SAVITRIBAI PHULE PUNE UNIVERSITY

T. Y. B. Sc. Biotechnology (Vocational)

(To be implemented from Academic Year 2015-16)

(A Vocational Subject under the UGC Scheme of Vocationalization at First Degree Level)

Title of the Course: Biotechnology (Vocational)

Introduction: Pattern- Semester

Eligibility: Should have offered Biotechnology (Vocational) at F.Y.B.Sc & S.Y.B.Sc and passed as per University rules

Examination

A) Pattern of examination:

i) 40-10 University semester examination of 40 marks & Internal assessment of 10 marks. Details as per syllabus

ii) Pattern of the question paper- As per specimen given

B) Standard of Passing: As per University norms

C) ATKT Rules: As per University norms

D) Award of Class: As per University norms

E) External Students : Not allowed

F) Setting of Question paper/ Pattern of Question paper: As per University norms

G) Verification of Revaluation: As per University norms

Structure of the Course:

i) Optional

ii) Medium of instruction: English

Equivalence subject/ papers & Transitory Provision: Biotechnology (Vocational)

University terms: As per University norms

Subject wise Detail Syllabus: Attached

Recommended books: Mentioned in the syllabus

Sem III

(Voc-BIOTECH-335) Paper I: Plant and Animal Biotechnology

Chapter 1	**ORGANOGENESIS** i) Introduction to organogenesis ii) Direct and indirect organogenesis iii) Rhizogenesis and Caulogenesis	04
Chapter 2	**EMBRYO CULTURE** i) History and methodology ii) Embryo rescue after wide hybridization iii) Applications	02
Chapter 3	**SOMATIC EMBRYOGENESIS** i) Induction of somatic embryos ii) Artificial seed production	02
Chapter 4	**SOMACLONAL VARIATIONS** i) Causes of somaclonal variation ii) Selection and multiplication of somaclones iii) Advantages and disadvantages	04
Chapter 5	**PRODUCTION OF HAPLOIDS** i) Importance of haploids ii) Anther culture and ovule culture, iii) Detection of haploids, iv) Uses of haploid in plant breeding	04
Chapter-6	**GENE TRANSFER METHODS IN PLANTS** i) Physical methods ii) Biological methods	04
Chapter-7	**SECONDARY METABOLITE PRODUCTION** i) Hairy root culture ii) Production of hairy root and precursors used iii) Advantages and limitation	04
Chapter-8	**ANIMAL CELL CULTURE** i) Established animal cell lines ii) Commonly used cell lines: origin and characteristics iii) Growth kinetics and cells in culture iv) Bioreactors for large scale culture of cells v) Cell fusion vi) Transplantation of cultured cells (Grafting) vii) Expressing cloned products in animal cells – (a) The need to express in animal cells (b) over production and processing of chosen protein.	08
Chapter-9	**TRANSGENIC AND EMBRYONIC STEM CELL TECHNOLOGY** i) Introduction to stem cells ii) Methods to generate transgenic using stem cell iii) Applications iv) Limitations and ethical issues	08
Chapter-10	**APPLICATIONS OF ANIMAL BIOTECHNOLOGY** i) Production of special secondary metabolites/ products (insulin, growth hormone, interferon, plasminogen activator, factor VIII etc) ii) Harvesting and purification of products. iii) Production of monoclonal antibodies and its applications iv) Production of vaccines using animal cell culture v) In vitro fertilization	08

Reference books		
	1) Plant tissue culture: M.K.Razdan 2) Plant tissue culture: H.D.Kumar 3) Plant biotechnology-K.G. Ramawat 4) Elements of Biotechnology- P.K.Gupta 5) Animal Biotechnology – edited by R.E. Spier and J.B. Griffith 6) Principles and practice in animal tissue culture—Sudha Gangal university Press 7) Animal cell culture- Ian Freshney	

