DEPARTMENT OF CHEMISTRY

Revised Curriculum and Syllabus for
MPhil Programme in
Environmental Science
(with effect from 2019 admissions)

St Berchmans College
Founded 1922
AUTONOMOUS | College with Potential for Excellence | Reaccredited by NAAC with A Grade
Affiliated to Mahatma Gandhi University, Kottayam, Kerala
Changanassery, Kottayam, Kerala, India-686101

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INTRODUCTION

The University Grant Commission (UGC) has sanctioned MPhil programme in Environmental Science at the Department of Chemistry in St Berchmans College, Changanassery, under innovative programme including courses in emerging fields during the 9th plan. The Course started from 2002-2003 academic year.

The objective of the study is to enable students to study the concepts and techniques in analysing, monitoring, and solving environmental issues and to develop programmes to inculcate environmental awareness among the common masses.

Programme outcome

- Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- Master core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
- Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
- Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.
- Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
- Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
- Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as interdisciplinary scholars and/or practitioners

REGULATIONS FOR MPhil PROGRAMME IN ENVRONMENTAL SCIENCE UNDER CREDIT SEMESTER SYSTEM 2019

1. SHORT TITLE

1.1 These Regulations shall be called St. Berchmans College (Autonomous) Regulations (2019) governing MPhil programmes under the Credit Semester System.

1.2 These Regulations shall come into force with effect from the academic year 2019 - 20 onwards.

2. SCOPE

2.1 The regulation provided herein shall apply to all MPhil programmes conducted by St. Berchmans College (Autonomous) with effect from the academic year 2019 - 20.

3. DEFINITIONS

3.1 'University' means Mahatma Gandhi University, Kottayam, Kerala.

3.2 'College' means St. Berchmans College (Autonomous).

3.3 There shall be an Academic Committee nominated by the Principal to look after the matters relating to the SB-CSS-PG system.

3.4 'Academic Council' means the Committee consisting of members as provided under section 107 of the University Act 2014, Government of Kerala.

3.5 'Parent Department' means the Department, which offers a particular MPhil programme.

3.6 'Department Council' means the body of all teachers of a Department in the College.

3.7 'Faculty Mentor' is a teacher nominated by a Department Council to coordinate the continuous evaluation and other academic activities of the MPhil programme undertaken in the Department.

3.8 'Programme' means the entire course of study and examinations.

3.9 'Duration of Programme' means the period of time required for the conduct of the programme. The duration of an MPhil programme shall be two (2) semesters.

3.10 'Semester' means a term consisting of a minimum 90 working days, inclusive of tutorials, examination days and other academic activities within a period of six months.

3.11 'Course' means a segment of subject matter to be covered in a semester. Each Course is to be designed under lectures/tutorials/laboratory/seminar/project/practical/ assignments/evaluation etc., to meet effective teaching and learning needs.

3.12 'Course Teacher' means the teacher who is taking classes on the course.

3.13 'Elective Course' means a course, which can be substituted, by equivalent course from the same subject and the number of courses required to complete the programme shall be decided by the respective Board of Studies.

3.14 'Project' means a regular research work with stated credits on which the student conducts research under the supervision of a teacher in the parent department/any appropriate research centre in order to submit a dissertation on the project work as specified.

3.15 'Dissertation' means a minor thesis to be submitted at the end of a research work carried out by each student on a specific area.

3.16 'Plagiarism' is the unreferenced use of other authors' material in dissertations and is a serious academic offence.

3.17 'Seminar' means a lecture expected to train the student in self-study, collection of relevant matter from books and Internet resources, editing, document writing, typing and presentation.

3.18 'Improvement Examination' is an examination conducted to improve the performance of students in the courses of a particular semester.

3.19 'Supplementary Examination' is an examination conducted for students who fail in the courses of a particular semester.

3.20 The minimum credits, required for completing the programme is thirty six (36).

3.21 'Credit' (C) of a course is a measure of the weekly unit of work assigned for that course in a semester.

3.22 'Course Credit': One credit of the course is defined as a minimum of one (1) hour lecture/minimum of two (2) hours lab/field work per week for eighteen (18) weeks in a semester. The course will be considered as completed only by conducting the final examination.

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

3.24 'Grade Point' (GP) is the numerical indicator of the percentage of marks awarded to a student in a course.

3.25 'Credit Point' (CP) of a course is the value obtained by multiplying the grade point (GP) by the credit (C) of the course.

3.26 'Semester Grade Point Average' (SGPA) of a semester is calculated by dividing total credit points obtained by the student in a semester by total credits of that semester and shall be rounded off to two decimal places.

3.27 'Cumulative Grade Point Average' (CGPA) is the value obtained by dividing the sum of credit points in all the courses obtained by the student for the entire programme by the total credits of the whole programme and shall be rounded off to two decimal places.

3.28 'Institution average' is the value obtained by dividing the sum of the marks obtained by all students in a particular course by the number of students in respective course.

3.29 'Weighted Average Score' means the score obtained by dividing sum of the products of marks secured and credit of each course by the total credits of that semester/programme and shall be rounded off to two decimal places.

3.30 First, Second and Third position shall be awarded to students who come in the first three places on the basis of CGPA secured in the programme in the first chance itself.

4. PROGRAMME STRUCTURE

4.1 The MPhil degree shall have the status of an intermediate degree between the postgraduate degree and the doctoral degree. The programme shall have both course work and project.

4.2 The programme shall include two types of courses; core courses and elective courses. There shall be a project/research work to be undertaken by all students. The programme will also include assignments, seminars, practical, viva-voce etc., if they are specified in the curriculum.

4.3 Total credits for the programme is thirty six (36)

4.4 **Research Guide**

Each student will be assigned to a Research Guide by the concerned Head of the Department and programme director. The students can also select a supervisor from a research field attached to their postgraduate degree. The student will choose the topic of his/her research based on the advice of the Research Guide. The person under whom a candidate is registered for the MPhil programme shall be required to possess PhD degree in the concerned discipline and working in any of the teaching departments of the college or in any of the affiliated colleges/recognized research Institutions and recognized by the University as a research

supervisor. The candidates are permitted to have a co-guide(s) with the recommendation of the guide. The number of candidates permitted to register under a supervisor at any point of time is determined by the rules and regulations prevailing at that time.

4.5 **Evaluations**

The evaluation of each course shall contain two parts.

i Internal or In-Semester Assessment (ISA)

ii External or End-Semester Assessment (ESA)

Both ISA and ESA shall be carried out using indirect grading. Marks for ISA is 30 and ESA is 70 for all courses except course IV and V. The marks for ISA and ESA are given below.

Course	Marks		Total	Credit
	ISA	ESA		
Course I	30	70	100	4
Course II	30	70	100	4
Course III	30	70	100	4
Course IV	50	-	50	2
Course V	50	-	50	2
		Total	**400**	**16**

4.6 **In-semester assessment of theory courses**

The in-semester assessment include the following components.

Component	Marks
Assignment	10
Seminar	10
Two test papers	10
Total	**30**

4.7 **Assignments**

Every student shall submit at least one assignment as an internal component for every course.

4.8 **Seminar**

Every student shall deliver one seminar as an internal component for each course. The seminar is expected to train the student in self-study, collection of relevant matter from the books and internet resources, editing, document writing, typing and presentation.

