work IV) internship and V) Dissertation

Additional credit components

(a) Talent & career club activity (optional)

(b) Social service (optional)

(c) Internship (Mandatory)

1.7. PROGRAMME STRUCTURE

A	Programme Duration	4 Semesters
B	Minimum credits required from theory courses	44
C	Minimum credits required from field work	07
D	Minimum credits required from practical courses	10
E	Dissertation and viva	16
	Total Credits required for successful completion of the programme	80
I	Minimum attendance required	75%

1.8. EXAMINATIONS.

The evaluation of each course shall contain two parts:

(i) CONTINUOUS INTERNAL ASSESSMENT (CIA)

(ii) END-SEMESTER EXAMINATION (ESE)

The internal to end semester examination ratio shall be 1:3, for both courses with or without practical. There shall be a maximum of 75 marks for external evaluation and maximum of 25 marks for internal evaluation.

1.9. Computation of Grade and Grade points.

For all courses (theory & practical), grades are given on a 07-point scale based on the total percentage of marks. ***(CIA+ESE)*** as given below

Percentage of Marks	**Grade**	**Grade Point**
90 and above	A+ - Outstanding	10
80-89	A - Excellent	9
70-79	B - Very Good	8
60-69	C - Good	7
50-59	D - Satisfactory	6
40-49	E - Adequate	5

Below 40	F - Failure	0

Note: Decimal are to be rounded to the next whole number

Grades for the different semesters and overall programme are given based

On the corresponding SGPA/ CGPA as shown below:

SGPA/*CGPA*	**Grade**
Above 9	***A+ - Outstanding***
Above 8, but below or equal to 9	***A - Excellent***
Above 7, but below or equal to 8	***B -Very Good***
Above 6, but below or equal to 7	***C – Good***
Above 5, but below or equal to 6	***D – Satisfactory***
Above 4, but below or equal to 5	***E – Adequate***
4 or below	***F – Failure***

Note: A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 40% are required for a pass for a course.

For a pass in a programme, a separate minimum of Grade E is required for all the individual courses. If a candidate secures **F** Grade for any one of the courses offered in a Semester/Programme only **F** grade will be awarded for that Semester/Programme until he/she improves this to **E** grade or above within the permitted period. Candidate secure **E** grade and above will be eligible for higher studies.

1.10. Detailed Distribution of Courses

PGCSS MSc. In Environmental Science Programme

Sem.	**Core Papers**	**Exam**	**Teaching hours**	**Credits**	**Weightage**	
					Internal	**External**
S1	**Theory**	S1	360	16	1	3
	Practical	S1	45	2		
	Field study	S1	45	1	1	3
S2	**Theory**	S2	360	16	1	3
	Practical	S2	45	2	1	3

	Field study	S2	45	1	1	3
S3	**Theory**	S3	270	12	1	3
	Practical	S3	120	6	1	3
	Field study	S3	60	1	1	3
S4						
	Field study	S4	100	4	1	3
	Dissertation	S5	350	12	1	3
	Viva	S5		4	1	3
	Internship	S5		3		
	Total Credits			80		

1.11. MARKS DISTRIBUTION FOR ENDSEMESTER EXAMINATION AND INTERNAL EVALUATION

Marks distribution for external and internal assessments and the components for internal evaluation with their marks are shown below:

Components of the internal evaluation and their marks are as below.

For all courses Marks of end semester Examination to Marks of internal evaluation : 3:1

Components of Internal Evaluation	**MARKS**
Attendance	**5**
Assignment (Written assignments, preparation of models, charts, posters etc., field survey, field work)	**5**
Seminar/Viva	**5**
Test papers-2	**10**
Total	**25**

All the FOUR components of the internal assessment are mandatory.

Project Evaluation: (Max. marks 350)

Components of Project-Evaluation	Marks

Dissertation	250
Internal	100
Total	**350**

Attendance Evaluation

For all courses without practical

% of attendance	Marks
90 and above	5
85 – 89	4
80-84	3
76-79	2
75	1

(Decimals are to be rounded to the next higher whole number)

1.12. CONDONATION OF SHORTAGE OF ATTENDANCE.

Candidate can seek condonation of shortage of attendance only once in a 2 year course and twice in other courses of longer duration. Following are the rules regarding attendance requirement:-

1. Every candidate is to secure 75% attendance of the total duration of the course.

2. A candidate having a shortage of 10% can apply for condonation of shortage in prescribed form on genuine grounds. Condonation of shortage of attendance if any should be obtained at least 7 days before the commencement of the concerned semester examination.

3. It shall be the discretion of the Principal to consider such applications and condone the shortage on the merit of each case in consultation with the concerned course teacher and HoD.

4. Unless the shortage of attendance is condoned, a candidate is not eligible to appear for the examination.

Grievance Redressal Mechanism

In order to address the grievance of students regarding Continuous internal assessment (CIA) a three-level Grievance Redressal mechanism is envisaged. A student can approach the upper level only if grievance is not addressed at the lower level.

Level 1:

At the level of the concerned course teacher

Level 2:

At the level of a department committee consisting of the Head of the Department,acoordinator of internal assessment for each programme nominated by the HoD and the course teacher concerned.

Level 3:

A committee with the Principal as Chairman, Dean of concerned Faculty, HOD of concerned department and one member of the Academic council nominated by the principal every year as members.

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Syllabus

MSc. Programme in ENVIRONMENTAL SCIENCE

SEMESTER I

COURSE- 1 FUNDAMENTALS OF ENVIRONMENTAL STUDIES

Course Code	
Title of the course	**FUNDAMENTALS OF ENVIRONMENTAL STUDIES**
Semester in which the course is to be taught	Semester I
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE. Aimed at constructing a basis of environmental sciences

4.2. OBJECTIVES OF THE COURSE. To cater the fundamental aspects of ecology

4.3. COURSE DESIGN

Module (1) 15 **HOURS**

Module (2) **15 HOURS**

Module (3) 15 **HOURS**

Module (4) 10 **HOURS**

Module (5) 15 hours

Module (6) 10 hours

Module (7) 10 hours

Course. I. FUNDAMENTALS OF ENVIRONMENTAL STUDIES

Module I. Ecology and Environment 15 hrs.

Physical Environment- biotic and abiotic interactions. Concept of Homeostasis; Concept of habitats and niche, resource partitioning, character displacement. Cybernetic nature of ecosystem, stability through feedback control and through redundancy of components; resistance and resilience stability. Gaia hypothesis. Concept of limiting factors- Liebig's law, Shelford's law. Ecological indicators.

Module II. Ecosystem - Structure and Function 15 hrs.

Landscapes, pathways in ecosystem, energy in the environment-Laws of thermodynamics, energy flow in the ecosystem. Primary productivity, Biomass and productivity measurement. Food chain, food web, trophic levels. Ecological efficiencies, Ecological pyramids, Biogeochemical cycles- patterns and types (CNP). Tropical versus Temperate Ecology.

Module III. Population Ecology 15 hrs.

Population group properties, density and indices of relative abundance, Concept of rate. Natality and mortality. Population age structure, Growth forms and concept of carrying capacity. Population fluctuations, density dependent and density independent controls. Life history strategies, *r & k* selection. Population structure, aggregation, Allee's principle, isolation, dispersal and territoriality. Population interactions- types, positive and negative, interspecific and intraspecific interactions. Ecological and evolutionary effects of competition. Concept of metapopulation. Levin's model of metapopulation. Comparison of Metapopulation and Logistic population model. Metapopulation structure.

Module IV. Community Ecology 10 hrs.

Concept of community - community structure and attributes, ecotone and edge effect. Development and evolution of the ecosystem, concept of climax. Species diversity in community and it's measurement- Alpha diversity, Simpson's diversity index, Shannon index, Fisher's alpha, rarefaction. Beta diversity- Sorensen's similarity index, Whittaker's index, Evenness, Gamma diversity, Guild and its functioning in the community. Drivers of species diversity loss and conservation.

Module V. Resource Ecology and ecosystem monitoring 15 hrs.

Natural Resources: Soil-soil formation, physical and chemical properties of soil. significance of soil fertility. Mineral resources with reference to India. Impact of mining on environment; Forest resources deforestation, forest scenario of India. Aquatic resources - Freshwater and water scarcity, water conservation measures - case studies from India; Wetlands and its importance, international initiatives for wetland conservation - Ramsar sites. Sand mining and its impacts. Wetland reclamation- causes and consequences. Depletion of resources and impacts on quality of life. Energy use pattern in different parts of the world, recent issues in energy production and utilization; Energy audit, Green technology and sustainable development. Ecosystem monitoring- GIS, Physics of remote sensing, role of remote sensing in ecology, GPS and its application; EIA- tools and techniques, Cocept of Ecosystem Modelling.