Sem III

(Voc-BIOTECH-336) PAPER II: MICROBIAL BIOTECHNOLOGY AND FERMENTATION

Chapter 1	**MICROBIAL BIOTECHNOLOGY** i) Definition ii) Principles of microbial technology iii) scope and importance iv) historical development	02
Chapter 2	**MICROBIAL GROWTH** i) Microbial growth ii) Microbial growth kinetics iii) Batch ,fed batch and continuous culture iv) growth linked and non growth linked products v) diauxic growth vi) yield coefficient	08
Chapter 3	Extremophiles- Acidophiles, basophiles, Psychrophiles, thermophiles Halophiles, Barophiles, Obligate anaerobes and their adaptations.	04
Chapter 4	**IMMOBILIZATION** i) Whole cell Immobilization- Methods, advantages ,disadvantages, applications and properties ii) Enzyme Immobilization-Methods, advantages ,disadvantages, applications and properties	02
Chapter 5	**APPLICATIONS OF MICROBIAL BIOTECHNOLOGY** i) Bioleaching, MEOR, Biosensors, ii) Applications in the field of medicines and Environment iii) Biopolymers and Bioplastics iv) Bio-fertilizers and Bio-pesticides v) Oriental fermented foods –Soy sauce, Templeh vi) Bioremediation (any one example) vii) Applications of GMO's in agriculture ,industry and medicine.(one example each)	08
Chapter-6	**FERMENTATION** i) Definition, history and importance ii) Layout of typical fermentation unit iii) Concepts of primary and secondary metabolites, iv) Fermentation media v) Types of fermenters vi) Screening (Primary and secondary) vii) Strain improvement	**10**
Chapter 7	vii)Inoculum build up (Bacteria, fungi, yeast) **FERMENTER DESIGN,OPERATION and DOWNSTREAM PROCESSING** i) Design of typical batch fermenter ii) Fermenter types (Batch, continuous , Fed batch, bubble column, air lift, packed bed, fluidized bed) iii) Measurement and control of different parameters during fermentation. iv) Downstream processing. v) SOP,GMP,QA and QC functions	08
Chapter-8	**APPLICATIONS OF FERMENTATION:**	06

	Production and recovery of industrially important products- i) Antibiotics- Penicillin and Streptomycin ii) Biomass- Baker's yeast ,Spirulina iii) Vitamin B12 iv) Enzymes –Proteases, amylases v) Beverages-Wine, Beer vi) Vaccines- DPT vii) Organic acids- Citric acid	
Reference books		
1	General Microbiology – Stanier	
2	Principles of Fermentation Technology - Whitaker, A. 2nd Edition	
3	Microbial biotechnology –principles and applications 2nd Edition Lee yuan kun 2006	
4	Industrial microbiology L.E.Casida 1968	
5	Microbial Technology: Fermentation technology second Ed Peppler 2004	

Sem IV

(Voc-BIOTECH-345) Paper I: Environmental Biotechnology and Bioinformatics

Chapter 1	**ENVIRONMENTAL BIOTECHNOLOGY** i) Introduction ii) Scope and importance	02
Chapter 2	**WASTE WATER TREATMENT** i) Microorganisms used in waste water treatment, ii) Bioaugmentation, iii) Biostimulation, iv) Bioreactors in waste water treatment	06
Chapter 3	**XENOBIOTIC DEGRADATION** i) Pesticide degradation by microbes ii) Herbicide degradation by microbes	02
Chapter 4	**BIOFUELS** i) Biogas production using methanogenic bacteria ii) Microbial hydrogen gas production iii) Ethanol production and its use as fuel, eg. Gasohol iv) Cellulose degradation for combustible fuel v) Photosynthetic pigments as solar energy convertors vi) 6. Plant based petroleum industry	06
Chapter 5	**BIOFERTILIZERS** i) Nitrogen fixing microorganisms enriching the soil with assimilable nitrogen ii) Phosphate solubilizers iii) Plant growth promoting rhizobacteria	04
	BIOREMEDIATION AND PHYTOREMEDIATION i) Bioremediation • In –situ bioremediation • Ex –situ bioremediation ii) Phytoremidiation • Phytosequestration • Rhizodegradation • Phytohydraulics • Phytoextraction • Phytovolatilization • Phytodegradation iii) Bioleaching: Enrichment of ores by microorganisms	04
Chapter-6	**APPLICATIONS OF ENVIRONMENTAL BIOTECHNOLOGY** i) Biotechnology applications to Hazardous waste management ii) Biotechnological applications to pesticide, tannery, paper, food and related industries	04
Chapter-7	**BIOINFORMATICS** i) Introduction and Definition ii) History and Scope iii) Application in various fields	02
Chapter-8	**OPEN ACCESS BIBLIOGRAPHIC RESOURCES AND LITERATURE DATABASES** i) PubMed, ii) BioMed Central, iii) PubMed Central,	04