4.9 **In-semester examination**

Every student shall undergo at least two in-semester examinations as internal component for each theory course.

4.10 To ensure transparency of the evaluation process, the ISA mark awarded to the students in each course in a semester shall be published on the notice board according to the schedule in the academic calendar published by the College. There shall not be any chance for improvement for ISA. The course teacher and the faculty mentor shall maintain the academic record of each student registered for the course which shall be forwarded to the office of the Controller of Examinations through the Head of the Department and a copy shall be kept in the office of the Head of the Department for at least two years for verification.

4.11 **End-semester assessment**

The end-semester examination shall be conducted by the College.

4.12 The end-semester examinations for theory courses shall be conducted at the end of each semester. There shall be one end-semester examination of three (3) hours duration in each lecture based course.

4.13 The question paper should be strictly on the basis of model question paper set by Board of Studies.

4.14 A question paper may contain short answer type, short essay type questions and long essay type questions.

4.15 The question paper pattern for theory examination is as follows.

Section	Type	No. of Questions to be Answered	Mark for Each Question	Total Marks
A	Short Answer	10 out of 13	2	20
B	Short Essay	6 out of 8	5	30
C	Essay	2 out of 3	10	20
	Grand Total	**18 out of 24**	**-**	**70**

4.16 **Dissertation**

The candidate shall submit three copies and one soft copy of the dissertation to the Controller of Examinations. The candidate shall give a pre-submission presentation on his/her dissertation work at the department before submitting the dissertation. The presentation shall be evaluated by a committee consisting of Head of the Department, Guide and one faculty member nominated by Head of the department.

The external evaluation of the dissertation shall done by an external examiner appointed by Controller of examinations. The minimum marks for pass for dissertation and viva voce will be 50%. If the candidate secures less than 50% marks the candidate shall be advised to revise the dissertation based on the suggestions made by the examiners and resubmit the dissertation, within a period of six months. The revised dissertation shall be sent to the same examiner who evaluated the dissertation at the first appearance of the candidate.

A student who fails to submit the dissertation within the stipulated time (12 months from the date of commencement of classes) on justifiable reasons, shall be permitted to submit the dissertation within a maximum period of two (2) years with the prior permission from Principal. The dissertation shall be evaluated only along with the next batch. The components for project evaluation is given below.

	Marks		Total	Credits
	ISA	**ESA**		
Pre-submission presentation	50	-	50	16
Dissertation	-	100	100	
Viva voce based on dissertation	-	50	50	
		Total	**200**	**16**

4.17 For all courses an indirect grading system based on a seven (7) point scale according to the percentage of marks (ISA + ESA) is used to evaluate the performance of the student in that course. The percentage shall be rounded mathematically to the nearest whole number.

Percentage of Marks	Grade	Performance	Grade Point
95 and above	S	Outstanding	10
85 to below 95	A+	Excellent	9
75 to below 85	A	Very Good	8
65 to below 75	B+	Good	7
55 to below 65	B	Above Average	6
50 to below 55	C	Satisfactory	5
Below 50	F	Pass	4

4.18 **Credit Point**

Credit Point (CP) of a course is calculated using the formula

CP = C × GP

where C is the credit and GP is the grade point

4.19 **Semester Grade Point Average**

Semester Grade Point Average (SGPA) is calculated using the formula

SGPA = TCP/TCS

where TCP is the total credit point of all the courses in the semester and TCS is the total credits in the semester

GPA shall be rounded off to two decimal places.

4.20 **Cumulative Grade Point Average**

Cumulative Grade Point Average (CGPA) is calculated using the formula

CGPA = TCP/TC

where TCP is the total credit point of all the courses in the whole programme and TC is the total credit in the whole programme

GPA shall be rounded off to two decimal places.

Grades for the different courses, semesters, Semester Grade Point Average (SGPA) and grades for overall programme, Cumulative Grade Point Average (CGPA) are given based on the corresponding Grade Point Average (GPA) as shown below:

GPA	Grade	Performance
9.5 and above	S	Outstanding
8.5 to below 9.5	A+	Excellent
7.5 to below 8.5	A	Very Good
6.5 to below 7.5	B+	Good
5.5 to below 6.5	B	Above Average
5 to below 5.5	C	Satisfactory
Below 5	F	Failure

4.21 A separate minimum of 40% marks each in ISA and ESA and aggregate minimum of 50% are required for a pass for a course. For a pass in a programme, a separate minimum of grade ‘C’ is required for all the individual courses.

5. SUPPLEMENTARY/IMPROVEMENT EXAMINATION

Supplementary/improvement examinations for theory courses in the first semester shall be conducted in the second semester.

6. ATTENDANCE

6.1 The minimum requirement of aggregate attendance during a semester for appearing the end semester examination shall be 75%. Condonation of shortage of attendance to a maximum of ten (10) days in a semester and once during the whole period of the programme may be granted by the College. This condonation shall not be counted for internal assessment.

6.2 Benefit of attendance may be granted to students representing the College, University, State or Nation in Sports, NCC, NSS or Cultural or any other officially sponsored activities such as College union/University union activities etc., on production of participation/attendance certificates, within one week from competent authorities, for the actual number of days participated, subject to a maximum of ten (10) days in a semester, on the specific recommendations of the Faculty Mentor and Head of the Department.

6.3 A student who does not satisfy the requirements of attendance shall not be permitted to appear in the end-semester examinations.

6.4 Those students who are not eligible even with condonation of shortage of attendance shall repeat the course along with the next batch after readmission.

7. BOARD OF STUDIES AND COURSES

7.1 The Board of Studies concerned shall design all the courses offered in the MPhil programme. The Board shall design and introduce new courses, modify or re-design existing courses and replace any existing courses with new/modified courses to facilitate better exposure and training for the students.

7.2 The syllabus of a programme shall contain programme objectives and programme outcome.

7.3 The syllabus of a course shall include the title of the course, course objectives, course outcome, contact hours, the number of credits and reference materials.

7.4 Each course shall have an alpha numeric code which includes abbreviation of the course in two letters, semester number, course code and serial number of the course.

7.5 Every programme conducted under Credit Semester System shall be monitored by the Academic Council.

8. REGISTRATION

8.1 A student who registers his/her name for the external examination for a semester will be eligible for promotion to the next semester.

8.2 A student who has completed the entire curriculum requirement, but could not register for the semester examination can register notionally, for getting eligibility for promotion to the next semester.

8.3 A student may be permitted to complete the programme, on valid reasons, within a period of four (4) continuous semesters from the date of commencement of the first semester of the programme

9. ADMISSION

9.1 The admission to MPhil programme shall be as per the rules and regulations of the College/University.

9.2 The eligibility criteria for admission shall be as announced by the College/University from time to time.

9.3 Separate rank lists shall be drawn up for seats under reservation quota as per the existing rules.

9.4 There shall be an academic and examination calendar prepared by the College for the conduct of the programmes.

9.5 The admission shall be based on the performance of the candidate in a written test and interview conducted by the college.

1.1 Admission will be made based on the total marks obtained in the qualifying examination, written test and interview in the following ratio.