Module VI. Impacts on environment and ecological manoeuvre 10 hrs.

Environmental Pollution-types, causes and consequences. Concept of waste, types and sources of solid wastes including e-waste; Environmental biotechnology and solid waste

management- aerobic and anaerobic systems. Concept of bioreactors in waste management. Liquid wastes and sewage. Bioremediation- need and scope of bioremediation in cleaning up of environment. Phytoremediation, bio-augmentation, biofilms, biofilters, bioscrubbers and trickling filters. Radiation Biology - natural and man-made sources of radioactive pollution; radioisotopes of ecological importance; effects of radioactive pollution; nuclear disasters (two case studies), Disposal of radioactive wastes. Toxicology- Principles, toxicants- types, dose and effects, toxicity of heavy metals. Global environmental problems and debates - past and present.

Module VII. Conservational ecology 10 hrs.

Principles and major approaches to conservation and environmental management. Role of UN-conventions, protocols; Climate change and the emerging discussions – mitigation and adaptation; Role of UNFCC and IPCC. Country specific laws- mention major environmental/ conservation laws and rules in India-Wildlife Protection Act 1972 amended 1991, Forest Conservation Act, 1980, Air (Prevention and Control of Pollution) Act 1981, Water (Prevention and Control of Pollution) Act 1974, amended 1988, The Environment Protection Act, 1986 and Rules, 1991. The Biological Diversity Act 2002, Rules 2004.Restoration Ecology- need and policies, case studies and success stories - global and national; Participatory resource management, community reserves, sacred groves, biovillages. Role of Intergovernmental and Non-governmental organizations in conservation-IUCN,WCMC,WRI, WWF, CI and Green Peace. National and Local NGOs**.**

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Misra, S P and Pandey S. N.2009. *Essential Environmental Studies.* Ane BooksPvt. Ltd.

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Odum E P (1983), Basic Ecology, Saunders College Publishing, Philadelphia

COURSE- 2 RESEARCH METHODOLOGY I

Course Code	
Title of the course	**RESEARCH METHODOLOGY I**
Semester in which the course is to be taught	Semester I
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE. Aimed nurturing with state of art methods of statistical analysis

4.2. OBJECTIVES OF THE COURSE. To equip them to do research applying statistics.

4.3. COURSE DESIGN

Module (1) 12 **HOURS**

Module (2) **8 HOURS**

Module (3) 13 **HOURS**

Module (4) 7 **HOURS**

Module (5) 16 hours

Module (6) 8 hours

Module (7) 14 hours

Module (8) 12 hours

Course II RESEARCH METHODOLOGY I

Module 1.Basics of Biostatistics 12 hrs.

Steps in Statistical Investigation, Data and Variable (Collection, Types, Sources). Population, Sample, Sampling Methods (Random, Cluster, Stratified and Geographical) and Sampling Errors/Bias. Organization of Data - Editing, Classification, Tabulation (forming a frequency distribution from raw data and types and characteristics of a Frequency table). Presentation of Data - Types and Characteristics of Tables and Visual aids – Graphs, Charts, Diagrams, Flow charts, Cartographs. Statistical Analysis Tools - Parametric and Non-Parametric; Bivariate and Multivariate Analysis. Interpretation and Forecasting.

Module II. Measures of Central Tendency 8 hrs.

Introduction, Characteristics, Merits and Demerits of Mean, Median and Mode. Calculations/Problems for different data (raw, frequency table).
Harmonic and Geometric Mean (Brief account only).

Module III. Measures of Dispersion 13 hrs.
Introduction, Characteristics, Merits and Demerits of Range, Quartile Deviation, Mean Deviation and Standard Deviation. Calculations/Problems for frequency table.
Standard Error and Relative Measures of Dispersion, Skewness and Kurtosis (Brief account only).

Module IV. Correlation Analysis 7 hrs.
Correlation - types and methods of correlation analysis, Problems for Karl Pearson's correlation coefficient and Spearman's rank correlation.

Module V. Regression Analysis 16 hrs.

Regression and Line of Best Fit , Types and methods of regression analysis.
Graphic Methods (Scatter method, Curve fitting). Algebraic method (Fitting of strait line through regression equation). Probit Analysis (Brief account only), Mathematical Models in Biology (Brief account only). Length - Weight Relationship. Von- Bertalanffy's Growth (VBG) Model.

Module VI. Theory of Probability 8 hrs.
Measures of Probability and Theorems in Probability. Probability distributions – Binomial, Poisson and Normal (Brief Account only).

ModuleVII. Testing of Hypothesis 14 hrs.

Hypothesis and types, Confidence Interval, Sampling, Methods and Errors.
Tests of significance (For large and small samples – Critical Ratio and P value). Z Test (Problem for small samples), Chi- Square Test (Problem for 2×2 table only).
Student's 't' test (Problem for small samples comparing mean of two variable).
F-test and Analysis of Variance (ANOVA - One way) (Brief account only).
Non-parametric tests: Mc Nemar and Mann Whitney U test (Brief account only).

Module VIII. Vital Statistics 12 hrs.

Introduction, uses, records and system of classification of vital statistics.
Sample registration system, Sample design, Survey of causes of death and Age classification.
Measures of Vital Statistics and Measures of Population (Mortality rates, Fertility rates). Life tables (Brief account only).

REFERENCES

Bailey,N.T.J. 1994. *Statistical Methods in Biology* (3rdedn). Cambridge University Press.
Chap T.Le.2003.*Introductory Biostatistics*. John Wiley &Sons, NJ, USA.
Daniel, W.W. 2006. *Biostatistics: A Foundation for Analysis in the Health Sciences* (7th edn). John Wiley & Sons, New York.
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Frank, Harry and Steven C. Althoen, 1995. *Statistics: Concepts and Applications*. Cambridge University Press
Pagano, M and K.Gauvreau. 2000. *Principles of Biostatistics*. Brooks/Cole, CA, USA
Prabhakara ,G.N. 2006.*Biostatistics*.Jaypee Bro. New Delhi

Rajathi A. and P. Chandran, 2010. *SPSS for You*. MJP Publishers, Chennai.
Sundar Rao,P.S.S and J.Richard.2006.*Introduction to Biostatistics and Research Methods* (4th edn). Prentice Hall, New Delhi.
Zar, Jerrold H. 2008. *Biostatistical Analysis* (3rdedn.). Pearson Education Inc., New Delhi.

COURSE- 3 RESEARCH METHODOLOGY II

Course Code	
Title of the course	**RESEARCH METHODOLOGY II**
Semester in which the course is to be taught	Semester I
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE. Aimed nurturing with state of art methods of research

4.2. OBJECTIVES OF THE COURSE. To equip them to do research using various methods of research.

4.3. COURSE DESIGN

Module (1) 7 **HOURS**

Module (2) **11 HOURS**

Module (3) 18 **HOURS**

Module (4) 15 **HOURS**

Module (5) 9 hours

Module (6) 7 hours

Module (7) 13 hours

Module (8) 10 hours

Course III RESEARCH METHODOLOGY II

Module I. Science and Life Sciences 7 hrs.

Basic concepts - Knowledge, Information and Data - Science, Pseudoscience.
Life Science - Definition, Laws, Characteristics. Scientific temper, Empiricism, Rationalism and Units of measurements.

Module II. Concepts of Research 11 hrs.

Basic concepts of research -Meaning, Objectives, Motivation and Approaches.
Types of Research (Descriptive/Analytical, Applied/ Fundamental, qualitative/Quantitative, Conceptual/Empirical. Serendipity, Research methods versus Methodology, Research and scientific method. Research Process.

Module III. Research Formulation 18 hrs.

Research formulation -Observation and Facts, Prediction and explanation, Induction, Deduction. Defining and formulating the research problem, Selecting the problem and necessity of defining the problem. Literature review -Importance of literature reviewing in defining a problem, Critical literature review, Identifying gap areas from literature review. Hypothesis - Null and alternate hypothesis and testing of hypothesis.

Module IV. Research Designs 15 hrs.

Research Design -Basic principles, Meaning, Need and features of good design, Important concepts. Types of research designs. Development of a research plan -Exploration, Description, Diagnosis, Experimentation, determining experimental and sample designs. Important experimental designs.

Module V. Sampling 9 hrs.

Definition, purpose, principle advantages of sampling.Unit of sampling, population: techniques, characteristics of good samples, Sampling errors and ways to reduce them.

Module VI. Data Collection. 7 hrs.

Experiments and surveys, Data collection techniques, collection of primary data, data through questionnairs, data through schedules, secondary data, selection of appropriate method for data collection, case study method.

