

“Education for Knowledge, Science and Culture”

-Shikshanmaharashi Dr Bapuji Salunke



VIVEKANAND COLLEGE, KOLHAPUR

(EMPOWERED AUTONOMOUS)

DEPARTMENT OF BIOTECHNOLOGY (OPTIONAL)

B.Sc. Part III - Biotechnology-Optional Semester V & VI

Academic year 2023-24

Subject details of B.Sc. III Optional Biotechnology

Semester	Course code	Course title	Credits	Marks
	DSC-1009E1	Plant Biotechnology	2	50
V	DSC-1009E2	Animal tissueculture	2	50
	DSC- 1009E3	Large-scale manufacturing process I	2	50
	DSC- 1009E4	Large-scale manufacturing process II	2	50
	SEC	Entrepreneurship development	2	50
	AECC –E-1501	English	4	50
VI	DSC-1009F1	Advances in Biotechnology -I (Biochemical techniques)	2	50
	DSC-1009F2	Advances in Biotechnology -II (Gene Technology and Bioinformatics)	2	50
	DSC-1009F3	Cell Metabolism and Virology	2	50
	DSC1009F4	EnvironmentalBiotechnology	2	50
	SEC	Ecology	2	50
	AECC-F-1501	English	4	50
	Practical	III & IV	8	100
	Practical	V & VI	8	100
		Total credits (SEM V+VI) Including SEC, AECC	44	800

VIVEKANAND COLLEGE KOLHAPUR, (EMPOWERED AUTONOMOUS)

Department of Biotechnology (Optional)

B.Sc. III Sem-V and Sem-VI

Program Specific Outcomes (PSOs) / Course Outcomes (CO) /

Program Outcomes (PO)

Program Specific Outcome (PSO):

PSO 1 Graduates will be able to apply knowledge of biotechnology to conserve flora & fauna.

PSO 2 Graduates will be able to outline various projects for human welfare & social awareness

PSO 3 Graduates will be able to perform various techniques in Life sciences.

PSO 4 Graduates will be able to differentiate plant & animals to species level.

Semester V

Programme outcome Pos

1. Graduates will gain and apply knowledge of life science to solve problems related to field of Biotechnology mainly plant and animal tissue culture
2. Graduate will be applying appropriate tools and techniques in plant and animal Biotechnology
3. Graduates will be able study industrial biotechnology and related concepts
4. Graduates are able to know required terms and conditions in fermentation processes
5. Students gain basic knowledge regarding ethical issue and IPR and related concept

Semester VI

Programme outcome Pos

1. Graduate will be able to understand need and impact of Biotechnological solution on environmental and social content keeping in view in sustainable solution
2. Graduates will gain and apply knowledge of biochemical techniques and gene technology. bioinformatics
3. Graduates will be able to decide and apply appropriate tools and techniques in biotechnology.
4. Graduates will be able to understand the need and importance virus study
5. Graduates are able to understand biomolecules and their respective metabolism.

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**Shri Swami Vivekanand Shikshan Sanstha’s
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)
Department of Biotechnology Optional
Academic year 2023-24
B.Sc. III Biotechnology Optional
Semester V and VI Course Outcomes (COs)**

Semester	Course outcome
Semester V	
Paper IX	DSC 1009 E1- Plant Biotechnology
	1.CO. To gain knowledge regarding basic concepts of plant tissue culture laboratory. 2.CO. To acquire knowledge about how to cultivate plant tissues <i>in vitro</i> 3.CO. To study various types of tissue culture 4.CO. Construct to design the commercial plant tissue culture laboratory
Paper X	DSC 1009 E2 -Animal tissue culture
	5. CO. To understand need of animal tissue culture 6.CO. To learn about the cultivation of animal tissues <i>in vitro</i> 7.CO. To gain knowledge about how to prepare and maintain animal tissues using various media and hormones 8.CO. Construct to design the commercial Animal tissue culture Laboratory
Paper XI	DSC1009 E3 Large-scale manufacturing processes-I
	1.CO. To learn about different designs of fermenters. 2.CO. To study the isolation of industrially important microbial strain production 3. CO. To learn the determination of the end product of fermentation. 4.CO: To students gain knowledge regarding Upstream and Downstream processing at fermentation industries
Paper XII	DSC1009 E4 Large-scale manufacturing processes- II
	5.CO. To understand various types of fermentation 6.CO. To learn about different fermentation product 7.CO. To learn about Intellect Property Rights and patenting 8 CO: After competing for the course students are eligible to work in the production department in the fermentation industry
Semester- VI	
Paper XIII	DSC 1009F1 Advances in Biotechnology I
	1.CO: To acquire knowledge about various advancements in applied biotechnology 2.CO: To acquire and learn about various centrifugation techniques, and protein precipitation. 3.CO: To study the use of chromatographic techniques and tracer technique 4. CO: After completing the course students are eligible to apply knowledge of electrophoresis in protein research
Paper XIV	DSC1009 F2 Advances in Biotechnology II
	5.CO: To understand important techniques in gene technology 6.CO: To learn about different therapies in gene technology 7.CO: To learn about applying Biotechnology in silico i.e. via Bioinformatics

