“Education for Knowledge, Science and Culture”

- Dr Bapuji Salunkhe

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

DEPARTMENT OF BIOTECHNOLOGY (OPTIONAL)

B.Sc. Part III- Biotechnology -optional

Semester V & VI

Subject details B.Sc. III Optional Biotechnology

Semester	Course code	Course title	Credits	Marks
V	DSE-1009 E1	Plant & environment biotechnology	4	100
	DSE-1009 E2	Large scale manufacturing process	4	100
	SEC	Entrepreneurship development	2	50
	AECC –E-1501	English	4	50
VI	DSE-1009 F1	Advance in Biotechnology	4	100
	DSE1009 F2	ATC & cell metabolism	4	100
	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,(Autonomous)

B.Sc.- III BIOTECHNOLOGY (OPTIONAL)

CBCS syllabus with effect from June 2020

S.N.	**Semester V** **DSE-1009-E1 Plant and Environmental Biotechnology**	Total lect.60
	CREDIT-I	15
1	Conventional and Non conventional fuel and environmental impact Modern fuel-Biogas , Bioethanol ,Biodiesel production Global environmental problems-Green house effect, ozone depletion, acid rain Waste- Define, Types- solid and liquid waste Solid waste management **Waste water treatment-** 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	**Bioremediation**- Define, Types, Example- hydrocarbon , dye, heavy metal, pesticides Bioremediation in Agriculture (Composting and vermicompost) Concept of Biopesticides, Biosorbtion, Phytoremediation **Bioleaching-** Types, Chemistry and examples- Copper and Uranium **Introduction to Biofertilizer**-Inoculants of Rhizobium, Azotobacter, , Frankia, Cyanobacteria, Phosphate solubilizer with method of application	

	Section II	
	Credit III	15
3	**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. **Scope, recent advance & applications of PTC** **Infrastructure & organization of Lab** Different work areas Equipments & Instruments required **Media & culture preparation** Role of micro & macro nutrients, Vitamins, amino acid, Hormones, activated charcoal, Solidifying agents. Culture Conditions- pH, Temperature, Humidity. **Aseptic Techniques** Sterilization of Media, Reagent & Glassware Surface sterilization of explants **Practical applications of tissue and organ** culture - Application in agriculture, application in horticulture and forestry, pharmaceutical ,research,paliobotany applications in industries, transgenic plants.	
	Credit IV	15
4	**Callus Culture** Introduction, principle, morphology & internal structure, protocol, factors affecting. **Somatic embryogenesis** Introduction, principle, protocol, factors affecting, applications. **Suspension Culture** Introduction, principle, protocol, growth measurement, synchronization, applications. **Pathways for clonal propagation** **Organogenesis** Introduction, principle, protocol, factors affecting, applications. **Haploid culture** Introduction, principle, protocol, applications, advantages of pollen culture over anther culture **Concept of Somaclonal Variation** **Concept Protoplast culture**	

Reference book:

1. Environmental biotechnology- InduShekhar Thakur.

2. Environmental biotechnology-Chattergy.

3. Environmental biology-Verma& Agarwal.

4. Environmental chemistry-B.K.Sharma.

5. Environmental Pollution- Peavy& Rowe.

6. Environmental problems & solutions- Asthana & Asthana.

7. Environmental science-SiagoCanninhham.

8. Environmental biotechnology-S.N.Jogdand.

9. Water engineering- Treatment dispose &reuse-Metcalf & Eddy.

10. Environmental Biotechnology-C.S.K Mishra &Juwarkar

11.Introduction to plant tissue culture-M.K.Razdan

12. Plant tissue culture – Theory & practice- S.S.Bhojwani&M.K.Razdan

13. Crop improvement in biotechnology-H.S.Chawala

14. Plant tissue culture-Kalyankumardey

15. Textbook of biotechnology- R.C.Dubey

16. Plant tissue culture- U .Kumar.

17. Biotechnology- B.D.Singh

	DSE-1009-E2- Large scale manufacturing process	Total lect.60
	Credit I	15
1	**Concept of Bioprocess engineering and fermentation technology** **Basic design of fermentator** , its contruction material and accessories associated with Fermentor, Fermentation media **Types of Fermentor**- Tube tower Fermentor, bubble cap Fermentor, fluidized bed Fermentor, Air lift Fermentor Concept of sterilization of fermentation media, equipment and air **Screening of industrially important microorganism**- Primary and Secondary screening, Pure culture techniques Stain improvement by mutation, Genetic engineering, Genetic recombination Maintenance of industrially important microorganism. culture collection centre in India Examples	
	Credit II	15
2	**Scale up**-Bench studies, pilot studies, industrial scale Use of computer in fermentation, Building of inoculums, pitching Types of fermentation-Continues, Batch, Solid state fermentation Downstream processing- Centrifugation, Distillation, Solvent extraction, Filtration, Ultra filtration, Precipitation, Ion Precipitation, Ion exchange chromatography, Gel filtration , Affinity chromatography, crystallization and drying **Assay** – Physico chemical assay- Gravimetric, Spectrophotometeric, Chromatographic Microbiological assay-Diffusion assay, Turbidometric assay, Metabolic assay, end point determination assay, enzymatic assay **Introduction to Quality control**	

	Section II	
	Credit III	15
3	**Specific fermentation**: Citric acid Fermentation Penicillin fermentation L-Lysine fermentation L-Asparginase fermentation Single cell protein- Spirulina Amylase production Vinegar production Bread fermentation Xanthan gum fermentation Vitamin B_{12} Lactic acid fermentation	
	Credit IV	15
4	**Alcoholic fermentation**- Red wine and Beer fermentation Cheese fermentation. Fermentation economics **Intellectual property rights**- Introduction Patents- Introduction , Criteria and process of patenting Trademarks, Trade secrets Copyrights	

Reference books-

1.Comprehensive Biotechnology volume 3 – Murray Moo- Young

2. Basic Biotechnology- Colin Ratledge&BijonKritinsen, cambridge university press ,UK

3. Industrial Microbiology –casida

4. Principles of Fermentation technology-Whittekar

5. Industrial Microbiology- Prescott &duns

6. Industrial Microbiology- A.H.Patel

7. Industrial Microbiology-Pepler& Perlman

Sr. no.	**Semester VI**	Total lect.60
	DSE- 1009 F1 Advances in Biotechnology	
	Credit I	15
1	**Cell disruption methods**-Grinding, abrasive presses, Enzymatic method, sonication. **Centrifugation** Introduction and basic principle of sedimentations Types of centrifuges, Types of Centrifugation- Differential centrifugation, density Gradient centrifugation . **Separation of proteins by precipitation**-Salt precipitation - procedure and methodology of Salting out by Ammonium sulphate. Organic solvent precipitation **Dialysis** **Chromatographic methods** – Principle, methodology and applications of Gel Filtration method 2 Ion exchange chromatography 3 Affinity chromatography 4 Gas liquid chromatography (GLC) 5 High Performance Liquid chromatography	
	Credit II	15
2	**Electrophoresis.** Introduction, types and general principle Supporting media – (Agarose. poly acryl amide gel) Electrophoresis of protein SDS-PAGE electrophoresis- Methodology and Applications. Isoelectricfocusing **Tracer technique**;- Introduction – Radioactivity, radioisotopes, types of radiation (α, β, γ), half-life period ofradioisotope. Methods of measurement of radioactivity Gas ionization, Solvent excitation- Liquid scintillation counter Autoradiography Applications of radioisotopes in biological system Spectroscopic method – Principle. Instrumentation and applications 1. Infra red spectroscopy 2. Florescence spectroscopy 3. Atomic spectroscopy	