Module VII. Scientific Documentation and Communication 13 hrs.

Research report writing (Thesis and dissertations, Research articles, Oral communications). Project proposal writing Presentation techniques - Assignment, Seminar, Debate, Workshop, Colloquium, Conference. Abstract, synopsis, summary. Referencing methods.

Module VIII. Information Science, Extension and Ethics 10 hrs.

Sources of Information -Primary and secondary sources. Library - books, journals, periodicals, reference sources, abstracting and indexing sources, Reviews, Treatise, Monographs, Patents. Internet -Search engines and software, Online libraries, e-Books, e- Encyclopedia, TED Talk, Institutional Websites. Intellectual Property Rights - Copy right, Designs, Patents, Trademarks, Geographical indications. Safety and precaution - ISO standards for safety, Lab protocols, Lab animal use, care and welfare, animal
houses, radiation hazards. Extension: Lab to Field, Extension communication, Extension tools. Bioethics: Laws in India, Working with man and animals, Consent, Animal Ethical Committees and Constitution.

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Ahuja,V.K. 2007. *Law Relating to Intellectual Property Rights*. Lexis Nexis-Butterworths Wardha,Nagpur.

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COURSE- 4 INFORMATION TECHNOLGY APPLICATIONS IN RESEARCH

Course Code	
Title of the course	**INFORMATION TECHNOLGY APPLICATIONS IN RESEARCH**
Semester in which the course is to be taught	Semester I
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE. Aimed nurturing with state of art methods of Information technology and computer analysis

4.2. OBJECTIVES OF THE COURSE. To equip them to do research applying IT and computer.

4.3. COURSE DESIGN

Module (1) 17 **HOURS**

Module (2) **20 HOURS**

Module (3) 18 **HOURS**

Module (4) 17 **HOURS**

Course IV INFORMATION TECHNOLGY APPLICATIONS IN RESEARCH

Module I. Basics of Computer 17 hrs

Types of Computers. Binary Number System, Digital and Analog systems. Hardware/Software/Firmware. Basics of Computer Functioning- Booting; Formatting; File, File Extensions; Temporary Files; Folder; GUI, Icon; Installation of Programs, Commands, Biossetup, Date and Time, Memory Partitions, Registry, Default Operations; Defragmentation (Brief account only). *Basics of Computers (Characteristics, History and Generations, Components and Organization).*

Module I. Hardware Basics 20 hrs.

Memory -Classification and Types of memory; memory devices; Units.
Input Devices -Types, working and functions. Output Devices –Types, working and functions. CPU components - Processors, Mother boards, SMPS, Accessory Cards – Graphic /Sound/ Networking/ Bluetooth/Wifi (Brief account only). New Generation Computers - Servers, Laptop; Palmtop; Cyborgs; Robotics, Zoobotics (Brief account only).

Module II. Software Basics 18 hrs.

System Software/Operating System -System Files; Working of OS; DOS, Widows, Linux and UNIX (Brief account only). Application Software -Programs and Packages, Calculator, MS Paint, MS Word, MS Excel, MS PowerPoint, Publisher, Acrobat Reader, E Book Reader, Explorer, Photoshop. Virus and Antivirus (Brief account only).
Statistical Software (MS Excel, PH Stat, SPSS). Databases -MS Access (Brief account only).

Module III. Computer Language and Programming 18 hrs.

Computer language -Classification and types, HTML, C and Java Programming concepts - Algorithm, Codes (Brief account only).

Module IV. Networking, Internet and Information Technology 17 hrs.

Computer Communication -Network Topology, Media of networking, Networking Protocols, PAN, LAN, WAN, MAN, INFLIBNET, Modem and Gateway. Internet and Internet Services -World Wide Web, Uploading, Downloading, Hosting, Portal, Search Engines, Firewall. Global Information System -BIOSIS, Medline and Medlars, AGRIS; E Journals and E Books Publishing. Cyber Crime and Cyber Laws (Brief account only).

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Pradeep Sinha and Priti Sinha.2010.*Computer Fundamentals*. BPB Publications., New Delhi
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COURSE V- FIELD STUDY

Study of fresh water ecosystem. On the spot study and make a report.

PRACTICAL I

Study of Pond/ wetland/ River ecosystem- Food web and food chain
(no museum specimen). Record the date, time, methodology, and observations in the record book.
Qualitative and Quantitative study of marine/freshwater planktons.
Estimation of primary productivity.
Quantitative estimation of salinity, phosphates and nitrates in water samples.
Study of pH and conductivity using pH and conductivity meter (2different samples).
Principles and application of the following instruments: Rain Guage, Plankton Net, Secchi Disc, GPS.

Bioinformatics

Data base search and data retrieval-using NCBI, SWISS-PROT, PDB, Expasy.
Methods of sequence alignment-BLAST and ClustalW.
Phylogenetic tree using PHYLIP.
Gene Prediction using GENSCAN/GRAI.
Protein structure visualization using RASMOL.

Biophysics/Instrumentation/Biological Techniques

Micrometry- principle and measurement of microscopic objects: Low power and high power.
Camera Lucida drawing with magnification and scale,Planimetry
Principle and working of phase contrast microscope, micro-photographic equipment and pH meter.
TLC using amino acids from purified samples and biological materials.
Study of Enzyme kinetics - Salivary amylase on maltose standards- influence of temperature and Substrate concentration on enzyme activity (Lineweaver Burk Plot) on enzyme activity.

SEMESTER II

COURSE- 6 TECHNIQUES IN RESEARCH

Course Code	
Title of the course	**TECHNIQUES IN RESEARCH**
Semester in which the course is to be taught	Semester II
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE. Aimed nurturing with state of art laboratory methods in research

4.2. OBJECTIVES OF THE COURSE. To equip them to do research using various techniques of research.

4.3. COURSE DESIGN

Module (1) 10 **HOURS**

Module (2) **14 HOURS**

Module (3)	12 **HOURS**
Module (4)	14 **HOURS**
Module (5)	6 hours
Module (6)	8 hours
Module (7)	4 hours
Module (8)	7 hours
Module (9)	2 hours
Module (10)	13 hours

Course VI TECHNIQUES IN RESEARCH

Module I. Microscopy 10 hrs

Differential Interference, contrast microscopy, Confocal microscope, Electron microscope – TEM, SEM, Scanning Tunnelling and Atomic Force Microscopes.

Module II. Chromatography 14 hrs

Course chromatography, Thin layer chromatography, Ion exchange chromatography. Gel permeation chromatography, Affinity chromatography, Gas chromatography High pressure liquid chromatography (HPLC).

Module III. Electrophoresis 12 hrs

Course electrophoresis, Gel electrophoresis, Polyacrylamide gel electrophoresis (PAGE) – SDS and non SDS , Agarose gel electrophoresis , Disc electrophoresis, High voltage electrophoresis, immunoelectrophoresis, isoelectric focusing.

Module IV. Colorimetry, Spectrophotometry, Spectroscopy 14 hrs

Principle and applications of colorimetry and spectrophotometry and spectroscopy. Flame emission spectroscopy, Atomic absorption spectroscopy, Nuclear Magnetic Resonance spectroscopy (NMR), Circular dichorism spectroscopy, ESR spectroscopy, Mass spectroscopy.

Module V. Centrifugation 6 hrs

Basic principles of sedimentation, Types of centrifuges, Analytical and Preparative centrifugation, Differential and density gradient centrifugation.

Module VI. Radioisotope Detection and Measurement. 8 hrs

Dosimetry: Ionization chamber, GM counter, Solid and liquid scintillation counters, Autoradiography.

Module VII. Nanotechnology. 4 hrs

Introduction to Nanobiology. Nanosensors and Nanomedicines.

Module VIII. Assays. 7 hrs

Radio Immuno Assay, Enzyme Linked Immuno Sorbant Assay (ELISA).

Module IX. pH meter 2 hrs.

Principle and working. Types of pH meters.

Module X. Biological and Histological Techniques. 13 hrs.

Fixation, preparation of temporary and permanent slides, whole mounts, smears, squashes and sections. Specimen preparation for TEM, SEM, shadow casting, freeze fracturing, freeze etching, negative staining. Microphotography. Cytochemical and histological methods- Microtome techniques, fixation, staining. Cytochemistry of nucleic acids, detection of carbohydrates, proteins and lipids.

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COURSE- 7 EARTH AND ATMOSPHERE

Course Code	
Title of the course	**EARTH AND ATMOSPHERE**
Semester in which the course is to be taught	Semester II
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE. Understanding earth and atmosphere

4.2. OBJECTIVES OF THE COURSE. To equip them to know about the earth and atmosphere at depth

4.3. COURSE DESIGN

Module (1)	6 **HOURS**
Module (2)	**6 HOURS**
Module (3)	26 **HOURS**
Module (4)	18 **HOURS**
Module (5)	4 hours
Module (6)	14 hours
Module (7)	16 hours

Course VII EARTH AND ATMOSPHERE

Module 1. Introduction to Environmental Science 6 hrs

Definition, Principle and Scope of environmental Science- its relation to other sciences.