	8.CO: After completing the course students are eligible to work in molecular diagnostic and Bioinformatics laboratory.
Paper XV	DSC 1009F3 Cell metabolism and virology
	1.CO: To acquire knowledge regarding biomolecules and their metabolism 2.CO: To learn about various metabolic pathways 3.CO. To understand the basics of viruses their structure, reproduction, and cultivation 4.CO: To study different virus cultivation techniques
Paper -XVI	DSC-1009 F4 Environmental Biotechnology
	5.CO: Implementation of green revolution i.e. to attain reduce, reuse & recycle 6.CO :To acquire knowledge and techniques related to wastewater treatment 7.CO: To acquire knowledge to grow healthy crops without chemical pesticides. 8.CO : To study Modern fuels and their applications
SEC V	SEC Sem V- Entrepreneurship development
	CO:1. students get knowledge about business organization CO:2. After completing the course students can incubate their business idea CO:3. Students can understand concepts of business finance CO: 4. students are able to become successful entrepreneurs
SEC VI	SEC Sem VI- Ecology
	CO1:Energy transfer in ecosystem CO2:To understand different industrial indicators of pollution CO3:Able to understand concepts of ecosystem CO4: Able to illustrate bioremediation to abatement of pollution

**Vivekanand College, Kolhapur (Empowered
Autonomous) B.Sc.- III BIOTECHNOLOGY
(OPTIONAL)**

CBCS syllabus with effect from July 2023

Semester V

DSC-1009-E1- Plant Biotechnology

	Paper IX- Plant Biotechnology	Total Lect.30
	Credit I	15
1	<p>1) Concept & Historical Background Conventional and Non-conventional methods for crop improvement, Landmarks in plant tissue culture. Concept of cell theory, Cellular totipotency, Differentiation, Dedifferentiation, Redifferentiation, Regeneration.</p> <p>2) Scope, recent advances & applications of Plant Tissue Culture (PTC)</p> <p>3) Infrastructure & organization of Laboratory, Different work areas, Equipment & Instruments required</p> <p>4) Media & culture preparation Role of micro & macronutrients, vitamins, amino acid, hormones, activated charcoal and solidifying agents. Culture Conditions - pH, Temperature, Humidity.</p> <p>5) Aseptic Techniques Sterilization of Media, Reagent & Glassware, Surface sterilization of explants</p> <p>6) Practical applications of tissue and organ culture - Application in agriculture, application in horticulture and forestry, pharmaceuticals, research, paleobotany, applications in industries, transgenic plants.</p>	
	Credit II	15
2	<p>1) Callus Culture Introduction, principle, morphology & internal structure, protocol, factors affecting.</p> <p>2) Somatic embryogenesis Introduction, principle, protocol, factors affecting, applications.</p> <p>3) Suspension Culture Introduction, principle, protocol, growth measurement, synchronization, applications.</p> <p>4) Pathways for clonal propagation and Organogenesis Introduction, principle, protocol, factors affecting, applications.</p> <p>5) Haploid culture: Introduction, principle, protocol, applications, advantages of pollen culture over anther culture</p> <p>6) Concept of Soma clonal Variation Concept Protoplast culture</p>	