	Section II	
	Credit III	15
3	**Techniques in gene biotechnology-** **DNA fingerprinting** –Introduction, Genetic marker Use of minisatellite and microsatellite, Multilocus and single locus probes.Scheme for DNA fingerprinting and applications Concept of Chromosome walking and jumping, Gene targeting Human gene therapy- Types of gene therapy- 1.Somatic gene 2.Germ line Methods of gene transfer-(Virus vector , non viral approach Limitations) Antisense therapy- Introduction, Principle, Application	
	Credit IV	15
4	**BIOINFORMATICS** Computer use in Biology- Internet, Networking- HTTP, HTML,WAN,LAN,MAN **Information resource**- National Center for Biotechnology Information(NCBI) , European Bioinformatics Institute (EBI), Sequence retrieval system- Entrez, DBGet **Genomics**- Human Genome Project- Goal, Application, Introduction to nucleic acid database- Gene Bank, EMBL , DDBJ **Introduction to Proteomics, Primary protein sequence database** – SWISS-PROT, PIR, MIPS, NRL-3D, Tr EMBL **Introduction to secondary protein sequence database-** PROSITE, PROFILE, PRINT,Pfam, BLOCK, IDENTIFY **Other database**- Literature database, Pub Med Introduction to structural database- Protein databank (PDB) , **Introduction to Molecular docking , Homology modelling**	

References:-

1. Practical Biochemistry principles and techniques – Wilson andWalkar
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 Biotechnology -S.N.Jogdand

7. Gene Manipulation – Old and Primrose

8. Introduction to Bioinformatics – Rastogi.

9. Introduction to Bioinformatics- T. K. Attwood.

	DSE- 1009 F2Animal tissue culture and cell metabolism	Total lect .60
	Section I	
	Credit I	15
1	**Historical Background** Landmarks in Animal tissue culture Scope, recent advances & applications of ATC **Requirements of Animal cell culture** Overview of ATC Lab Infrastructure, Substrate for cell growth, Equipments required for animal cell culture (Laminar air flow, CO2 incubator, Centrifuge, Inverted microscope). **Sterilization of Glassware's, Equipments & culture media** Glassware sterilization, reagent and media sterilization, sterility testing. **Culture media** Natural media, synthetic media (serum containing media, serum free media, balanced salt solution, media constituent, complete culture media, physicochemical properties of media).	
	Credit II	15
2	**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. **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 **Organ and Histotypic culture** Types and maintenance of organ culture, Histotypic culture	
	Section II	
	Credit III	15
3	General Metabolism- Introduction, Definition, Reactions ofMetabolic Pathways. Methods for study of Metabolic Pathways by using radioisotopes, by using mutants, in vitro studies. **– Metabolism of Carbohydrates** 1- Carbohydrate metabolism- Reactions, Energetics Significance, of-Glycolysis 2- Reactions, significance of Pentose Phospate Pathway 3- Reactions & Energetics of TCA Cycle. **Lipid Metabolism** 1 Biosynthesis of Saturated Fatty acid- Palmitic Acid 2 β-Oxidation of Fatty acid - Palmitic Acid **Respiratory ElectronTransport Chain** 1 Components of ETC	

	2.Mechanism of ATPgeneration – Chemical coupling hypothesis , Chemiosmotic hypothesis. **Credit IV**	
	Protein and Nucleotide Metabolism. 1. Uera cycle 2. Purine biosynthesis (Denovo and Salavage pathway) 3. Purine degradation 4. Pyrimidine biosynthesis 5. Pyrimidine degradation Regulation of purine and pyrimidine metabolism **Virology-** Inroduction. Types of viruses on the basis of Host & type of Nucleic acid General Characteristics of Viruses. **General Structures of Viruses**- TMV, Adeno virus, T4 Bacteriophage- **Reproduction ofViruses**- .1- Adeno virus .2- Bacteriophages- T4, 3. λ- Phage **Isolation & Cultivation of Plant & Animal Viruses**- Tissue culture &Embryonated Eggs	15

Reference book-

1. Animal cell culture- Fresheny.
2. Biotechnology – B.D.Singh.
3. Biotechnology- R.C.Dubey.
4. Gene Biotechnology- S.N.Jogdand
5. Biochemistry – LubertStrayer.
6. Principles of Biochemistry- Lehninger.
7. Virology- Luria & Delbruck. 4. Fundamentals of Biochemistry- J.L.JainS.Chand
8. Animal cell culture- Fresheny.