Module II. Earth System and Biosphere 6 hrs

Concept of life and life supporting systems. The origin and structure of earth, primary differentiation and formation of core, mantle, crust, atmosphere and hydrosphere.

Module III. The Physical Environment 26 hrs

Lithosphere - Weathering and soil formation, - soil colloids, adsorption and exchange of anions and cations, role of microbes in soil, types of soil, soil profile, classification of rocks, folds, faults and dykes and other geological formations and their environmental significance. Geomorphological processes-plate tectonics, sea floor spreading, mountain building, evolution of continents and structural deformation.
Atmosphere -Physico-chemical characteristics, divisions, composition and significance of atmospheric components. Hydrosphere -Visible and invisible hydrosphere, Range of aquatic habitats, water cycles between earth and the atmosphere, Global water balance, ice sheets, origin and composition of sea water, sea level changes, River basins and watershed. Physico-chemical characteristics of water- diffusion of
oxygen from the atmosphere to surface waters. Influence of pH, turbidity and light on aquatic life.

Module IV. Weather and Climate 18 hrs

Definitions and scope of climatology, weather and climate, components of climate system, earth's thermal environment, earth intercepts solar radiation, seasonal variation in intercepted solar radiation, air temperature in relation to altitude, global circulation of air masses, wind and earth's rotation on ocean currents, influence of temperature on moisture content of air, global pattern of precipitation , influence of topography on regional pattern of precipitation. classification of climate-Koeppen's classification
and Thornthwaite's scheme, climatic types and zones. Global climatic phenomena-*El Nino* and *La Nina*, causes and factors of climate change. Effect of climate

change on ecosystems and human welfare. Organisms and microclimate.

Module V. Climate of India 4 hrs

Climatic regions of India, tropical monsoon climate-onset, rain bearing systems, break in the monsoon, retreat of monsoon. Monsoon in Kerala, oceanic and continental influence.

Module VI. Landscape Ecology 14 hrs

Land and Landscape processes; Hierarchy: ecosystems to land units; ecological principles at work with Landscapes ; Human dimensions and Land Use in agro-ecosystems, urban ecosystems, rangelands, riparian and wetland systems, coastal and estuarine systems. Concept of ecological land degradation desertification,
water logging, salinisation and soil erosion. Ecological assessment of landscape for vegetation and habitats. Integrated analytical techniques- land suitability analysis and carrying capacity studies; Use of soil survey, aerial photos, topographic maps and other resource data in landscape management; case studies on corridor selection problems.

Module VII. Biological Invasions 16 hrs

Introduction Elton's hypothesis – Invasion patterns and process biological attributes for invasion: Reproductive potential, Allelopathy Phenotypic plasticity, fitness to the new environment. Hypotheses for invasion success: Natural enemy hypothesis evolution of invasiveness hypothesis, empty niche hypothesis, novel weapon hypothesis, turbance hypothesis and Propagule pressure hypothesis. Invasive alien species of India (plants and animals). Databases of biological invasions. Impacts and management of invasions: impacts of exotics on biodiversity, productivity, nutrient cycling. Management: Bio-control programmes, mechanical and chemical control Positive utilization uarantine
and EIA of biological invasion.

REFERENCES

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Williamson, M. 1996. *Biological Invasion*. Chapman & Hall, London.

COURSE- 8 DISASTER MANAGEMENT

Course Code	
Title of the course	**DISASTER MANAGEMENT**
Semester in which the course is to be taught	Semester II
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE. Equip students with knowledge of various natural as well as man made calamities and aware them the methods to overcome or rectify it.

4.2. OBJECTIVES OF THE COURSE. To equip them to know about the various disasters and calamities both manmade and natural and methods to overcome it

4.3. COURSE DESIGN

Module (1) 5 **HOURS**

Module (2) **10 HOURS**

Module (3) 30 **HOURS**

Module (4) 30 **HOURS**

Course XIII DISASTER MANAGEMENT

Module I : Introduction 5 hrs
Introduction to Disaster Management, Distinguishing between an emergency and a disaster situation
Types of natural and non-natural disasters, Implications of disasters on environment ,Environmental Planning and management for environmental hazards

Module II Disaster Management Cycle 10hrs
Introduction, Disaster Management Cycle, Disaster Mitigation ,Mitigation strategies,Hazard identification and vulnerability analysis, Mitigation measures,

Module III: Disaster Preparedness, Response and Recovery 15 hrs
Introduction, Disaster Preparedness, Disaster Risk Reduction (DRR),The Emergency Operation Plan (EOP)
Disaster Response and Recovery, Modern methods of disaster response, The Recovery Plan.

Module IV: Disaster Education and Public Awareness 30 hrs
Community-based Initiatives, Stakeholders' Roles and Responsibilities, Categories of stakeholders
Government, Non Government Organisations (NGOs),Regional and International Organizations / Donor Agencies, Island Councils / Local Government, Community Workers, National and Local Disaster Managers, Trainers, Policy Makers and Grass-roots people, Advantages and Disadvantages of the Community-Based Approach, Duties of Response Personnel, Pre-Disaster Mitigation Plan, Hazardous Materials, Ways of storing and safely handling hazardous materials, Opportunities and regional planning for hazard management.

Module V The Role of Technology in Disaster Management 30 hrs
Geographic Information Systems (GIS) and Disaster Management, Remote Sensing and Disaster Management, The Role of Media in Disaster Management,

Unit VI Physical and Socio-economic Impacts of Disasters,
Disaster Associated Health Issues, Emergency Health Services in Disasters, Infrastructure and procedures in accessing emergency situations, Communicable diseases common in disaster situations Monitoring and Evaluation of Communicable Diseases Control, Programme Disaster and Development The impact of disasters on development programmes, Vulnerabilities caused by development

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Edward Bryant (2004), Natural Hazards

Embard Haque C (2005) Mitigation of Natural Hazards and DisastersNatural

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Delhi.

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Sumit Malhotra,(2005) Natural Disaster Management. Aavishkas Publishing,

Jaipur

William J Petals et al.(1982)Natural Hazard Risk Assessment and Public Policy,

Springer-verlag ,New York

Introduction to Disaster Management, Course Manual. Virtual University for

Small States of the Commonwealth (VUSSC).Disaster Management. Version 1.0

Course IX REMOTE SENSING AND GIS

Course Code	
Title of the course	**REMOTE SENSING AND GIS**
Semester in which the course is to be taught	Semester II
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE. students are known to the use of remote sensing and GPS in studying environment and environmental changes.

4.2. OBJECTIVES OF THE COURSE. To equip them to know about the techniques and benefits of remote sensing and GPS

4.3. COURSE DESIGN

Module (1) 28 **HOURS**

Module (2) **4 HOURS**

Module (3) 21 **HOURS**

Module (4) 12 **HOURS**

Module (5) 25 hours

Course IX REMOTE SENSING AND GIS

Module I: Fundamentals of Environmental Appraisal Tools 28 hrs

1.1 Scales

 Definition, types of scales, representation and conversion (introduction only)

1.2 Maps

Definition and classification, Map conversions (Grids, Contours, Isobars, Etc), Measurements of area and distance (Square and Plannimeter Methods)

1.3 Topographical Maps, Cadestral maps, Toposheets (Interpretation and studies)

1.4 Surveying

Definition and classification, Survey instruments (Introduction to Compass, Theodolite, Clinometer, Abeny Level, Cartographic equipments), Preparation of maps (Basics of cartography)

1.5 Photogrammetry

Definition and types (Aerial and terrestrial photographs), Method and equipments used in Aerial Photo Interpretation (Introduction only)

Module II: **Remote Sensing: Introduction 4 hrs**

Definition, History and Scope of Remote Sensing, Principles and concepts of Remote Sensing Meaning and Scope of remote Sensing, Indian Remote sensing Programmes

Module III: **Remote Sensing : Application 21 hrs**

Electromagnetic Spectrum, Sensors and Platforms, Types of platforms, scanners and data products Image processing, Photo-interpretation and Photogrammetry, Applications of remote Sensing. Electromagnetic spectrum; spectral characteristics of surface features (rocks, soils, vegetations, water). Space Imaging Landsat, SPOT, IRS, NOAA, Seasat, ERS, RADARSAT, INSAT. Satellites and their sensors, geometry and radiometry, Digital Image Processing: Principles, Image Rectification and restoration, Image enhancement and Mosaicing. Image classification. Supervised, Unsupervised, Ground truth data and training set manipulation, Classification accuracy assessment.