	DSC- 1009E2 Paper X - Animal tissue culture	Total lect .30
	Credit I	15
1	<p>1) Historical Background Landmarks in Animal Tissue Culture Scope, recent advances & applications of ATC</p> <p>2) Requirements of Animal cell culture</p>	
	<p>Overview of ATC Lab Infrastructure, Substrate for cell growth, equipment required for animal cell culture (Laminar air flow, CO2 incubator, Centrifuge, Inverted microscope).</p> <p>3) Sterilization Glassware, Equipments & culture media Glassware sterilization, reagent and media sterilization, sterility testing.</p> <p>4) Culture media Natural media, synthetic media (serum-containing media, serum free media, balanced salt solution, media constituent, complete culture media, physicochemical properties of media).</p>	
	Credit II	15
2	<p>1) Conceptual Background Biology and Characterization- Characteristics of cultured cells, cell adhesion, cell proliferation, cell differentiation, metabolism of cultured cells, Initiation of cell culture, Evolution and development of cell lines.</p> <p>2) Basic technique of mammalian cell culture Isolation of tissue, disaggregation of tissue, measurement of viability, primary cell culture, Cell lines, Maintenance of cell culture, Subculture, Stem cell cultures. Scale up in monolayer- Roller bottle culture, Spinner Culture, Microcarrier culture</p> <p>Organ and Histotypic Culture: Types and maintenance of organ and histotypic culture,</p>	

Reference Books-

1. Introduction to plant tissue culture-M.K.Razdan
2. Plant tissue culture – Theory & practice- S.S.Bhojwani&M.K.Razdan
3. Crop improvement in biotechnology- H.S.Chawala
4. Plant tissue culture-Kalyankumar Dey
5. Textbook of biotechnology- R.C.Dubey
6. Plant tissue culture- U .Kumar.
7. Biotechnology- B.D.Singh
8. Animal cell culture- Fresheny.

DSC-1009-E3 and E4- Large scale manufacturing process & Specific fermentation

Sr.No.	DSC-1009 E3 Paper XI- Large-scale manufacturing process I	Total lect.30
	Credit I	15
1	<p>Concept of Bioprocess Engineering and Fermentation Technology</p> <ol style="list-style-type: none"> 1) Basic design of fermenter: Construction materials and accessories associated with it 2) Types of Fermenters- Tube tower fermenter, Bubblecap fermenter, Fluidized bed fermenter, Airlift fermenter 3) Fermentation medium: Constituents of medium like carbon source, nitrogen source, amino acids, vitamins, minerals, water, buffers, antifoam agents, precursors, inhibitors, inducers, alternative sources, and monitoring of different parameters 4) Sterilization Concept: Fermentation media, equipment, and air 5) Medium optimization 6) Strains of Industrially important microorganisms <ul style="list-style-type: none"> • Desirable characteristics of an industrial strain • Principles and methods of primary and secondary screening • Inoculum development- Master, working, seed culture • Pure culture techniques & strain improvement by mutation, genetic engineering and genetic recombination • Preservation & maintenance of industrially important microorganisms • Culture Collection Centers in India 	
	Credit II	15
	<ol style="list-style-type: none"> 1) Types of fermentations: Batch, Continuous and Solid-state fermentation 2) Scale Up: Bench Studies, Pilot studies, Industrial scale 3) Downstream Processing: Methods, principle, types, examples of fermentations, factors affecting, merits and demerits of large-scale operations <ul style="list-style-type: none"> • Filtration, Ultrafiltration, Nano filters • Liquid-liquid extraction, solvent extraction • Chromatography: Ion exchange, Affinity, Gel filtration • Distillation • Crystallization • Drying • Reverse Osmosis 4) Use of computers in fermentation 5) Qualitative and quantitative assays <ul style="list-style-type: none"> • Physicochemical Assays: Gravimetric, spectrophotometric, chromatographic • Microbiological Assays: Diffusion assay, turbidimetric assay • Metabolic Assays: Endpoint, enzymatic assay 	