Qualifying examination (Master's degree) – 50 Marks
Written test – 40 Marks
Interview – 10 Marks

10. ADMISSION REQUIREMENTS

10.1 Candidates for admission to the first semester of the MPhil programme shall be required to have passed an appropriate postgraduate degree examination of Mahatma Gandhi University or any University or authority, duly recognized by the Academic council of Mahatma Gandhi University as equivalent thereto.

11. MARK CUM GRADE CARD

11.1 The College under its seal shall issue to the students, a Mark cum Grade Card on completion of each semester, which shall contain the following information.

i. Name of the Student
ii. Register Number
iii. Photo of the Student
iv. Degree
v. Programme
vi. Semester and Name of the Examination
vii. Month and Year of Examination
viii. Faculty
ix. Course Code, Title and Credits of each course opted in the semester
x. Marks for ISA, ESA, Total Marks (ISA + ESA), Maximum Marks, Letter Grade, Grade Point (GP), Credit Point (CP) and Institution Average in each course opted in the semester
xi. Total Credits, Marks Awarded, Credit Point, SGPA and Letter Grade in the semester
xii. Weighted Average Score
xiii. Result

11.2 The final Mark cum Grade Card issued at the end of the final semester shall contain the details of all courses taken during the entire programme including those taken over and above the prescribed minimum credits for obtaining the degree. The final Mark cum Grade Card shall show the CGPA and the overall letter grade of a student for the entire programme.

12. AWARD OF DEGREE

The successful completion of all the courses with 'C' grade shall be the minimum requirement for the award of the degree.

13. MONITORING COMMITTEE

There shall be a Monitoring Committee constituted by the Principal to monitor the internal evaluation conducted by the College. The Course Teacher, Faculty Mentor, and the College Coordinator should keep all the records of the continuous evaluation, for at least a period of two years, for verification.

14. GRIEVANCE REDRESS COMMITTEE

14.1 In order to address the grievance of students relating to ISA, a two-level grievance redress mechanism is envisaged.

14.2 A student can approach the upper level only if grievance is not addressed at the lower level.

14.3 Department level: The Principal shall form a Grievance Redress Committee in each Department comprising of course teacher and one senior teacher as members and the Head of the Department as Chairman. The Committee shall address all grievances relating to the internal assessment of the students.

14.4 College level: There shall be a College level Grievance Redress Committee comprising of Faculty Mentor, two senior teachers and two staff council members (one shall be an elected member) and the Principal as Chairman. The Committee shall address all grievances relating to the internal assessment of the students.

15. TRANSITORY PROVISION

Notwithstanding anything contained in these regulations, the Principal shall, for a period of three years from the date of coming into force of these regulations, have the power to provide by order that these regulations shall be applied to any programme with such modifications as may be necessary.

PROGRAMME STRUCTURE

Course Code	Course Title	Credit	ISA	ESA	Total
Semester I					
BPES101	Research Methodology	4	30	70	100
BPES102	Studies in Environmental Science	4	30	70	100
	Elective Course	4	30	70	100
BPES103	Laboratory Course	2	50	-	50
BPES104	Project Course	2	50	-	50
	Total	**16**	**190**	**210**	**400**
Semester II					
BPES2PJ	Project and Viva Voce	20	50	150	200
	Grand Total	**36**			**600**

ELECTIVE COURSES

No.	Course Code	Name of the Course
1	BPES1E01	Water Resource Management
2	BPES1E02	Advanced Topics in Chemistry
3	BPES1E03	Recent Advances in Zoology
4	BPES1E04	Advanced Botany
5	BPES1E05	Disaster Management
6	BPES1E06	Recent Trends in Biotechnology

SEMESTER I

BPES101: RESEARCH METHODOLOGY

Credit: 4

Objectives

- To understand the basic concepts of research and its methodologies
- To learn about the different statistical tools used in research
- To comprehend the basic concepts of Remote Sensing and Geographic information system
- To understand the Structure of a Research Paper/ Thesis

Outcome

After the successful completion of the course, the student shall acquire thorough knowledge on:

- Research methodologies
- Theories and application of statistical tools in research
- Writing a research thesis
- Concepts and importance of Remote Sensing and Geographic information system
- Basic concepts of important analytical techniques and instrumentation

Module 1: What is Research?

Definition

Types of research – basic research, applied research and policy research

Essential qualities of a researcher – Scientific temperament and attitude

Module 2: Methods of Research

Identifying the problem

Literature survey

Formulating hypothesis

Objectives, designing and carrying out experiments/survey

Observation and collection of data

Analysis of data - qualitative and quantitative

Drawing inferences, arriving at conclusions and suggestions

Module 3: Statistical Tools in Research

Measures of central tendency- Mean, Median, Mode, Standard deviation, Coefficient of variation, error analysis.

Fundamentals of testing hypothesis- Chi-square, students t test; Analysis of variance (ANOVA – one way and two way), Regression and Correlation

Design of experiments- CRD, RBD and Factoral analysis

Software in statistical analysis; Modelling

Module 4: Scientific writing - Structure of a Research Paper/ Thesis

Research Paper: Title, Abstract, Key words, Introduction, Review of literature, Methods, Results and Discussion, Conclusions, References; Submission of research papers to journals

Review paper: Scheme and structure of a review paper; significance of review papers

Thesis: Review of literature; Presentation of results- tables, figures, and plates; References- citations pattern; Acknowledgements, Appendix; Thesis preparation- Standard model

Seminars and Conferences: Preparation of Abstracts and full papers- Online submission

Presentation (Oral/Poster): Standard methods; Conference proceedings, editing

Project proposals: Title, Abstract, Introduction- Rationale, Objectives, Methodology

Time frame and Work plan; Budget and justification; References

Module 5: Remote Sensing and GIS

Basics of remote sensing and GIS

Mapping concepts; Satellite remote sensing – EMR, platforms, sensors, visual interpretation and elements, digital image processing; Aerial photography; Global Positioning system: Geographic Information System – components, data structures, data capture, spatial analysis and modelling; applications in environment science and management.

Module 6: Analytical Techniques and Instrumentation

Chromatographic techniques, TLC, GC, HPLC, GC-MS, Electrophoresis, Microscopy, Fluorescence Microscopy, SEM, AFM, TEM, Basics and applications of spectroscopy, UV, IR, Raman, NMR, AAS, ICP,IRMS, CVAFS,

Thermal methods: TG, DSC, DTA, PCR principle and applications, ELISA, radio immuno assay (RIA).

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20. Christian Gary D (2014).*Analytical Chemistry*. John Wiley and Sons. New York

BPES102: STUDIES IN ENVIRONMENTAL SCIENCE

Credit: 4

Objectives

- To familiarize with the basic concepts of ecology
- To understand the fundamentals of environmental chemistry
- To comprehend environment management
- To get an overview on environmental biotechnology
- To get an idea about the water quality studies

Outcome

After the successful completion of the course, the student shall acquire thorough knowledge on:

- Ecosystem structure and dynamics, ecosystems of India
- Basic concepts of Population and Community Ecology
- Green chemistry, basics of environment chemistry and different types of pollution
- Methods of environment management like EIA, SWOT.
- Applications of environment biotechnology
- Water quality studies

Module 1: Ecology and Environment

Ecological principles and variables, Energy flow, Ecosystem structure and dynamics, Temporal and spatial dimensions, Biogeochemical cycles, Biodiversity-significance, Global and National Biodiversity status, Critical eco-systems and landscape-level conservation, Tools for the management of Natural resources, Biogeographical regions in India, Ecosystems of India- Status and conservation strategies by Govt. of India, Acts and treaties relating to biodiversity conservation, bioprospecting, biopiracy, WTO regime and commercialization of biodiversity. Convention on Biological Diversity, 1992. Basic aspects of physical environment (study of minerals, rocks, soil).