Module IV: **Geographical Information System (GIS) – I 12 hrs**

History and Development, Concepts, Components and Organisation of GIS, Introduction to mapping and GIS, Remote Sensing, GPS and GIS.

Module V:Geographical Information System (GIS) – II 25 hrs

Fundamentals of computing GIS, Theory of GIS, Spatial Data concepts, Processing and visualization, Information analysis and digital data processing, Introduction to GIS packages, Raster and vector data, Map projection, Topology creation, Overlay analysis, Data structure and Digital cartography; Software used in GIS Surveying: Leveling, Triangulation, Geodetic survey; Global Positioning System (GPS) Basic principles, Applications to environmental studies, Geographical analysis.

REFERENCE

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Rao, D.P (Ed).1998. *Remote Sensing for Earth Resources*. Association of Exploration Geophysicist, Hyderabad.
Schowengerdt, Robert A. (2007). Remote sensing: models and methods for image processing (3rd ed.). Academic Press

COURSE X- FIELD STUDY

Study of marine ecosystem. On the spot study and make a report.

PRACTICAL II

Map conversions (Grids, Contours, Isobars, Etc), Measurements of area and distance (Square and Planimeter Methods).
Separation and identification of soil arthropods using Berlese funnel.
Soil texture using micrometry from two different sites.
Determination of moisture content.
Determination of soil pH from at least three different locations and correlate it with the soil type.
Determination of soil organic carbon and chlorides.
Study of soil profile.
Study of soil types.
Study of soil micrometry.
Isolation and Enumeration of microorganisms in soil (TBC or TMC).
Bacteriological quality testing of water and wastewater.
(a). Presumptive coliform test
(b). Confirmatory coliform test

SEMESTER III

Course XI ENVIRONMENTAL POLLUTION AND TOXICOLOGY

Course Code	
Title of the course	**ENVIRONMENTAL POLLUTION AND TOXICOLOGY**
Semester in which the course is to be taught	Semester II
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE Impart students with knowledge of various environmental pollution and toxicology and make aware them the methods to overcome or rectify it.

4.2. OBJECTIVES OF THE COURSE. To equip them with the knowledge of preventing pollution.

4.3. COURSE DESIGN

Module (1) 3 **HOURS**

Module (2) **12 HOURS**

Module (3) 15 **HOURS**

Module (4) 10 **HOURS**

Module (5) 15 hours

Module (6) 07 hours

Module (7) 08 hours

Module (8) 20 hours

Course XI ENVIRONMENTAL POLLUTION AND TOXICOLOGY

Module I. Introduction 3 hrs.

Brief history of human civilization, industrialization and urbanization. Definition of pollution. Different types of pollution- Air, Water and soil and their local, regional and global aspects.

Module II. Air Pollution 12 hrs.

Sources and classification of air pollution ; particulates and gaseous pollutants in the atmosphere. Primary and secondary pollutants. Effects of air pollutants on human health, animals, vegetation, materials and structures. Air pollution monitoring - methods, air quality standards; ISI, EPA. Sampling and measurement of particulate matters (SPM) - gaseous pollutants, $C0_2$, CO, NO_x, $S0_2$, H_2S, oxidants, ozone and hydrogen fluoride.
Control of gaseous emission: adsorption by liquids, adsorption by solids, combustion and condensation. Control of $S0_2$, NO_x, CO, CO_2 and hydrocarbons.

Module III. Water Pollution 15 hrs.

Sources of water pollution-Domestic (municipal sewage), industrial and agricultural. Health effects of water pollution. Water borne and water related diseases. Effects of water pollution on aquatic system. Water quality standard for potability - Pollution parameters, BOD, COD, Coliform bacteria. Treatment of water for potable purpose (mixing, sedimentation, coagulation, filtration and disinfection) Primary and secondary treatment. Sludge disposal. Biological treatment: Kinetics of Biological growth - activated sludge treatment - trickling filters - anaerobic digestion, combined aerobic and anaerobic treatment process, aerobic process. Advanced waste water treatment - removal of dissolved organics and inorganic - precipitation, iron exchange, reverse osmosis, electro dialysis, adsorption and oxidation. Removal of nutrients. Removal of heavy metals - overall waste water treatment for sewage water. Water pollution treatment using constructed wetlands Bioremediation; traditional water purification techniques.

Module IV. Soil Pollution 10 hrs.

Sources of soil pollution; - agricultural, industrial and domestic. Hazardous waste compounds, formulations and classes of substances, chemical classification of hazardous waste. Soil factors affected by pollution – physico-chemical and biological impacts. Case studies on soil pollution in wetland and Highland soils in Kerala. Control of soil pollution. Soil quality parameters and test methods.

Module V. Solid Waste Management 15 hrs

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Municipal solid wastes (MSW) - quantities and characteristics, waste collection and transport, waste processing and resources recovery and recycling. Aerobic and anaerobic systems-composting, vermicomposting; Biodigesters (Biogas plants); incineration, pyrolysis, plasma pyrolysis; sanitary land fills and open dumping yards. Management of plastic and e-waste. Better management strategies (any two model case studies). Treatment process for unsegregated waste, fixation of hazardous solid
waste prior to disposal, hazardous waste in land fill. Hazardous waste (Management and Handling) Rules 1989 - the Manufacture Storage and Import of Hazardous Chemicals Rules 1989 - Biomedical Waste (Management and Handling) Rules 1998 -
Plastic Act 1999. Extended producer responsibility.

Module VI. Noise, Thermal and Oil Pollution 7 hrs.

Properties of sound and noise. Effects of noise on People and ecosystem. Basic principles of noise control. National and International Standards. Assessment and measurement of sound.

Thermal Pollution-causes and consequences Oil pollution – causes and consequences (any two case studies).

Module VII. Radiation Pollution 8 hrs.

Radiation pollution- Definition, Radioactivity, Radionuclide, Radiation emissions, sources, Radioactive decay and buildup. Biological effects of radiation. Radioactive pollution impacts on ecosystem. Nuclear reactor disasters (Any two case studies), safety standards.

Module VIII. Toxicology 20 hrs.

Definition, scope and history of toxicology, Acute and chronic toxicity, selective toxicity, dose, synergism and antagonism. Dose – Response relationships – Graded response, quantal response, Time action curves, Threshold Limit value (TLV); LC_{50}; Margin of safety; Toxicity curves; Cumulative toxicity and LD_{50} and CTF. Toxic chemicals in the Environment – Biochemical aspects of As, Cd, Pb, Hg, Cu, O_3, PAN, pesticides,
MIC and other carcinogens. Bio accumulation and biomagnification. Occupational toxicology-hazardous chemicals, disorders from chemical exposure at work, assessment of occupational hazards. Toxicity testing; Bioassay – Definition, purpose, criteria for selection of test organism, methodology, estimation of LC_{50}, Limitation and importance of bioassay, acute toxicity (single); sub acute toxicity; chronic toxicity; teratogenicity, carcinogenicity and mutagenicity. Bio-monitoring of toxic chemicals - objectives, programs and parameters, concepts of bio indicators. Bio-transformation of Xenobiotics (Selective Toxicity).

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APHA-AWWA-WPCF, 1989. *Standard Methods for the Examination of water and Waste water*. (17_{th} edn.). Publishers.
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Publications (P) Ltd. New Delhi
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Course XII ENVIRONMENTAL MONITORING AND MANAGEMENT

Course Code	
Title of the course	**ENVIRONMENTAL MONITORING AND MANAGEMENT**
Semester in which the course is to be taught	Semester II
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE. Impart students with knowledge of various environmental monitoring and management methods.

4.2. OBJECTIVES OF THE COURSE. To equip them to monitor and manage environment

4.3. COURSE DESIGN

Module (1) 20 **HOURS**

Module (2) **25 HOURS**

Module (3) 20 **HOURS**

Module (4) 10 **HOURS**

Module (5) **15 hours**

Course XII ENVIRONMENTAL MONITORING AND MANAGEMENT

Module I. Environmental Management 20 hrs.

Basic principles: Management of physical, social, and economic environment. Concepts and scope of environmental planning, regional planning and management. Cost-benefit analysis and Resource economics. Environmental modeling- simulation modeling, input-output modeling, Linear programming, Software and resource management. Tool box for environmental management – An over view of Ecological foot prints, SEA, Ecological Economics, conflict resolution strategies. Eco funds. Environmental auditing and standards Eco labeling and certification, accreditation – need, objectives and benefits; Corporate social responsibility and Corporate environmental responsibility, ISO standards for environmental management systems (EMS) ISO 14000, 14001 and 26001; OHSAS 18001.