	DSC-1009 E4Paper XII- Large-scale manufacturing process II	Total Lect.30
	Credit I	15
1	<p>1) Production of primary metabolites</p> <ul style="list-style-type: none"> • Organic acid- Citric Acid, Lactic acid • Amino acid- L lysine • Enzyme- Asparaginase, amylase <p>2) Production of secondary metabolites</p> <ul style="list-style-type: none"> • Antibiotics- Penicillin, Streptomycin <p>3) Production of fermented foods</p> <ul style="list-style-type: none"> • Cheese • Vinegar • Beer • Red wine • Bread • Mushroom cultivation <p>4) Microbial biomass production</p> <ul style="list-style-type: none"> • Probiotics • SCP- <i>Spirulina</i> • Xanthan Gum 	
	Credit II	15
2	<p>1) Production of Recombinant-products:</p> <ul style="list-style-type: none"> • Recombinant and synthetic vaccines • Growth hormones • Insulin <p>2) Intellectual Property Rights: Introduction Patents: Introduction, criteria, and process of patenting, trademark, trade secrets, copyrights</p> <p>3) Fermentation economics</p> <p>4) Introduction to Good Manufacturing Practices (GMP)</p> <p>5) Introduction to Quality Control (QC) and Quality Assurance (QA)</p> <p>6) Introduction to Biosafety Levels (BSL) I, II, III</p>	

Reference Books:

1. Comprehensive Biotechnology Volume 3 – Murray Moo- Young
2. Basic Biotechnology - Colin Ratledge & Bijon Kritinsen, Cambridge University press, UK
3. Industrial Microbiology – Casida
Principles of Fermentation Technology-WhittakerReference books-
4. Industrial Microbiology- Prescott & Duns
5. Industrial Microbiology- A.H. Patel
6. Industrial Microbiology - Pepler and Perlman

Semester VI

DSC- 1009-F1 Advances in Biotechnology I

Sr. no.	Paper XIII - Biochemical techniques	Total lect.30
	Credit I	15
1	<p>1) Chromatographic methods – Principle, methodology, and applications of</p> <ul style="list-style-type: none">a) Gel Filtration methodb) Ion exchange chromatography & Affinity chromatographyc) Gas-liquid chromatography (GLC)d) High-Performance Liquid chromatography <p>2) Spectroscopic method – Principle, instrumentation, and applications</p> <ul style="list-style-type: none">a) Infra-red spectroscopyb) Fluorescence spectroscopyc) Atomic spectroscopyd) Mass spectroscopye) NMR spectroscopy	
	Credit II	15
2	<p>1) Electrophoresis: Introduction, types, and general principle Supporting media – (Agarose, Polyacrylamide gel) Electrophoresis of proteins SDS-PAGE electrophoresis- Methodology and Applications. Isoelectric focusing</p> <p>2) Tracer technique; - Introduction – Radioactivity, radioisotopes, types of radiation (α, β, γ), half-life period of the radioisotope, Methods of measurement of radioactivity Gas ionization, Solvent excitation- Liquid scintillation counter, Autoradiography Applications of radioisotopes in biological system</p>	

	DSC- 1009-F2 Paper XIV Advances in Biotechnology II	Total Lect.30
	Gene Technology and Bioinformatics Credit I	15
3	Techniques in gene biotechnology- 1) DNA fingerprinting – Introduction, Genetic marker, Use of minisatellite and microsatellite, Multilocus and single locus probes, Scheme for DNA fingerprinting and applications 2) Gene targeting - Method and application Types of gene therapy – Somatic gene Germ line Methods of gene transfer (Virus vector, non-viral approach Limitations) 3) Antisense therapy - Introduction, Principle, Application	
	Credit II	15
4	Bioinformatics 1) Computer use in Biology- Internet, Networking- HTTP, HTML, WAN , LAN, MAN 2) Information resource- National Center for Biotechnology Information (NCBI), European Bioinformatics Institute (EBI), Sequence retrieval system- Entrez, DBGet 3) Genomics- Human Genome Project- Goal, Application, Introduction to nucleic acid database- Gene Bank, EMBL , DDBJ 4) Introduction to Proteomics, Primary protein sequence database – SWISS-PROT, PIR, MIPS, NRL-3D, TrEMBL 5) Introduction to secondary protein sequence database- PROSITE, PROFILE, PRINT, Pfam, BLOCK, IDENTITY 6) Other databases - Literature database, Pub Med 7) Introduction to structural database- Protein databank (PDB) , 8) Introduction to Molecular docking , Homology modelling	

Reference Books-

1. Practical Biochemistry principles and techniques – Wilson and Walkar
2. Protein purification – Robert Scoop
3. Biophysical Chemistry – Nath Upadhyay
4. Textbook of Biotechnology- R.C. Dubey
5. Textbook of Biotechnology- B.D. Singh
6. Gene
6. Biotechnology - S.N. Jogdan
7. Introduction to Bioinformatics – Rastogi.
8. Introduction to Bioinformatics- T. K. Attwood
9. Gene Manipulation – Old and Primrose