Case Studies*: Western Ghats- Biodiversity, Ecological Significance, Major threats and strategies, Ethnic communities of Western Ghats; Value of traditional science and technology for sustainable management of natural resources, Participatory forest management.*

Module 2: Population and Community Ecology

Population ecology- Characteristics, Growth Curves and modelling approaches, Carrying capacity, Population genetics. Community Ecology- Concept and classification, Community analysis, niche concept, adaptations and interactions, Evolutionary Fundamentals and applications. Microbial ecology.

Case Studies: *Climate change and biological invasion, Eco-restoration programmes- International and national level studies, Human – Animal Conflicts, Development and Ecology- selected National and International issues.*

Module 3: Environmental Chemistry and Pollution

Green Chemistry-fundamentals, Atmospheric chemistry, Air , water and Soil pollution, Ecotoxicology, Toxicity of metals, pesticides, radioactive minerals, fluorides etc, Interaction of toxicants with environment, bioaccumulation and magnification, Bio monitoring- bio indicators, biomarkers, Water treatment, recent advances in water purification , case studies- air pollution , water pollution, soil pollution, water, sanitation and human health.

Case Studies: *water and air pollution*

Module 4: Environment and Management

Principles, tools in EIA, LCA, Environment Audit.

Human activities and impacts: Local, regional and global; short term and long-term impacts on Environment. Origin and development of EIA, National environmental policy and Statutory requirements of EIA; objectives of EIA, Methodology of EIA; Scoping, Categorization and Evaluation criteria; prediction and assessment of impact, interactions between environmental components and impacts. Alternate strategies, mitigation measures, environmental monitoring and audit. SWOT analysis in environment management. CRZ and EEZ –introduction.

Case Studies*:* *EIA; Environment movements*

Module 5: Environmental Biotechnology

Overview, Biotechnological, solutions to Environmental Pollution; Air, water and Soil; Emerging Trends in wastewater treatment; Agrobiotechnology: Ecological Engineering; Biodegradable plastics; Biotechnological methods in solid waste management; Processing/treatment of hazardous wastes; Bioremediation technology.

Case Studies*: GM Crops- Bt Cotton, Bt Brinjal; Hazardous waste dumping- Love canal, Exxon-Valdez oil spill.*

Module 6: Water Quality Studies

pH, EC- Electrical conductivity, colour, odour, turbidity, solids- Total Dissolved Solids, Total Suspended Solids, Total Solids, hardness- total and Calcium hardness, Nitrogen- Kjeldhal N, NO_3-N.

NO_2-N, Phosphate- Total P, Potassium, acidity, alkalinity, chloride, salinity, DO, biological oxygen demand- BOD, Chemical oxygen demand- COD.

Microbiological parameters.

Case Study: *Water pollution studies and cultural eutrophication in Vembanadu Lake.*

Reference

1. Stanley E. Manahan (2005), *Environmental chemistry*. CRC press. London
2. Gary W. V and Stephen J. D (2000), *Environmental Chemistry a Global Perspective*, Oxford University Press, New York
3. Skoog, D. A and Leary, J. J (1992) , *Principles of Instrumental Analysis*, 4 th ed., Saunders college Publishing, Fortworth
4. Anjaneyalu Y (2007), *Environmental Impact Assessment Methodologies*. B S Publications. New Delhi
5. Abbasi S. A, Arya D. S (2002), *Environmental Impact Assessment*. Discovery Publishing Pvt. Ltd. New Delhi
6. Rao Sasi Bhusana (2007), *Environment Management*. Regal Publications. New Delhi
7. Newman Michael, Clement William (2008), *Ecotoxicology: A comprehensive treatment*. CRC press. Florida
8. Scragg Alan (2004) , *Environmental biotechnology*, Pearson Education Ltd. England
9. Abbasi S.A and Ramasamy E.V. (1999). *Biotechnological Methods of Pollution Control*, universities Press. New Delhi, 338 p.
10. Battacharrya B. C., Banerjee R (2007). *Environmental Biotechnology*, Oxford University Press. New Delhi, 338 p
11. Odum E.P., Barrett W.G. (2005). *Fundamentals of Ecology*, Thomson Cole India edn.598 p
12. Anantha Krishnan TN (1993). *Bioresources Ecology*, Oxford IBH Publ. Co. New Delhi

BPES103: LABORATORY COURSE

Credit: 2

Objectives

- To study and get a hands on experience in water quality analysis
- To understand and get a hands on experience in analysis of Microbiological Parameters

Outcome

After the successful completion of the course, the student shall acquire thorough knowledge on:

- Water quality analysis
- Different microbiological Parameters analysis

Water Quality Analysis

1. pH, Electrical conductivity, colour, odour, turbidity
2. solids- Total Dissolved Solids, Total Suspended Solids, Total Solids
3. hardness- total and Calcium hardness
4. Nitrogen-Kjeldhal N, NO_3-N, NO_2-N
5. Phosphate- Total P
6. Potassium
7. Acidity
8. Alkalinity
9. Chloride, salinity
10. DO, biological oxygen demand- BOD, Chemical oxygen demand- COD

Reference

1. APHA (2005*) Standard methods for the examination of water and waste water*, 21st edn. American Public Health Association, Washington, DC

Microbiological Parameters

1. Isolation of microorganisms – streak plate, pour and spread plate
2. Identification of microorganisms – staining of isolated bacteria,
3. Motility testing
4. Biochemical testing – catalase, oxidase, carbohydrate fermentation test

BPES104: PROJECT COURSE

Credit: 2

Mini project: Prepared on a topic related to environment science.

ELECTIVE COURSES

Each student is supposed to select any one of the following courses, which is done on the basis of his/her MSc degree. He/She is advised to select a course related to his/her PG.

BPES1E01: WATER RESOURCE MANAGEMENT

Credit: 4

Objectives

- To learn about the hydrological cycle
- To get in-depth knowledge about surface and ground water resources
- To comprehend water pollution
- To study in detail about the water quality monitoring
- Has knowledge about the major water resource projects in India

Outcome

The student shall be able to get an idea about

- Importance of water cycle
- Clear knowledge about the different surface water resources like stream, rivers, lakes, oceans, snow, ice and glaciers
- Information about ground water resources like aquifers and ground water conservation by water budgeting
- Understand water pollution and different steps involved in water quality monitoring
- Knowledge about Water resources in India for public water supply, irrigation and hydroelectric power generation, for tourism and fisheries development, N. G.Os and local bodies in Water resource management.

Module 1: Water as a Vital Resource

Water as a Vital Resource, Hydrological cycle

Module 2: Surface Water Resources

Streams, Rivers and Lakes: Types of streams, Stream patterns, mechanics of stream works, stream transportation, changes in stream profiles, stream depositions. Methods of erosion and erosional landforms, landslides, catchment area management, river systems in India, sand mining and other associated issues, development of lakes and lake types, estuaries.