	iv) Public Library of Sciences (PloS).	
Chapter-9	**SEQUENCE DATABASES: FORMATS, QUERYING & RETRIEVAL** i) Nucleic acid sequence databases: GenBank, EMBL, DDBJ ii) Protein sequence databases: SWISS-PROT, TrEMBL, PIR-PSD. iii) Repositories for high throughput genomic sequences: EST, STS GSS. iv) Genome Databases at NCBI, EBI, TIGR, SANGER ,Viral Genomes,Archeal and Bacterial Genomes , Eukaryotic genomes with special reference to model organisms (Yeast, Drosophila, *C. elegans*, Rat, Mouse, Human, plants such as *Arabidopsis thaliana*, Rice, etc.)· v) Structure Databases: PDB, NDB, PubChem, Derived Databases Knowledge of the following databases with respect to: basic concept of derived databases, sources of primary data and basic principles of the method for deriving the secondary data, organization of data, contents and formats of database entries, identification of patterns in given sequences and interpretation of the same. vi) Prosite, Pfamo Structure: CATH, SCOP, DSSP, PDB Goodies, Extraction of knowledge from databases on Immunology, Plant, animal &infectious diseases: search new databases & servers using NAR Database & Web server Issue, BMC Bioinformatics etc. vii) Sequence Analysis various file formats for bio-molecular sequences: GenBank, FASTA, GCG, MSF, BRF-PIR etc.	08
Chapter-10	**DATABASE SEARCHES** i) Basic concepts of sequence similarity, identity and homology, definitions ii) of homologues, orthologues, paralogues. iii) Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series, principles based on which these matrices are derived. iv) Keyword-based Entrez and SRS, Sequence-based: BLAST & FASTA, Use of these methods for sequence analysis including the on-line use of the tools and interpretation of results from various sequence and structural as well as bibliographic databases.	06
Reference books		
1. Environmental biotechnology – Dr.P.R.Yadav2006. Discover publishing House 2. Environmental biotechnology-S.N. Jogdand -Himalaya publishing house 3. Environmental biotechnology and cleaner processes. Edited by Eugenia Olegin ,Gloria Sanchez,Elizabeth Hernandez, 4. A textbook of biotechnology –H.D.Kumar. 5. Bioinformatics Databases, Tools and Algorithms: Orpita Bosu, Simminder Kaur Thukral 6. Bioinformatics Sequence and Genome Analysis: David Mount.		

SEMESTER-IV

(Voc-BIOTECH-346) PAPER II: ENTREPRENEURSHIP DEVELOPMENT

Entrepreneurship is a tremendous force that can have a big impact in growth, recovery, and societal progress by fuelling innovation, employment generation and social empowerment.

Through entrepreneurship education, young people, including those with disabilities, learn organizational skills, including time management, leadership development and interpersonal skills, all of which are highly transferable skills sought by employers.

The syllabus for T.Y.B.Sc., Vocational students thus is aimed at creating an awareness amongst the students about the benefits of becoming an entrepreneur and at the same time equip them with information about a good and a viable opportunity; making a business plan by assessing the techno-economic feasibility, seeking financial assistance, variety of procedures and formalities for setting up an Small Scale enterprise, taking decisions in such a manner so that entrepreneurship becomes a life time career goal.

OBJECTIVES:

- To create awareness about self-employment and motivate the students to go for self-employment.
- To study entrepreneurship concepts and their applicability.
- To familiarize the students to the practical world of enterprise/business.