DSC- 1009 F3 and F4 Cell Metabolism and Environmental Biotechnology

DSC- 1009 F3 Paper -XV Cell metabolism and Virology		Total lec .30
Credit I		15
1	<p>General Metabolism- Introduction, Definition, Reactions of Metabolic Pathways. Methods for the study of Metabolic Pathways by using radioisotopes, by using mutants, and <i>in vitro</i> studies.</p> <p>– Metabolism of Carbohydrates</p> <p>1- Carbohydrate metabolism- Reactions, Energetics Significance. 2- Reactions, the significance of Pentose Phosphate Pathway 3- Reactions & Energetics of TCA Cycle.</p> <p>Lipid Metabolism</p> <p>1 Biosynthesis of Saturated Fatty acid- Palmitic Acid 2 β-Oxidation of Fatty acid - Palmitic Acid</p> <p>Respiratory Electron Transport Chain</p> <p>1 Component of ETC 2. Mechanism of ATP generation – Chemical coupling hypothesis, Chemiosmotic hypothesis.</p>	
Credit II		15
2	<p>Protein and Nucleotide Metabolism.</p> <ol style="list-style-type: none"> 1. Urea cycle 2. Purine biosynthesis (Denovo and Salvage pathway) 3. Purine degradation 4. Pyrimidine biosynthesis 5. Pyrimidine degradation <p>Regulation of purine and pyrimidine metabolism</p> <p>Virology-</p> <p>Introduction, Types of viruses on the basis of Host & type of Nucleic acid General Characteristics of Viruses.</p> <p>General Structures of Viruses- TMV, Adenovirus, T4 Bacteriophage-</p> <p>Reproduction of viruses- .1- Adeno virus .2- Bacteriophages- T4, 3. λ- Phage</p> <p>Isolation & Cultivation of Plant & Animal Viruses- Tissue Culture & Embryonated Eggs</p>	

DSC- 1009 F4		
Sr.No.	Paper XVI - Environment Biotechnology	Total lect.30
Credit – I		15
1	<p>1) Conventional and Nonconventional fuel and environmental impact</p> <ul style="list-style-type: none"> • Modern fuel-Biogas, Bioethanol, and Biodiesel production <p>2) Global environmental problems - Greenhouse effect, ozone depletion, acid rain</p> <p>3) Wastewater treatment-</p> <ul style="list-style-type: none"> • Primary treatment - Screening, grinding, grit removal, flocculation, sedimentation, coagulation • Secondary treatment - Aerobic (Trickling filter, activated sludge, stabilization pond) and Anaerobic (Up-flow anaerobic sludge digestion) • Tertiary treatment - chemical, precipitation 	
Credit – II		15
2	<p>1) Bioremediation- Define, Types, Examples - hydrocarbon, dye, heavy metals, pesticides</p> <p>2) Bioremediation in Agriculture (Composting and vermicompost) Concept of Biopesticides, Biosorption, Phytoremediation</p> <p>3) Bioleaching- Types, Chemistry, and examples - Copper and Uranium</p> <p>4) Introduction to Biofertilizer - Inoculants of <i>Rhizobium</i>, <i>Azotobacter</i>, <i>Frankia</i>, Cyanobacteria, Phosphate solubilizing bacteria (PSB) with methods of applications.</p>	

Reference books:

1. Biochemistry – Lubert Strayer.
2. Principles of Biochemistry- Lehninger.
3. Virology- Luria & Delbruck. 4. Fundamentals of Biochemistry- J.L.Jain S.Chand
4. Environmental biotechnology- Indu Shekhar Thakur.
5. Environmental biotechnology- Chattergy.
6. Environmental biology -Verma & Agarwal.
7. Environmental chemistry-B.K.Sharma.
8. Environmental Pollution- Peavy & Rowe.
9. Environmental problems & solutions- Asthana & Asthana.
10. Environmental science-Siago Canninham.
11. Environmental biotechnology-S.N.Jogdand