Oceans: Physical, Chemical and biological properties of oceans, life Zones and marine ecology, ocean basis, oceanic circulation and movements, wave motions and wave characteristics, tidal effects, Productivity zones, shore erosion , shore deposition and coastal zone management.

Snow, Ice and Glaciers: causes of glaciations, glacial erosion and deposition, temporary glacial lakes, permafrost, ice ages and climatic changes.

Precipitation, rainwater harvesting and acid rain.

Module 3: Ground Water Resources

Ground water zones, water table, aquifers, factors affecting infiltration, permeability.

Hydraulic conductivity, factors affecting water logging and skimming of fresh water; springs, Geysers and artesian wells.

Well and tube wells, over drawing of water resources recharge and methods of natural and artificial recharge ,ground water conservation of water budgeting.

Module 4: Water Pollution

Sources, types and effects of water pollution, eutrophication, problems of Aquatic weeds, coir retting, methods of water purification and sewage treatment.

Module 5: Water Quality Monitoring

Sampling and analysis (physical, chemical and biological), quality assessment, quality standards, Water and health.

Hydrographic studies of aquatic ecosystems, environmental impact assessment of water resource projects, satellite technologies in water resource management.

Module 6: Major Water Resource Projects in India

Water resources for public water supply, water resource utilization for irrigation and hydroelectric power generation, water resources for tourism and fisheries development, N. G.Os and local bodies in Water resource management.

Reference

1. APHA (2005) *Standard Methods for the examination of water and wastewater*, 21st edn. American Public Health Association, Washington, DC.
2. Ira S. Allison and Donald F. Palmer (1980), *Geology: The Science of Changing Earth* (7th edition). Mc Graw- Hill Book Company, New York.

3. Abbasi S. A (1999), *Wetlands Of India- Ecology and Threats*. Discovery Publishing House, New Delhi.
4. Abbasi S. A (2000), *Water Resource Projects and Their Environmental Impacts*, Discovery Publishing House, New Delhi.
5. Misra S. P. and Panday S. N (2009). *Essential Environmental Studies*, Ane Book Pvt. Ltd, New Delhi.
6. Ahluwalia V. K. (2008). *Environmental Chemistry*, Ane Book Pvt. Ltd, New Delhi.
7. De A. K. (2008).*Environmental Chemistry*, New Age Internal Publishers, New Delhi.
8. Miller G. T. (2005). *Living in the Environment*. Thomson, Chennai.

BPES1E02: ADVANCED TOPICS IN CHEMISTRY

Credit: 4

Objectives

- To learn about Advanced Microscopic Techniques
- To comprehend concepts of Resonance Spectroscopy
- To study about different Electro analytical Techniques
- To learn Applications of Mass Spectrometry to Bio molecules
- To study about Fluorescence Spectroscopy
- Understanding Fundamentals of Biological Chemistry

Outcome

The student shall be able to get an idea about

- Working of TEM, SEM, STEM, AFM, MFM, STM and other techniques
- Basic concepts and applications of ESR spectroscopy
- In detail knowledge about Electro analytical Techniques
- Understanding about how Mass Spectrometry can be applied to Bio molecules
- Fluorescence quenching and its applications in some biological systems like proteins, membranes, DNA etc
- Knowledge about Chemistry in bio systems
- Supramolecular chemistry and their applications

Module 1: Advanced Microscopic Techniques

Electron Microscopy, Transmission electron microscope (TEM), general design, resolution, electron source, TEM grids, electron lenses, electron–sample interactions

Scanning transmission electron microscope (STEM), Scanning probe microscopy - Atomic and molecular force microscopes (AFM and MFM), Scanning tunneling Microscope (STM); Scanning near-field and far-field optical microscope (SNOM and SFOM) - Fluorescence microscopy, single-molecule fluorescence imaging, single molecule FRET (Fluorescence energy transfer) techniques, Confocal microscopy.

Module 2: Resonance Spectroscopy

^{1}H NMR: Long-range coupling–Homotopic, enantiotopic and diastereotopic systems - Conformationally mobile, open-chain systems, Virtual coupling – Coupling of proton to fluorine, phosphorus-Nuclear Overhauser effect.

^{13}C NMR: Off resonance decoupling –Coupling of carbon to deuterium, fluorine, phosphorus – DEPT – Application of proton and carbon data in identifying small organic compounds.

2D NMR: Principles of 2D NMR spectroscopy - ^{1}H- ^{1}H COSY, $^{1}H^{13}C$ COSY, HMBC and HSQC.

Basic concepts of ESR spectroscopy – g-tensor- Factors affecting the magnitude of g and A tensors in metal complexes – Anisotropy in g and A values -Zero-field splitting and Kramers degeneracy.

Applications of EPR to some simple systems like methyl radical,p-benzosemiquinone and naphthalene anion, Cu(II),Fe(II), Mn(II) and Ni(II) complexes – Spin-trapping. Basic principles of ENDOR spectroscopy and its applications in inorganic chemistry.

Module 3: Electroanalytical Techniques

Potentiometric sensors- criteria for choosing these sensors, selective electrodes- primary ion-selective electrodes encompassing crystalline and non-crystalline electrodes membrane ion-selective electrodes including gas-sensing and enzyme substrate electrodes- all solid state ion-selective electrodes – Voltammetric sensors, chronoamperometry- potential sweep techniques (cyclic voltammetry including study of reaction mechanisms)- step and pulse techniques- Normal pulse and differential pulse voltammetry- square wave voltammetry- AC techniques- stripping voltammetry (anodic and cathodic)- stripping analysis.

Module 4: Applications of Mass Spectrometry to Bio molecules

Basic Instrumentation - Resolution, EI, CI and APCI methods - base peak, isotopic peaks, metastable peak, parent peak - determination of molecular formula Techniques in Instrumentation - Soft Ionization Methods - Fast Atom-Ion Bombardment-Electron spray Ionization - Matrix-Assisted Laser Desorption/Ionization - Mass Analyzers – Detectors Hyphenated techniques, GC-MS, LC-MS and tandem Mass spectrometry- Applications to Biomolecules - Molecular weight Determination - Protein Identification – Protein Peptide Sequencing - Nucleic Acid Applications.

Module 5: Fluorescence Spectroscopy

Emission spectra and excitation spectra, 2D – emission spectra, frequency-domain spectra and time-domain spectra- definition of lifetime of an excited state multiexponential decays- time-correlated single-photon counting technique to obtain time-domain spectra- micro- nano- pico and femto second transient recordings using laser flash photolysis techniques- various laser

sources and light-emitting diodes- Fluorescence quenching and its applications in some biological systems like proteins, membranes, DNA etc.

Module 6: Fundamentals of Biological Chemistry

Chemistry in biosystems (distinct from non-living systems) – Weak non -covalent interactions - Molecular recognition – Enzyme chemistry – Mechanism of enzyme action – Chymotrypsin – Antibodies as enzymes-Enzymes in synthetic organic chemistry - Coenzyme chemistry - NADH – NADPH and FADH(2) as electron carriers – Pyridoxal phosphate - Thiamine pyrophosphate – suicide enzyme inactivators and affinity labels – Bioenergetics and metabolism –Biological energy – ATP – Carbohydrate metabolism – Lipid metabolism – Citric acid cycle – Enzyme models – utility of cyclodextrins, Crown ethers and calixarenes as enzyme models – Molecular recognition and drug design – Supramolecular chemistry – Supramolecular reactivity and catalysis.