Module II Ecosystem Management 25 hrs.

An overview Population, Resources and ecosystem management Exponential growth in human numbers and the implications. Major management concepts and methodologies The five basic laws of Ecology and their relevance for ecosystems management; paradigm shifts in the management of Ecosystems- influence of economics in ecology.

Management practices for various ecosystems: grasslands, forests, mountains, wetlands and coastal areas. Environmental planning and management of – waste lands, reclaimed lands, mining areas, human settlements, industrial lands and agricultural lands. Eco restoration/remediation; local knowledge and management systems; environmentally sound management of Biotechnologies; the common property resources and their management.

Module III. Environmental Impact Assessment (EIA) 20 hrs

Introduction- Definition, history, Aim, principles, concept and scope. Baseline data collection, Methods and steps - Adhoc method, checklist method, matrices, Map overlays method, network method, index method. Impact assessment and impact evaluation-E1A Processes, Stages, E1A Statement Environment management plan- Risk assessment and disaster management programme. National Policy on EIA and
Regulatory Framework: Environmental Impact Assessment Notification 2006 and Coastal Zone Notification
1991; Environmental Clearance Process in India; Legislative requirements (discharge requirements and area restrictions); Environmental Appraisal procedure for mining, industrial , thermal power, nuclear power and multipurpose river valley projects; Central and state pollution control boards for environmental protection. EIA case studies. Life Cycle Assessment (LCA) and its significance.

Module IV. Environment Vs Development 10 hrs

Dominance of Man on earth. Limits of growth. Industrial revolution and resource utilization, environmental consequences. Modern agriculture and green Revolution- environmental impacts. Conflicts of interest - environment and development. Tragedy of the commons.

Module V. Sustainable Development 15 hrs

Our common future and the idea of Sustainable Development - concepts and dimensions. Basic needs- Imperatives relating to sustainable development. Johannesberg Conference 2002 and follow up Conference on sustainable development. Securing Sustainable futures Millennium Development Goals and Strategies (MDG & S); the earth charter; need and scope for evolving participatory, community based environmental management strategies. Education for sustainability. Building sustainable societies and lifestyles. Ecological Foot Print analysis and its significance. Environmental concerns in traditional societies, Gandhian environmentalism.

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Web Resources

www,moef.gov.in (of Ministry of Environment and Forests, Govt. of India)
www.millenniumassesment.org. (for Millennium Ecosystem Assessment Synthesis Reports)
www.unep.org

Course XIII BIODIVERSITY , CONSERVATON AND SOCIAL ISSUES

Course Code	
Title of the course	**BIODIVERSITY , CONSERVATON AND SOCIAL ISSUES**
Semester in which the course is to be taught	Semester II
No. of credits	4
No. of contact hours	90

4.1. COURSE AIM/RATIONALE. Impart students with knowledge of various natural animal resources and the need of their conservation and conservation methods.

4.2. OBJECTIVES OF THE COURSE. To equip them to conserve animal resources

4.3. COURSE DESIGN

Module (1) 15 **HOURS**

Module (2) **10 HOURS**

Module (3) 15 **HOURS**

Module (4) 25 **HOURS**

Module (5) 25 hours

Course XIII BIODIVERSITY , CONSERVATON AND SOCIAL ISSUES

Module I Biodiversity 15 hrs

Introduction – Definition: genetic, species and ecosystem diversity Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values, Biodiversity at global, national and local levels, India as a mega-diversity nation, Hot-spots of biodiversity,threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India .

Module II Concepts and Patterns of Biodiversity 10

Biodiversity-. Types of biodiversity-wild biodiversity, agro-biodiversity, domesticated biodiversity. Values of biodiversity, ecosystem functions and biodiversity, mobile links and valuating ecosystem services. Drivers of biodiversity loss.
Tools and techniques for biodiversity estimation- biodiversity indices.

Module III Conservation Biology 15

Introduction, Origin, concepts and definition of conservation biology, Fitness and Viability of Population, Minimum Viable Population, Heterozygocity and Fitness, Pattern of Diversity and Rarity, including Endemism, Habitat Fragmentation and its effects, Community processes

Community Stability and Structure, Co-adaptation and co-evolution (plant and animal interactions-basic, concepts only), Keystone Species and Dominant species, Infectious diseases and conservation biology, Conservation of Habitats, Threats and management of habitats, Theory and practice of conservation (basics only), Restoration, reclamation and regeneration of habitats (measures and steps introduction only).

Module IV Conservation strategies 25

In-situ conservation: sanctuaries, biospheres reserves, national parks, nature reserves, preservation plots. *Ex-situ* conservation: botanical gardens, zoos, aquaria, homestead garden; herbarium; *In-vitro* Conservation: germplasm and gene bank; tissue culture: pollen and spore bank, DNA bank. GEF-World Bank initiatives. Biodiversity hotspots and their characteristics, global distribution. CBD, IPRs, National and international programmes for biodiversity conservation. CITES and TRAFFIC. National Board of Biodiversity, State Board of Biodiversity. Ecosystem people and traditional conservation strategies; People's participation in conservation-PFM, community reserve and People's Biodiversity Register (PBR). Biodiversity Management Committee (BMC). Wildlife values and eco-tourism, wildlife distribution in India, problems in wildlife protection-Policies and programmes. Threatened animals of India.

Module V Social Issues and the Environment 25hrs

From unsustainable to sustainable development · Urban problems and related to energy, Water conservation, rain water harvesting, watershed management · Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. · Waste land reclamation· Consumerism and waste products, Environmental Protection Act· Air (Prevention and Control of Pollution) Act· Water (Prevention and control of Pollution) Act , Indian Biodiversity Act 2002 and laws· Wildlife Protection Act, Forest Conservation Act· Issues involved in enforcement of environmental legislation· Public awareness

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Tyler Miller, G Jr, 2005. *Advantage Series: Sustaining the Earth An Integrated Approach* (with CD ROM and Info Trac). 7th Edition., Thomson/Brooks Cole, USA.

UN General Assembly.2010. *Keeping the promise: a forward-looking review to promote an agreed action agenda to achieve the Millennium Development Goals by 2015.* Report of the Secretary General.

COURSE XIV- FIELD STUDY

Study of wetland and mangrooves ecosystem. On the spot study and make a report.

PRACTICAL –III

Determination of Chloride, Calcium, Magnesium, Potassium and Phosphorous.
Determination of Calcium Carbonate in Egg shell- (Three different types of egg; calculate the mean
value and the standard deviation, and compare it with the standard values).
Estimation of primary productivity in two different aquatic ecosystems and interpretation of the results.
Compare the results of Dark and Light bottle method and Chlorophyll method.
Identification of trophic levels from gut analysis (Fish or insect)
Study of biodiversity in Forest/Grass land and Pond/River and report the species richness, abundance and animal interactions. Calculate frequency, abundance, eveness and diversity indices

PRACTICAL-IV

Water Quality Analysis:
a. Determination pH, Electrical conductivity, Alkalinity, Salinity, Hardness, Nitrate, Phosphate
and Silica
b. Determination of total dissolved salts (TDS)
Toxicity Analysis of Water: For Chlorine, H_2S, Ammonia, Copper and Chromium
Estimation of BOD and COD of polluted water
Determination of LC_{50} for fish (pesticide) using Probit analysis (use of appropriate software is suggested to find out the value)
Study of histo-pathological changes in any two of the tissues (Liver/ Kidney/ Gonad) using CCl_4
or NH_3 (five stained permanent slides [normal and affected] to be submitted for the examination).

SEMESTER IV

XV DISSERTATION : Major Research Project

XVI FIELD STUDY

XVII INTERNSHIP

MSc IN ENVIRONMENTAL SCIENCE

SACRED HEART COLLEGE (AUTONOMOUS), THEVARA, KOCHI

SYLLABUS

SEMESTER I

Course I- FUNDAMENTALS OF ENVIRONMENTAL SCIENCE.