**Practical
III, IV, V, VI**

Sr.No.	Practical titles	
	Techniques in plant and animal tissue culture	
1	Laboratory Organization and general techniques in PTC	
2	Preparation of MS media, stock solution and medium	
3	Aseptic seed germination	
4	Micropropagation stage I- Initiation of micropropagation Shoot tip culture, auxiliary bud culture	
5	Micropropagation stage II- structure and multiplication of culture	
6	Callus culture techniques- Initiation of culture and callus morphology	
7	Suspension culture technique- Initiation of culture, growth requirement	
8	Anther Culture technique	
9	ATC laboratory design and equipment used in ATC	
10	Animal cell culture media preparation sterilization, washing, packing	
	Techniques in Environmental Biotechnology	
11	Determination of BOD	
12	Determination of COD	
13	Isolation of <i>Rhizobium</i> from root nodules	
14	Isolation of <i>Azotobacter</i> from soil	
15	Isolation of Phosphate Solubilizing Bacteria (PSB) from soil	
16	Determination of hardness of water	
17	Determination of the oligodynamic effect of copper on pathogen	
	Techniques from Microbiology Bioprocess	
18	Screening of Amylase Producers from Soil	
19	Production of bacterial amylase by submerged culture method. Estimation of amylase activity by DNSA method	
20	Isolation of vitamin B12 auxotrophic mutant	
21	Bioassay of antibiotic	
22	Bioassay of vitamin B12	
23	Estimation of citric acid from lemon juice	
24	production of ethanol by using immobilized yeast cells and determination of alcohol content by specific gravity method	
25	Production of xanthan gum from <i>Xanthomonas</i>	
	Techniques from advanced biotechnology	
26	Purification of protein by gel filtration chromatography	

27	Purification of protein by ion exchange chromatography	
28	Immobilization of invertase by using sodium alginate, study of invertase activity by DNSA method	
29	Estimation of alcohol by potassium dichromate method	
30	Demonstration of SDS –PAGE of protein	
31	Demonstration of thermocycler	
32	Isolation of coli phages	
33	Transformation of <i>E. coli</i>	
34	Determination of molecular weight of DNA	
35	Browsing and understanding of NCBI web page Introduction of literature database - Pubmed	
36	Protein structure exploring database – Protein Data Bank (PDB)and use of Rasmol to three dimensional structure of protein	
37	Exploring nucleic acid databases	
38	Separation of plant pigments by adsorption chromatography	
39	Study of Human genome project	
40	Determination of total dissolved solid from waste water sample	
	Practical VI	
	Project	
	Study tour	

B.Sc III Biotechnology Optional Semester -V

ENTREPRENEURSHIP DEVELOPMENT

Credit I	INTRODUCTION	(10)
	Meaning, Needs and Importance of Entrepreneurship, Promotion of entrepreneurship, Factors influencing entrepreneurship, Features of a successful Entrepreneurship.	
	ESTABLISHING AN ENTERPRISE	12
	Forms of Business Organization, Project Identification, Selection of the product, Project formulation, Assessment of project feasibility.	
Credit II	FINANCING THE ENTERPRISE (15 Periods)	15
	Importance of finance / loans and repayments, Characteristics of Business finance, Fixed capital management: Sources of fixed capital, working capital its sources and how to move for loans, Inventory direct and indirect raw materials and its management.	
	MARKETING MANAGEMENT	10
	Meaning and Importance, Marketing-mix, product management – Product line, Product mix, stages of product like cycle, marketing Research and Importance of survey, Physical Distribution and Stock Management.	

SUGGESTED READING

1. Holt DH. Entrepreneurship: New Venture Creation.
2. Kaplan JM Patterns of Entrepreneurship.
3. Gupta CB, Khanka SS. Entrepreneurship and Small Business Management, Sultan Chand & Sons.