Reference

1. T. Pradeep (2007). *Nano: The Essentials*, Tata Mc Graw-Hill Edn, New Delhi.
2. P.M. Silverstein, F.X. Wester (1998). *Spectroscopic Identification of Organic Compounds*, 6 th Ed., Wiley
3. J. Mohan (2004), *Organic Spectroscopy Principles and Applications*, CRC; 2nd Ed.
4. D.L. Pavia, G.M. Lampman and G.S. Kriz, *Introduction to Spectroscopy*, Brooks Cole, 3rd Ed., 2000.
5. H. Gunther, *NMR spectroscopy, basic principles, concepts and application in chemistry*, John Wiley and Sons, 2nd Ed., 1995.
6. R. S. Drago, *Physical Methods in Chemistry*, Saunders, 1977.
7. J. A. Weil, J. R. Boldton and J. E. Wertz, *Electron Paramagnetic Resonance: Elementary\ Theory and Practical Applications*, John Wiley and Sons, 1994.
8. Christopher M.A Brett and Ana Maria Oliveira Brett, *"Electroanyalysis"* Oxford University Press, Oxford, 1998.
9. Daniel C. Harris (1996), *"Quantitative Chemical Analysis",* Third Edn., W.H. Freeman and Company, New York.
10. A.J. Bard L.F. Faulkner (1998), *Electrochemical methods – Fundamentals and Applications*, Second Edn., Wiley-VCH.
11. J. Janata (1989), *"Principles of Chemical Sensor",* Plenum Press, New York.
12. Joseph Wang (2001), *"Analytical Electrochemistry",* Second Edn., Wiley-VCH.

13. Joseph R. Lakowicz (2006). *"Principle of Fluorescence Spectroscopy*" 3rd Edn. Springer, USA.
14. A. L. Lehninger, D. L. Nelson, M. M. Cox (1993). *Principles of Biochemistry*, 2nd edition, Publisher: CBS Publishers and Distributors (India).
15. Hermann Dugas (2003). *Bioorganic Chemistry: A Chemical Approach to Enzyme Action*, 3rd edition, Springer International Edition.

BPES1E03: RECENT ADVANCES IN ZOOLOGY

Credit: 4

Objectives

- To learn about fundamentals of Molecular Biology
- To study about concepts related to Immunology
- In detail study of Environmental Pollution Management specially in India
- To understand basics of Microbial Genetics and its related techniques
- To comprehend fundamentals related to transplantation and tumour immunology
- To learn about Basics of Biotechnology

Outcome

The student shall be able to get an idea about

- DNA Sequencing and Human Genome Project
- Reproductive technologies related to Human in vitro Fertilization.
- Human Gene Therapy
- Mechanism of Immune Response and Generation of Immunological diversity.
- Basics of environmental pollution management
- Knowledge about molecular diagnosis, Karyotying – FISH – RFLP HLA, tissue typing and Organ Transplantation.
- Understanding about tumor and Immunosurveillance.
- Understanding fundamental concepts of Biotechnology

Module 1: Fundamentals of Molecular Biology

DNA Sequencing and Human Genome Project, DNA Finger Printing and Foot Printing, DNA Amplification and RT – PCR, Gene and cDNA Library. Detection of genetic diseases using DNA recombinant technology, Screening and Counseling – Human Gene Therapy – Animal Cell Culture primary and established cell line – Stem Cell Therapy. DNA Methylation, antisense RNA, Transposons, Signaling by receptors. Cloning technique and its application in Biology, knock out genes – Ethical issues. Reproductive technologies related to Human in vitro Fertilization.

Module 2: Immunology

Antigen – Structure and functions of different classes of immunoglobulins, Primary and Secondary Immune Response Lymphocytes and Accessory Cells. Humoral and Cell Mediated

Immunity, MHC, Mechanism of Immune Response and Generation of Immunological diversity.

Module 3: Environmental Pollution Management

Environmental Pollution (air, water and soil) – causes and remedies – Environmental impact assessment – Environmental laws – Risk assessment. Environmental Education, Planning and Management – Bioremediation. Bio-indicators and Molecular markers. Renewable and Non Renewable sources of Energy, Conventional and Non-Conventional, Solar and Tidal Energy – Biogas Production – Nuclear Energy – Indian Nuclear Power Plants. Biodiversity – Types, Measures of Diversity – Biodiversity Conservation laws. Remote sensing and GIS – Basic concepts.

Module 4: Microbial Genetics and Related Techniques

Organization and Expression of Immunoglobulin gene. Vaccine – Whole Organism Vaccines, Recombinant Vaccines, DNA Vaccine, Edible Vaccines. Applications of RIA, Immunoflouresence, ELISA, Western Blot and Monoclonal Antibodies, in diagnosis of various diseases. Molecular Diagnosis: Karyotying – FISH – RFLP HLA, tissue typing and Organ Transplantation.

Module 5: Transplantation and Tumour Immunology

Transplantation – Barriers to transplantation, Genetic predisposition for graft rejection, prevention of rejection. Immunity to infection – viruses, bacteria, fungi, parasites, nature of interaction; immunopathological considerations. Tumor immunology – Immunity to tumors, tumor specific antigens. Immunosurveillance.

Module 6: Basics of Biotechnology

Methods involved in the Production of DNA Technology – Transgenic Plants and Animals and their uses. Production of Recombinant antibiotics, Insulin and Growth Hormone. Genetic Engineering – Enzyme Technology – Terminator Genes. Biofertilizers – Composting – Biopesticides – SCP – Production and Sources.

Reference:

1. Dupraw E.J. (1969). *Cell and Molecular Biology,* Academic Press, Oxford and IBH.
2. Beyer, A.L. et. al. (1979). *Molecular Genetics, Part – III: Chromosome Structure,*Taylor, J.H. Academic Press, New York.

3. Kavitha B Ahluwalia (1991). *Genetics*, Wiley Eastern Ltd., New Delhi.
4. Capeuter, P.L. (1975). *Immunology and Serology* 3rd ed., W.B. Sawnders Co. Philadelphia.
5. Bellanti, J.A. (1971). *Immunology*, W.B. Sawnders Co. Philadelphia.
6. Dutcherlony, O. (1968). *Hand Book of Immunodiffusion and Immunoelectrophoresis*. Ann. Arbor Science Publishers, Ann. Arbor, Michigan.
7. Bernard J. Nebel (1987). *Environmental Science. The way world works*, 2nd ed., Prentice Hall Inc. Englewood, Cliffes, New Jersey.
8. Monney H.A. and M. Goddon (1983). *Disturbance and Ecosystems*. Springer, verlag publication, New York.
9. Moran, J.M. Moran, M.D. and J.H. Wiersma (1980). *Introduction to Environmental Science*, H.W. Freeman and Co. San Francisco, U.S.A.
10. Moat, A.G. and Foster, J.N. (1995). *Microbial Physiology*, 3rd ed., Wiley – Liss, New York.
11. Friefelder, D. (1987). *Microbial Genetics Jones and Bartlett Publication*, Boston.
12. Freeman, B.A., (1979). *Text Book of Microbiology*, W.B. Saunders and Co.
13. Morgan, J. and Welan, W.J. (1979). *Recombinant DNA and Genetic Experimentation*. Pergmon Press, Oxford, New York.
14. R.H. Pritchand and Holland, I.B. (1985). *Basic Cloning Techniques a Manual of Experimental Procedures*. Blackwell Scientific Publications, Oxford, London.
15. Williams, J.C. (1981). *The Preparation and Screening of cDNA Clone Bank*. Genetic Engineering Vol. I (ed. Williamson, K) Academic Press, London.