1. INTRODUCTION:

Concept of entrepreneurship, Historical background, need and scope of entrepreneurship in modern society, Entrepreneurial behavior, attributes and skills.
Key elements of entrepreneur, Entrepreneurial process, Entrepreneurial culture,
Environment of Entrepreneurship, Socio economic origins of Entrepreneurship,
Barriers of Entrepreneurship and means to reduce those, types of Entrepreneurs, Characteristics of Entrepreneur. 8 Lectures

2. BUSINESS ORGANIZATIONS:

Forms of business organizations such as sole proprietorship, partnership, Joint Stock Company, cooperative organization etc.
Meaning and definition , Relative merits and demerits of each form, ,
Types of Small Scale Industry.
3 Lectures

3. Study of organizations promoting Entrepreneurship

Sources of Information: Where to go for what?

a) District Industry Centre (DIC)
b) Maharashtra Industrial Development Corporation (MIDC)
c) Maharashtra State Small Industries Development Corporation (MSSI DC)
d) Small Industries Services Institute (SISI)
e) National Institutes of Entrepreneurship and Small business Development (NIESBUD)
f) National Entrepreneurship Development Board (12) (NEDB)
g) Entrepreneurship Development Institute of India
h) Commercial and Co-operative Banks
i) State Industrial Development Bank (SIDBI)
j) Pollution Control Board 3 Lectures

Legal Aspects of Small Business:

Elementary knowledge of Income Tax, Sales Tax, VAT, Service Tax, Patent Rules, Excise Rules, Factory Act and Payment of Wages Act**,** TDS act Procedures for registration of SSI, TDS no, PAN no. 2 Lectures

3. ENTREPRENEURSHIP DEVELOPMENT:

Identification of opportunities for entrepreneurship, ideas to start new business, criteria for selection of new product or service, Market Survey as a tool, Technical and economic feasibility of a project, Role of consultancy organizations. 8 Lectures

Project formulation and project report preparation (Use guidelines given in Schedule II)
4 Lectures

4. FINANCIAL ASPECTS:

Govt/Public sources of finance

Sources of finance, Role of various funding agencies, government and commercial Role of various funding corporations and funding institutes such as chamber of commerce, MSFC, MCED, NSSIDC, Banks, special institutes such as IDBI,MIDC,SICOM etc, Working capital, cash flow, fund flow, study of basic financial statements, costing and pricing, breakeven point, SWOT analysis.

Private Sources

1. Equity –Angel finance , Venture capital
2. Debt Finance – Loans from banks loan against co-lateral security, PMYR-Loans with subsidy from Central GOVT, State Govt , CGTSME(Central Grant For Small Medium Enterprise)

8 Lectures

5. MARKETING ASPECTS:

Meaning, scope and importance, Marketing strategy, Market segmentation, marketing channels. Marketing mix and its effect.
Digital marketing through Web browsing, Face book , Google search engines SMS campaigns , Mailers , Hand bills etc 6 Lectures

6. HUMAN RESOURCE ASPECTS: (H.R Policies)

Concept and scope in modern industry,
Different modes of employment, Placement of proper person for a job, Interpersonal relations and communication skills, training of personnel, guidance for stress management, soft skills.
Drafting -Appointment letter, termination tenure , experience certificates , exit policies
Legal liabilities of employees, Group insurance for factory workers, understanding WAC (Workers Accident Compensation)

6 Lectures

Practicals/ Assignments

The practicals to be conducted are with an objective to transform the knowledge gained by the students in their classes to real life experience. These practicals will be based on the vocational subject and the Principal subject a student has offered

Internal assessment should carried out on the practicals/ assignments done by a student

Sr. No.	Title of Practical	Objective	Mode
1.	Role of District industry centre	Understand the working of District industry centre	Visit and report submission
2.	Visit to a small scale Industry	To understand plant location and plant layout and to submit a report on the guidelines given in **schedule I**	Visit and report submission
3.	Visit to a service unit	To study the legal aspects of a service unit and to submit a report	Visit and report submission
4.	Entrepreneurial ideas	Describe in brief two entrepreneurial ideas of yours	Home assignment
5.	Project formulation	Prepare a preliminary document about an enterprise you want to start It should contain executive summary, customer/target market analysis and strategy (use guidelines given in **schedule II**)	Home assignment
6.	Review business plans For this Plans should be exchanged with other teams	Submit a **review** of a business plan of **other team**. It should include critical and constructive comments	Home assignment
7.	Drafting a business plan	It should contain executive summary, customer/target market analysis and strategy, marketing and operations, risks, management team and financial projections	Power Point Presentation