	B.Sc III Semester VI (Optional) Biotechnology	
	Skill Enhancement Course	
	ECOLOGY AND ENVIRONMENT MANAGEMENT	
	Credit I	
	<p>Our Environment: Geological consideration of Atmosphere, Hydrosphere, Lithosphere. Scope of Ecology. Development & Evolution of Ecosystem. Principles & Concepts of Ecosystem.</p> <p>Structure of ecosystem. Strata of an ecosystem. Types of ecosystem including habitats.</p> <p>Biological control of chemical environment.</p> <p>Energy transfer in an Ecosystem. Food chain, food web, Energy budget, Production & decomposition in a system.</p> <p>Ecological efficiencies, trophic structure & energy pyramids, Ecological energetic, Bio-geochemical cycles (N,C,P cycles)</p>	15
	Credit II	
	<p>Pollution & environmental Health related to Soil, Water, Air, Food, Pesticides, Metals, Solvents, Radiations ,Carcinogen, Poisons. Detection of Environmental pollutant. Indicators & detection systems. Bio-transformation, Plastic, Aromatics, Hazardous wastes Environmental Cleanup</p> <p>Environmental biotechnologies, Biotechnologies in protection and preservation of environment.</p> <p>Bioremediation, Waste disposal</p>	15
	Practical	
1	Study of all the biotic and abiotic components of any simple ecosystem natural pond or terrestrial ecosystem or human modified ecosystem.	
2	Study of the types of soil, their texture by sieve method and rapid tests for pH, chlorides, nitrates, carbonates and organic carbon	
3	Principle of GPS (Global Positioning System).	
4	Study any five endangered/ threatened species- one from each classes	

SCHEME OF MARKING FOR (THEORY)

Sem	Core Course	Marks	Evaluation	Sections	Answer Books	Standard of passing
5	DSC-1009-E1	70	Semester wise	Two sections each of 35 marks	As per instruction	35% (25 marks)
5	DSC-1009-E2	70	Semester wise	Two sections each of 35marks	As per instruction	35% (25 marks)
6	DSC- 1009 F1	70	Semester wise	Two sections each of 35 marks	As per instruction	35% (25 marks)
6	DSC- 1009 F2	70	Semester wise	Two sections each of 35 marks	As per instruction	35% (25 marks)

SCHEME OF MARKING (CIE) Continues Internal Evaluation

Sem	Core Course	Marks	Evaluation	Sections	Answer Books	Standard of passing
5	DSC-1009-E1	30	Semester wise	One	As per instruction	35% (10marks)
5	DSC-1009-E2	30	Semester wise	One	As per instruction	35% (10marks)
6	DSC- 1009 F1	30	Semester wise	One	As per instruction	35% (10marks)
6	DSC- 1009 F2	30	Semester wise	One	As per instruction	35% (10marks)

SCHEME OF MARKING (PRACTICAL)

Sem	Course	Marks	Evaluation	Section	Standard of passing
V and VI	Practical III,IV,V,VI	200	Annual	As per instruction	35% (72marks)

*A separate passing is mandatory

Nature of Question Paper (Theory)

Instructions

1. All the questions are compulsory.
2. Figures to the right indicates full marks.
3. Draw neat labelled diagram wherever necessary.

Time: 2Hrs

Total Marks: 35

SECTION - I

Q. 1.A Choose the correct alternative and rewrite the sentences.

(5Marks)

i.

- a) b) c) d)

ii.

- a) b) c) d)

iii.

- a) b) c) d)

iv.

- a) b) c) d)

v.

- a) b) c) d)

Q.1B Fill in the blanks

(2Marks)

i)

ii)

Q. 2. Attempt any two.

(16 Marks)

i.

ii.

iii..

Q. 3. Attempt any three out of five

(12 Marks)

- i.
- ii.
- iii.
- iv.

Instructions to paper setters : Equal weight age should be given to all units

For Continues Internal Evaluation : (30 Marks)

Mandatory 1) Presenty ----- (5 marks)

Select any one for B.Sc.III ----- (25 marks)

- 1) Unit test
- 2) Home assignment
- 3) Project
- 4) Seminar

*Yet it is not finalized

NATURE OF QUESTION PAPER AND DISTRIBUTION OF MARKS

PRACTICAL EXAMINATION

Practical III, IV, V,VI

First day

Q.1 Major experiment 20

Q.2 Minor experiment 10

Q.3 Spotting 10

Q.4 Viva-voce 10

Second day

Q.5 Major experiment 20

Q.6 Minor experiment 10

Q.7 Minor experiment 10

Q.8 Journal 10

Third day

Q.1 Major experiment 20

Q.2 Minor experiment 10

Q.3 Spotting 10

Q.4 Viva-voce 10

Practical VI -Project presentation and study tour for----- 50M

1. Project report	20M
2. Project Presentation	15M
3. Study tour report	15M
TOTAL MARKS	200 M