BPES1E04: ADVANCED BOTANY

Credit: 4

Objectives

- To learn about the Biodiversity of India and its Conservation
- Introduction to Plant Genome Organization
- Understanding the Fundamentals of Gene Expression and Protein Engineering
- To study the basics of Genetic Engineering
- To comprehend Molecular Marker - Aided Breeding
- To learn about Plant Biotechnology

Outcome

The student shall be able to get an idea about

- Concepts, significance of biodiversity of India and its Conservation
- Basic fundamentals of Plant Genome Organization
- In depth knowledge about Gene Expression and Protein Engineering
- Understanding Genetic engineering in plants
- Clear understanding about Molecular marker–aided breeding, RFLP maps, linkage analysis, RAPD markers, microsatellites, SCAR, map base cloning and Molecular marker assisted selection.
- In-vitro culture techniques, Horticultre and Forestry; Industrial Applications of Tissue culture for secondary metabolite production; Agrobacterium-mediated plant transformations. Edible plant Vaccine (EPV) technology; Molecular Farming/pharming-metabolic engineering of plants.

Module 1: Biodiversity of India and its Conservation

Concepts, significance and magnitude; Levels of Biodiversity; (Genetic, Species Population, community, Ecosystem and Habitat); Biodiversity profile in India and Kerala; Plant and Microbial Diversity; Mega diversity Zones and Hot Spots; Uses of Biodiversity; Threat to Biodiversity; IUCN threat categories, Red Data book; Conservation of Biodiversity.

Module 2: Plant Genome Organization

Plant Genome Organization – Structural features of a representative plant gene. Chromatin and gene families in plants. Organization of chloroplast and mitochondrial genome. Nucleus

encoded and chloroplast encoded genes for chloroplast proteins. Targeting of proteins to mitochondria.

Module 3: Fundamentals of Gene Expression and Protein Engineering

Regulation of prokaryotic and eukaryotic gene expression and gene silencing. Genetic code, protein synthesis – Initiation and their regulation – Elongation and elongation factors, aminoacylation of tRNA, aminoacytl tRNA synthesis, translation, inhibitors, post – translation modification of proteins.

Module 4: Basics of Genetic Engineering

Genetic engineering in plants – Selectable markers, reporter genes and promoters used in plant vectors – Plant transformation technology – Ti and Ri Plasmids, Mechanism of gene transfer in plants – Direct gene transfer methods – Electroporation, microprojectile bombardment methods, microinjection. Transgenic plants – virus resistance, pest resistance, herbicide resistance, resistance to Fungi and Bacteria.

Module 5: Molecular Marker - Aided Breeding

Molecular marker–aided breeding – RFLP maps, linkage analysis, RAPD markers, microsatellites, SCAR (Sequence Characterized Amplified Regions), SSCP (Single Standard Conformational Polymorphism), AFLP, QTL, map base cloning, Molecular marker assisted selection.

Module 6: Plant Biotechnology

In-vitro culture techniques; Plasticity and totipotency, Culture types – callus, cell suspension culture, Protoplast, Root culture, Shoot tip and Meristem culture, Embryo culture, Microspore culture. Plant regeneration - Somatic embryogenesis, Organogenesis; Applications of tissue culture in plant breeding, Horticultre and Forestry; Industrial Applications of Tissue culture for secondary metabolite production; Agrobacterium-mediated plant transformations. Edible plant Vaccine (EPV) technology; Molecular Farming/pharming-metabolic engineering of plants.

Reference

1. H.S. Chawla (2001). *Introduction to Plant Biotechnology*. Oxford and IBH Publishing Co. Pvt. Ltd.
2. Peter J. Lea, Richard C .Leegood (1999). *Plant Biotechnology and Molecular Biology*. John Wiley and Sons.

3. Maarten J. Chrispeels and David E. Sadava (2000). *Plants, Genes and Agriculture*. Jones and Barlett Publishers.
4. Bray CM. (1983). *Nitrogen metabolism in plants*, Longman.
5. Westhoff, P. (1998). *Molecular plant development from gene to plant*. Oxford University Press, Oxford, UK.
6. Plummer, DT. (1988). *An introduction to practical Biochemistry*. Tata McGraw Hill Pub. Co. Ltd., New Delhi.
7. S.B. Primrose, R.M. Twyman and R.W. Old (2001). *Principles of gene manipulation*, Blackwell Science.
8. S.B. Primrose (1994). *Molecular biotechnology*, Blackwell Scientific Pub. Oxford.

BPES1E05: DISASTER MANAGEMENT

Credit: 4

Objectives

- Introduction to Disaster Management
- To study about Disaster Management Cycle
- To understand about Disaster Preparedness, Response and Recovery
- To learn about Disaster Education and Public Awareness
- To understand The Role of Technology in Disaster Management
- Knowledge about Physical and Socio-economic Impacts of Disasters

Outcome

The student shall be able to get an idea about

- Learn different concepts in disaster management
- Learn Disaster Management Cycle, Disaster Mitigation measures
- Knowledge about the emergency operation plan (EOP), disaster response and recovery, modern methods of disaster response
- Importance of RS and GIS in Disaster Management
- In depth understanding of impacts of disaster

Module 1: Introduction to Disaster Management

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 2: Disaster Management Cycle

Introduction, Disaster Management Cycle, Disaster Mitigation, Mitigation strategies, Hazard identification and vulnerability analysis, Mitigation measures.

Module 3: Disaster Preparedness, Response and Recovery

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 4: Disaster Education and Public Awareness

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 5: The Role of Technology in Disaster Management

Geographic Information Systems (GIS) and Disaster Management, Remote Sensing and Disaster Management, the Role of Media in Disaster Management.

Module 6: 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.

Reference

1. Abbasi S.A, Krishnakumari P.K and Khan F.I. (1999), *Hot topics*, Oxford University Press. Chennai.
2. Ghosh G.K (2006), *Disaster management* (vol2),Kul Bhushan Nangia, APH Publishing Corporation, New Delhi.
3. Namboodripad P (2008). *Disasters and Hazard Management*. Rajadhani Printers, Delhi.
4. Sharma R.K and Gagandeep, Sharma (2005) *Natural Disaster*, APH Publishing Corporation, New Delhi.
5. Sumit Malhotra (2005). *Natural Disaster Management.* Aavishkas Publishing, Jaipur
6. William J Petals et al. (1982). *Natural Hazard Risk Assessment and Public Policy*, Springer-Verlag, New York

BPES1E06: RECENT TRENDS IN BIOTECHNOLOGY

Credit: 4

Objectives

- To apprehend the concepts of genome
- To learn about the stem cell technology
- To learn about Biosensors
- Fundamentals of Nano Biotechnology
- To understand the concepts of Microarray Chips
- Knowledge about Environmental Biotechnology

Outcome

The student shall be able to get an idea about

- Central dogma of molecular genetics, concept and methods of genome analysis
- Methods and applications of stem cell technology
- Concepts and application of Nano Biotechnology
- Theory and methods involved in Microarray Chips
- Learn about the usage of biosensors in environmental monitoring
- Application of Environmental Biotechnology

Module 1: Genome and Genomics

Introduction, central dogma of molecular genetics, experiments to show DNA as the genetic material, DNA replication, change the sequence of DNA, genes and chromosomes a gene codes for a single polypeptide, recombination occurs by physical exchange of DNA, nature of genetic code. Concept and methods of genome analysis, genome projects. Transcriptome and Transcriptomics: Concept and methods. Proteome and Proteomics: Concept and methods of Proteome analysis. Metabolome and Metabolomics.