Course II -RESEARCH METHODOLOGY I

Course III- RESEARCH METHODOLOGY II

Course IV -INFORMATION TECHNOLGY APPLICATIONS IN RESEARCH
Course V -FIELD STUDY

PRACTICAL- I

SEMESTER II

Course VI- TECHNIQUES IN RESEARCH

Course VII- EARTH AND ATMOSPHERE

Course VIII- DISASTER MANAGEMENT

Course IX - REMOTE SENSING AND GIS

Course X- FIELD STUDY

PRACTICAL- II

SEMESTER III

Course XI -ENVIRONMENTAL POLLUTION AND TOXICOLOGY

Course XII ENVIRONMENTAL MONITORING AND MANAGEMENT

Course XIII- BIODIVERSITY, CONSERVATON AND SOCIAL ISSUES

Course XIV-FIELD STUDY

PRACTICAL- III

PRACTICAL- IV

SEMESTER IV

COURSE XV- MAJOR STUDENT PROJECT

Course XVI-FIELD STUDY - Forest ecosystem

Course XVII INTERNSHIP

Abstract of the Programme

	Code	Course	Hours/ Week	Marks		Total Hours	Credit
				Internal	External		
Semester 1		Fundamentals of Environmental Science	5	25	75	90	4
		Research Methodology I	5	25	75	90	4
		Research Methodology II	5	25	75	90	4
		Information Technology Applications in Research	5	25	75	90	4
		Practical 1- Environmental Biology, Biostatistics, Computer Application and Research Methodology	5	25	75	45	2
		Field Study - Fresh water ecosystem	-	25	75	45	1
		Total	**25**	**150**	**450**	**450**	**19**
Semester 2		Techniques in Research	5	25	75	90	4
		Earth and Atmosphere	5	25	75	90	4
		Disaster Management	5	25	75	90	4
		Remote Sensing and GIS	5	25	75	90	4
		Practical 2- Techniques in research, geology, GIS and remote sensing	5	25	75	45	2
		Field Study - Marine Habitat		25	75	45	1
		Total	**25**	**150**	**450**	**450**	**19**
Semester 3		Environmental Pollution and Toxicology	5	25	75	90	4
		Environmental monitoring and Management	5	25	75	90	4
		Biodiversity, Conservation and Social Issues	4	25	75	90	4
		Practical 3 -Pollution and Toxicology	3	25	75	60	3
		Practical 4 – Biodiversity	4	25	75	60	3
		Field study-Wetland and Mangroves ecosystem	-	25	75	60	1
		Total	**25**	**150**	**450**	**450**	**19**
Semester 4		**Dissertation**	-	100	250	350	12
		Field Study- Forest ecosystem	-	50	150	100	4
		Viva voce	-	-	150	-	4
		Internship	-	-	-	-	3
		Total	**25**			**450**	**23**
		Grand Total		**600**	**1900**		**80**

4

PATTERN OF QUESTIONS

Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set. He/She shall also submit a detailed scheme of evaluation along with the question paper.

A question paper shall be a judicious mix of short answer type, short essay type /problem solving type and long essay type questions.

Pattern of questions for external examination for theory paper without practical.

	Total no. of questions	Number of questions to be answered	Marks of each question	Total marks
	12	10	2	20
	8	5	5	25
	3	2	15	30
TOTAL	**23**	**17**	x	**75**

5

Model Question paper

Course. I. FUNDAMENTALS OF ENVIRONMENTAL STUDIES

Total Hours: 3 **Total Marks: 75**

Section A

Answer any ten (2 marks each)

1. Comment on Gaia hypothesis.
2. Explain Alpha diversity.
3. Comment on species richness.
4. What is carrying capacity?
5. What are ecological indicators?
6. What is green ecology?
7. Explain biofilms and biofilters.
8. Define energy audit.
9. What are electrostatic precipitators?
10. Comment on the significance of red data book.
11. What are radionuclide?
12. Comment on environmental inventory.

Section B

Answer any five (5 marks each)

13. Explain the concept of metapopulation.
14. Evaluate Sorensen's similarity index.
15. Write brief notes on biogas as an ecofriendly fuel.
16. Explain climate change.
17. What is participatory resource management. Explain with examples.
18. Describe briefly the environmental protection act.
19. Explain bioremediation and its applications.
20. Write briefly on energy resources.

Section B

Answer any two (15 marks each)

21. Enumerate the various environmental conservation and protection laws. Evaluate its relevance, implications and applicability.
22. Discuss the global environmental issues and mitigation - present and past.
23. What are resources? Give examples and discuss the challenges.

Course II- RESEARCH METHODOLOGY I

Total Hours: 3 **Total Marks: 75**

Section A
Answer any ten
(2 marks each)

Explain the following

1. Non parametric tests
2. Harmonic mean and geometric mean.
3. Probit analysis.
4. Skeweness
5. VBG model.
6. Cartogram.
7. Range.
8. Null and alternative hypothesis.
9. Linear correlation.
10. Mutually exclusive events
11. Pie diagram
12. Scatter diagram

Section B
Answer any five (5 marks each)

13. With an illustration explain discrete and continuous data.
14. Explain (I) addition theorem (II) multiplication theorem of probability.
15. Write the properties of a Binomial distribution and Poisson distribution.
16. Explain sampling error. Derive the equality of two population means for small sample sizes
17. Define Vital statistics. Mention its uses
18. Calculate arithmetic mean for the following data

0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
4	6	5	10	5	5	10	20

19. Find the regression of X on Y from the following data
    $\Sigma x=24\ \Sigma y=44\ \Sigma xy=306\ \Sigma x2=164\ \Sigma y2=574\ N=4$
    Also, find the value of x when y=6
20. Determine the equation of a straight line which best fits the data.

X:	10	12	13	14	17	20	25
Y :	10	22	24	27	29	33	37

Section C
Answer any two (15 marks each)

21. (a)Explain the term correlation between two variables? What are the properties of correlation. Define Karl Pearson correlation coefficient?
    (b) Calculate Karl Pearson's coeffieient of correlation.

Fertilizer used (X)	15	18	20	24	30	35	40	50
Productivity(Y)	85	93	95	105	120	130	150	160

22. (I)Explain Mc Nemar and Mann Whitney U test (ii)Give a brief account of analysis of one way classified data

23. (a) Explain Chi square test
    (b) A certain drug was administered to 500 people out of a total of 800 to test the efficacy against typhoid. The results are given below

	Typhoid	No Typhoid
Drug	200	300
No Drug	280	20

On the basis of the data, can it be concluded that the drug is effective in preventing typhoid. (Given $\chi^2_{0.05} = 3.84$)

Course III- RESEARCH METHODOLOGY II

Total Hours: 3 **Total Marks: 75**

Section A

Answer any ten
(2 marks each)

1. Comment on workshop, colloquium and seminar.
2. Write short notes on science and scientific temper.
3. What is randomized block design?
4. What is null hypothesis?
5. Differentiate basic and applied research.
6. What is empirical research and serendipity?
7. What is cohort study?
8. Comment on animal ethics in research.
9. Write the importance of on line library in research.
10. Comment on sampling errors.
11. Differentiate abstract and synopsis.
12. What is trade mark?

Section B

Answer any five (5 marks each)

13. What is hypothesis? Explain different types of hypothesis. And testing of hypothesis.
14. Explain the importance of literature reviewing in research. What are the sources of literature?
15. What are the different presentation techniques? Expalin.
16. What are the different methods of referencing? Write its importance in research publications.
17. What is data collection ? Explain briefly the different techniques in data collection.
18. What is sampling? What are the characteristics of good sample?
19. What is research publication? Explain the different types research publications.
20. Explain briefly the different types of research.

Section C

Answer any two (15 marks each)

21. What is research design? Explain in detail the types of research design.
22. Explain research process.
23. What is the importance of funding in research? Explain project proposal construction.

Course IV- INFORMATION TECHNOLGY APPLICATIONS IN RESEARCH

Total Hours: 3 **Total Marks: 75**

Section A

Answer any ten (2 marks each)

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1. Define any three input devices and any three output devices.
2. Discuss about formatting.
3. Define GUI and its advantages.
4. Explain the terms Hardware, Software and Firmware.
5. Explain about Bluetooth and Wifi.
6. Explain client and server with examples.
7. What is data communication and different media available in communication?
8. Differentiate between E-Journal and E-Book.
9. What is Binary Number System, Digital and Analog system?
10. What is the need of protocol? Which are the types of protocols?
11. Discuss briefly about different CPU components.
12. What is modem and gateway?

Section B

Answer any five (5 marks each

13. Define types of computers.
14. What are the similarities and differences between RAM, ROM, and hard drives?
15. Illustrate the functional diagram of computer and explain the functions of eachcomponents.
16. What is application software? Explain briefly about different types of application software.
17. Define the terms Search Engines and Firewall.
18. What is topology? Discuss about different types of topology.
19. Differentiate between LAN, MAN and WAN.
20. What is cybercrime and how to prevent?

Section C

Answer any two (15 marks each)

21. Differentiate between system software and operating system. What are the functions of OS and give different types of OS available?
22. Explain computer language, its classification and types. Define the language HTML, C and Java with codes.
23. Define Internet and its services. Define WWW, uploading, downloading, and hosting.