RECOMMENDED BOOKS

Text book

1. Dynamics of Entrepreneurial Development and Management – Shri. Vasant Desai.(Latest edition)

Reference books (Latest Editions)

1. Environment & Entrepreneur: Mr.B.C.Tondon
2. Business Environment: Dr.G.V.Kayande Patil
3. Udyogvardhini –MCED
4. Basic Communication Skills: By P. Kiranmai Dutt & Geetha Rajeevan, 2000
5. Fundamentals of Office Management: By J.P. Mahajan , Office Management – By S. P. Arrora, latest edition
6. A guide to small Scale Entrepreneurs, Director of Industries, Govt. of Tamil Nadu Chennai, latest edition
7. Entrepreneurship and small Business Management- Dr. C. B. Gupta & Dr. Khanna
8. Project Management- K. Nagarajan
9. 100 project Reports Yashwantrao Chavan Open Universiy (YCMOU) Edition
10. Entrepreneurship Ideas in Action Cynthia L. Greene (YCMOU) Edition
11.

Schedule-I

Visit to a small scale Industry

1	Year of commencement of the project	
2	Work experience of the entrepreneur before staring the project	
3	Detailed information of the product	
4	Type of customers using their product	
5	Pricing details of all the product range	
6	No. of workers/ Staff working in the Unit	
7	Turnover in the last three years	
8	Mode of Advt/Marketing adapted for promoting the Products	
9	Investment done at the time of starting the project	

Schedule II

Project formulation

1	Product /services Selected its justification	
2	Capital investment required to start the Services /Product	
3	Minimum Infrastructure requirement	
4	Rent as per current rates for the same premises/ Office /Factory	
5	Various Competitors currently for the same product /Services	
6	Your unique selling proposition USP ie write down why your product will be preferred by the customer as against the present competition. 1) Features 2) Cost 3) Geographic location 4) service 5)durability	
7	Marketing Strategy used for Advertising your product	
8	Various digital marketing methods to be selected	
9	What will be your ROI(Return On Investment)	
10	What will be your Break even point	
11	How will you be raising the finance for the same	
12	Prepare a three years Balance sheet, / P/L statement taking help from a Third year commerce stream student.(optional)	

SN	Practical title	Hours
1	Laboratory design and equipments in animal tissue culture facility	1x3
2	Methods of sterilization of apparatus and glasswares for plant and animal cell/ tissue culture	1x3
3	Working and principles of different instruments- Autoclave, Laminar air flow, pH meter, Water distillation unit.	1x3
4	Preparation of nutrient media for plant and animal cell and tissue culture with emphasis on composition and calculation of concentration of ingredients	1x3
5	Study of effects of auxins on explants	1x3
6	Study of effects of cytokinins on explants	1x3
7	Monitoring of contamination in media /reagents in animal cell culture	1x3
8	Culture of lymphocytes from blood/tissue sample	2x3
9	Initiation of primary animal cell culture	2x3
10	Study of growth curve of Bacteria by Turbidometry	1x3
11	Screening of antibiotic producers from soil samples	1x3
12	Standardization of different solvents for purification of antibiotics from fermented broth and Determination of potency of antibiotics	1x3
13	Immobilization of yeast on calcium alginate	1x3
14	Qualitative analysis of water samples for pH, turbidity, microbial contamination	1x3
15	Study of biological control of crop pests	1x3
16	Biodegradation of pesticides by microbes	1x3
17	Isolation and cultivation of *Rhizobium*	1x3
18	Ethanol production from agricultural waste	1x3
19	Purification of alcohol from broth and alcohol estimation	1x3
20	Literature mining using pubmed, pubmed central and Medline	1x3
21	Retrieving Protein and DNA Sequences using Entrez at NCBI, SRS at EBI	1x3
22	Website navigation to PDB, swissprot, uniprot and ccsd.	1x3
23	Explore: Derived databases of structures: DSSP, FSSP, CATH & SCOP	1x3
24	Perform FASTA Search for DNA and Protein Data.	1x3
	List of practicals for Entrepreneurship Development is separately given	

Note:

(i) Students must submit visit reports and home assignments at the time of examination.

(ii) Students must present business plant as Power Point Presentation at final examination