Module 2: Stem Cell Technology

Types of stem cells, Manipulations of stem cells and applications in medicine. In vitro fertilization: Principle, methods, applications and ethics. Cloning of animals: Methods and applications.

Module 3: Nano Biotechnology

Introduction, Biomaterials and biological materials-examples and uses. DNA nanotechnology-structural DNA assembly-Nanopore and Nanoparticles-biological arrays- nanoprobes for

analytical applications. Nano biosensors-nanoscale organization-characterization-quantum size effects- sensors of the future. Tools for measuring nanostructures. Microscopies-SEM-TEM-AFM. Modern advances in microanalysis-optical detection of single molecules.

Module 4: Microarray Chips

Concept, design of biochip, types of DNA chips. Gene Therapy for Human Diseases. Protein Crystallization; Theory and methods: API Electro spray and MALDI-TOF. SNP's and GMS (Genome mismatch Signals).

Module 5: Biosensors

Concept, principle, Organization of biosensors and types. Biosensors in Health and Medicine, Food technology, Environment monitoring. Bacterial biosensors; Array Biosensors.

Module 6: Environmental Biotechnology

Global environmental issues and biotechnological solutions. Treatment of industrial effluents-solid waste management- Management of nuclear waste. Bioremediation- in situ and ex situ bioremediation. Biodegradation of xenobiotics. Biomonitoring. Biodiversity conservation. Bioremediation. Biotechnology for solid waste management, Biotechnology for wastewater treatment, Biotechnology for air pollution abatement and odour control, Biodegradation of persistent organic pollutants. Bioenergy – biofuel and biodiesel.

Reference

1. Agarwal, S.K., (1998). *Environmental biotechnology*. APH Publishing Corporation, New Delhi.
2. Baker K.H. and D.S. Herson 1994. *Bioremediation.* Mc Graw HillInc. New York.
3. Hoffman, A.A. (1993). *Evolutionary genetics and environmental stress*. Oxford university press.
4. Jogdand S.N. (1995). *Environmental biotechnology* – industrial pollution management. Himalaya publishing house, Bombay.
5. Lehninger, A.L. (1998). *Principles of biochemistry*. C.B.S. Publishers and Distributors, New Delhi.
6. Strich Berger (1996). *Genetics*. Prentice hall of India, New Delhi.

Model question papers

Reg. No. .....

Name .....

MPhil DEGREE EXAMINATION

First Semester

BPES101: Research Methodology

Time: 3 Hours **Maximum: 70 Marks**

Part A

Answer **any ten** questions. Each question carries **2 Marks**

1. Citation and Impact factor.
2. AAS.
3. PCR.
4. SEM and TEM.
5. GPS.
6. Differentiate between RASTER, VECTOR and TIN.
7. What are signatures? What is their basis
8. what if F test ?
9. ELISA.
10. EMR.
11. Active and passive remote sensing.
12. Scanner sensor systems in remote sensing.
13. Differentiate between spatial and spectral resolution.

(10×2=20)

Part B

Answer **any six** questions. Each question carries **5 Marks**

14. Write a short note on PCR.
15. Explain Digital image processing.
16. Explain the methods for water purification.
17. Write a note on thermal pollution.
18. Explain thin layer chromatography – TLC.
19. Explain briefly the analytical techniques employed for soil analysis.
20. Explain the Surface scanning techniques: SEM and TEM.

21. Write a note on waste management

(6×5=30)

Part C

Answer **any two** questions. Each question carries **10 Marks**

22. Give a detailed account of the theory and applications of GIS.
23. Describe the various steps involved in writing a research thesis.
24. Write about the applications of remote sensing and GIS in environmental science and management.

(2×10=20)

Reg. No. .....

Name .....

MPhil DEGREE EXAMINATION

First Semester

BPES102: Studies in Environmental Science

Time: 3 Hours **Maximum: 70 Marks**

Part A

Answer **any ten** questions. Each question carries **2 Marks**

1. Energy flow.
2. Bioprospecting and Biopiracy.
3. CBD.
4. Bioaccumulation and Biomagnification.
5. Biopol
6. Exon valdaze oil spill
7. Bioinvasion
8. Sanitary landfill
9. Biomonitoring
10. Environmental biotechnology
11. Bt cotton
12. Agro biotechnology
13. Objectives of EIA

(10×2=20)

Part B

Answer **any six** questions. Each question carries **5 Marks**

14. Explain energy flow in an ecosystem with the help of a diagram.
15. Elucidate the concept of niche citing examples.
16. Explain the biogeochemical cycling of Nitrogen with a suitable diagram.
17. Describe the ecological principles and variables.
18. Write a short note on the Environmental movements.
19. Explain the threats to biodiversity.
20. Write a short note on CRZ and EEZ.
21. Briefly explain about biomonitoring, bioindicators and biomarkers.

(6×5=30)

Part C

Answer **any two** questions. Each question carries **10 Marks**

22. Biotechnological solutions to water pollution and air pollution.

23. Biotechnological solutions to soil pollution.

24. Write an essay about ecological importance of Western Ghats of India.

(2×10=20)

Reg. No. .....

Name .....

MPhil DEGREE EXAMINATION

First Semester

BPES1E01: Water Resource Management

Time: 3 Hours **Maximum: 70 Marks**

Part A

Answer **any ten** questions. Each question carries **2 Marks**

1. Acid rain.
2. Springs.
3. Geysers.
4. Artesian wells.
5. Permafrost.
6. Landslides.
7. Estuaries.
8. Causes of glaciation.
9. Ground water zones.
10. Water table.
11. Aquifers.
12. Eutrophication.
13. “Jalanidhi” project.

(10×2=20)

Part B

Answer **any six** questions. Each question carries **5 Marks**

14. Explain the Types and patterns of stream.
15. Describe the mechanics of stream.
16. Write a short note on Stream depositions
17. Write briefly about glacial erosions and depositions.
18. Write a short note on ocean shore erosions and depositions
19. Explain Catchment area management
20. Explain Sand mining with examples.
21. Write briefly about ice age, global warming and climate change

(6×5=30)

Part C

Answer **any two** questions. Each question carries **10 Marks**

22. Write an essay on Water pollution sources, types, effects, causes, methods of purification and sewage treatment.
23. Write about water resources for tourism and fisheries development.
24. Write an essay on Water resources utilization for irrigation and hydroelectric power generation.

(2×10=20)