	Practical III.IV.V.VI	
S.N.	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	Micro propagation stage I- Initiation of micropropagation Shoot tip culture ,auxiliary bud culture	
5	Micro propagation 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 *Rhizobium* from root nodules	
14	Isolation of *Azotobacter* from soil	
15	Isolation of PSB from soil	
16	Determination of hardness of water	
17	Determination of oligodynamic effect of copper on pathogen	
	Techniques from microbiology Bioprocess	
18	Screening of Amylase Producers from Soil	
19	Production of amylase by submerged culture method. Estimation of amylase activity by DNSA method	
20	Isolation of vitamin B12 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 ofalcohol content by specific gravity method	
25	Production of xanthan gum from xanthomonas	

	Techniques from advanced biotechnology	
26	Purification of protein by gel filtration chromatography	
27	Purification of protein by ion exchange cromatography	
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 proein	
31	Demonstration of themocycler	
32	Isolation of coli phages	
33	Transformation of E.Coli	
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 dimensiomal 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	

B.Sc III Biotechnology Optional Semester -V		
ENTERPRENEURSHIP 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	
	Our Environment: Geological consideration of Atmosphere, Hydrosphere, Lithosphere. Scope of Ecology. Development & Evolution of Ecosystem. Principles & Concepts of Ecosystem. Structure of ecosystem. Strata of an ecosystem. Types of ecosystem including habitats. Biological control of chemical environment. Energy transfer in an Ecosystem. Food chain, food web, Energy budget, Production & decomposition in a system. Ecological efficiencies, trophic structure & energy pyramids, Ecological energetic, Bio-geochemical cycles (N,C,P cycles)	15
	Credit II	
	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 Environmental biotechnologies, Biotechnologies in protection and preservation of environment. Bioremediation, Waste disposal	**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	DSE-1009-E1	80	Semester wise	Two sections each of 40 marks	As per instruction	35% (28 marks)
5	DSE-1009-E2	80	Semester wise	Two sections each of 40 marks	As per instruction	35% (28 marks)
6	DSE- 1009 F1	80	Semester wise	Two sections each of 40 marks	As per instruction	35% (28 marks)
6	DSE- 1009 F2	80	Semester wise	Two sections each of 40 marks	As per instruction	35% (28 marks)

SHEME OF MARKING (CIE) Continues Internal Evaluation

Sem	Core Course	Marks	Evaluation	Sections	Answer Books	Standard of passing
5	DSE-1009-E1	20	Semester wise	One	As per instruction	35% (7marks)
5	DSE-1009-E2	20	Semester wise	One	As per instruction	35% (7marks)
6	DSE- 1009 F1	20	Semester wise	One	As per instruction	35% (7marks)
6	DSE- 1009 F2	20	Semester wise	One	As per instruction	35% (7marks)

SHEME 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: 3Hrs **Total Marks**: **80**

SECTION -I

Q. 1. Choose the correct alternative and rewrite the sentences. (8 Marks)

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)

vi.

a) b) c) d)

vii.

a) b) c) d)

viii.

a) b) c) d)

Q. 2. Attempt any two. (16 Marks)

i.

ii.

iii..

Q. 3. Attempt any four. **(16 Marks)**

i.

ii.

iii..

iv.

v.

vi.

SECTION II

Q. 4. Choose the correct alternative and rewrite the sentences. (8 Marks)

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)

vi.

a) b) c) d)

vii.

a) b) c) d)

viii.

a) b) c) d)

Q. 5. Attempt any two. **(16 Marks)**

i.

ii.

iii..

Q. 6. Attempt any four. **(16 Marks)**

i.

ii.

iii..

iv.

v.

vi.

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

For Continues Internal Evaluation : (20 Marks)

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

Select any one for B.Sc.III-------(15 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 for 50M

1. Project report 25M
2. Project Presentation 15M
3. Oral 10M

TOTAL MARKS 200 M