Course VI- TECHNIQUES IN RESEARCH

Total Hours: 3 **Total Marks: 75**

Section A

Answer any ten (2 marks each)

1. Define paper chromatography.
2. Expalin the term electrophoretic mobility.
3. Write the principle of flame photometry.
4. Write notes on beam spectrometry.
5. Explain preservation .
6. What is ELIZA?
7. Comment on micrometry.
8. What is dosimetry?
9. What is disc electrophoresis?
10. What is shadow casting?
11. What is meant by Alizarin preparation?
12. Write the Applications of autoradiography.

Section B

Answer any five (5 marks each)

13. Explain the instrumentation and application of camera lucida. Write the principle and application of electron microscopy.
14. What are the advantages and disadvantages of liquid scintillation counter?
15. Write the principle and working of spectrophotometer.
16. What is RIA? Explain the process in brief.
17. Discuss the cytochemical methods for the detection of lipids.
18. Write notes on Polyacrylamide gel electrophores.
19. Explain the principle of ion exchange chromatography

Section C

Answer any two (15 marks each)

20. Explain GM counter, its working applications.
21. Describe the principle, procedure and applications of HPLC technique.
22. What technique will you choose to separate protein molecule of molecular weight of ten thousand Daltons. Explain the procedures involved in the technique.

Course VII- EARTH AND ATMOSPHERE

Total Hours: 3 **Total Marks: 75**

Section A

Answer any ten (2 marks each)

1. What is weathering?
2. Define climatology.
3. Differentiate weather and climate.
4. What are soil colloids?
5. Differentiate river basin and water sheds.
6. Comment on El nino and La nina.
7. Explain the characteristics of stratosphere.
8. What re topographical maps?
9. Mention two roles of microbes in soil.
10. What is soil profile? How does it vary?
11. What is gleization?
12. What is microclimate?

Section B

Answer any five (5 marks each)

13. Write notes on urban climatology.
14. Explain the process of soil formation.
15. Explain the effect of climate change on ecosystem.
16. Describe the physicochemical characteristics of estuaries.
17. Explain the structure of atmosphere.
18. Explain phenotypic plasticity and Elton's hypothesis
19. What is wetland system? Briefly explain importance and types of wetlands.
20. What are the chemical properties of soil?

Section C

Answer any two (15 marks each)

21. Explain classification of climate with special reference to Koeppen's and Thornthwaite's shemes.
22. Explain the physicochemicall characteristics of lithosphere and hydrosphere.
23. Describe human dimensions and land use in agrosystem, urban ecosystems and range lands.

Course VIII- DISASTER MANAGEMENT

Total Hours: 3 **Total Marks: 75**

Section A

Answer any ten (2 marks each)

1. What is disaster management?
2. What is disaster management cycle?
3. What are hazardous materials? Give two examples.
4. What is the role of community workers in disaster management?
5. Enumerate the natural disasters.
6. Name infrastructure in accessing emergency situation.
7. Write notes on the vulnerabilities caused by development.
8. What is disaster preparedness?
9. What is disaster risk reduction (DRR)?
10. What are the disadvantages of the community based approach in disaster education?
11. What are disaster associated health issues?
12. What are the physical socioeconomic impacts of disaster?

Section B

Answer any five (5 marks each)

13. What are the implications of disasters of environment?
14. Explain modern methods of disaster response and recovery.
15. Explain the various methods of disaster education.
16. Discuss the role of media in disaster management.
17. Explain opportunities and regional planning for hazard management.
18. Explain pre-disaster mitigation plan.
19. Evaluate emergency health services in disaster.
20. Enumerate the duties of response personnel in disaster management.

Section C

Answer any two (15 marks each)

21. Discuss the various types of natural and non natural disasters, implications and environmental planning.
22. Explain the role of disaster education and public awareness in mitigating managing disasters.
23. Discuss the communicable diseases common in disaster situation and its management.

Course IX - REMOTE SENSING AND GIS

Total Hours: 3 **Total Marks: 75**

Section A

Answer any ten (2 marks each)

Define scales.
What are Cadastral maps?
What is plannimeter?
Write notes on clinometers.
What are the types of photogrammetry?
What are sensor and platform?
Write notes on SPOT.
What is digital image processing?
What is leveling.
What is Abeny level?
What is cartography?
What is the significance of aerial photography?

Section B

Answer any five (5 marks each)

Define and classify survey instruments.

Explain scope of remote sensing.
Write notes on Indian remote sensing programme.
Explain topographical maps and toposheets.
What is map conversion? Explain grids and contours.
Describe briefly the methods and equipments used in aerial photo interpretation.
Write the principle and concepts of remote sensing.
Explain the applications of remote sensing in environmental monitoring and disaster management.

Section C

Answer any two (15 marks each)

Describe the interaction of EMR with earth's surface helping remote sensing.
Explain the various stages of image analyzing.
Describe the application of remote sensing with examples.

Course XI -ENVIRONMENTAL POLLUTION AND TOXICOLOGY

Total Hours: 3 **Total Marks: 75**

Section A

Answer any ten (2 marks each)

1. What is bioventing?
2. What are trickling filters?
3. What are Biopesticides?
4. What is the unit of radiation?
5. What is NAMP?
6. What is fluorosis?
7. What is indicator organism?
8. What is PAN?
9. What is sludge disposal?

10. What is pyrosis?
11. Differentiate acute and chronic toxicity.
12. What is teratogenicity?

Section B

Answer any five (5 marks each)

13. Write down the method of assessment of noise pollution. Comment on national and international standards of noise pollution.
14. What is bioremediation? Describe briefly on biodegration of pesticides.
15. What is suspended particulate matter? Write down the methods to its removal and control.
16. What is bioindicator of pollution? Explain with examples.
17. Describe the methods forbiological treatment of air pollution.
18. How do surfactants work to reduce pollution?
19. Write notes on biodegradable plastics.
20. Describe stack sampling technique.

Section C

Answer any two (15 marks each)

21. Describe the biochemical aspects of As, Cd, Pb,Hg,Cu,O3, PAN, Pesicides and MIC.
22. Write an essay on modern techniques and equipments in water quality monitoring.
23. Give an account of four basic operations of sewage treatment plants.

Course XII ENVIRONMENTAL MONITORING AND MANAGEMENT

Total Hours: 3 **Total Marks: 75**

Section A

Answer any ten (2 marks each)

1. What is environmental modeling?
2. What is ecofunds?
3. What is ISO standards for environmental management system?
4. What are the five basic laws of ecology?
5. What is ecorestoration?
6. Write the significance of ecological foot print analysis.
7. What is checklist method?

8. Write notes on corporate environment responsibility.
9. What is education for sustainability?
10. What is the scope of environmental palnning?
11. What is SEA?
12. What is Ecological economics?

Section A

Answer any ten (2 marks each)

13. Describe environmental planning and management of waste land and reclaimed land.
14. Write notes on various environmental modeling.
15. Comment on Environmental auditing and standards responsibility.
16. Comment on the environmental of modern agriculture and green revolution.
17. Write notes on Gandhian environmentalism.
18. Explain the role of state and central pollution control boards.
19. Explain the risk assessment and disaster management programme.
20. How does industrial revolution affect environment and development?

Section C

Answer any two (15 marks each)

21. What is sustainable development? What are the goals and strategies of a sustainable future?
22. Enumerate the process of EIA. Explain environmental clearance process in India.
23. Discuss conflicts of interests in development and environmental protection.

Course XIII- BIODIVERSITY, CONSERVATON AND SOCIAL ISSUES

Total Hours: 3 **Total Marks: 75**

Section A

Answer any ten (2 marks each)

1. What are biological hot spots?
2. What is habitat loss?
3. What are endemic and cosmopolitan animals?
4. Differentiate endangered and threatened animals.
5. What are biodiversity indices?

6. What are key stone species?
7. What is CBD?
8. Comment on peoples biodiversity register(PBR).
9. What is ecotourism? Why is it called so?
10. Differentiate reclamation restoration.
11. Why is India called megadiversity nation?
12. What are drivers of biodiversity loss?

Section A

Answer any ten (2 marks each)

13. Comment on legal measures in biodieversity control.
14. Explain ex-situ conservation of biodiversity and its advantages.
15. Comment on the ethics of environmental conservation practices.
16. Write notes on urban forestry programme.
17. Give an account of environmental quality management.
18. Explain environmental planning and management of mining areas.
19. Write down the objectives of environmental audit.
20. Explain resource economics.

Section C

Answer any two (15 marks each)

21. Discuss the causes of depletion of biodiversity in India and the national action plan to preserve biodiversity.
22. Write an account on the methods and strategies of conservation of biodiversity.
23. Explain the social issues emanating with the climate change and mitigation.

SACRED HEART COLLEGE AUTONOMOUS 1944 THEVARA, KOCHI-682 013

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