Swami RamanandTeerthMarathwada University, Nanded

Choice Base Credit System (CBCS) Course Structure

Faculty of Science

B.Sc. Third Year

Fifth Semester Biotechnology Syllabus

Effective From June 2018

Core Course /Code No.	**CourseTitle**	**Instruction Hrs/Week**	**Total Period**	**Credits**
DSEBT- 1E	Environmental Studies	03	45	***
DSEBT-2E	r-DNA Technology	03	45	3
DSEBT-3E	Animal and Plant Development	03	45	3
DSEBT-4E	Bioprocess Engineering	03	45	3
DSEBT-5E	Agriculture Biotechnology	03	45	3
DSEBTP-1E	Practicals based on DSEBT -2E & 3E	03+03	20	4
DESBTP-2E	Practicals based on DSEBT -4E& 5E	03+03	20	4
DESBTP-3E	Industrial training / Industrial Visit	….	….	2
SEC-III	**Skill enhanced Course-3 III A) Mushroom Cultivation Technology III B) Techniques in Plant Tissue Culture (Micropopagation)	02	10	2
Total Credits				24

Swami RamanandTeerthMarathwada University, Nanded

Choice Base Credit System (CBCS) Course Structure

Faculty of Science

B.Sc. Third Year

Sixth Semester Biotechnology Syllabus

Effective From June 2016

Core Course /Code No.	**Course Title**	**Instruction Hrs/Week**	**Total Period**	**Credits**
DSEBT-1F	Pharmaceutical Biotechnology	03	45	3
DSEBT-2F	Industrial Biotechnology	03	45	3
DSEBT-3FA	Environmental Biotechnology	03	45	3
DSEBT-4FA DSEBT-4FB DSEBT-4FC DSEBT-4FD DSEBT-4FE	*Herbal Drugs Development * Food Biotechnology *Advanced Bioinformatics *fundamentals of Nanobiotechnology *Medical Biotechnology	03	45	3
DSEBTP-1F	Practicals based on DSEBT-1F & 2F	03+03	20	4
DSEBTP-2F	Practicals based on DSEBT - 3F&4F(A or B or C or D or E)	03+03	20	4
DSEBTP-3F	Dissertation Project Work	02	45	2
SEC-IV	**Skill enhanced Course-4 IV A) Biofertilizers and Biopesticides. IV B) Fermentation Technology	02	10	2
Total Credits				24
TotalCredits of B.Sc. I, II & III Year	Total Marks of B.Sc. Biotechnology Degree (Three years course with dissertation CBCS Pattern)			44+ 48+ 48= 140

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester V)
Semester Pattern effective from June 2018
Biotechnology
DSEBT-2E r DNA technology

Maximum Marks : 75 **Hours : 45** **Credits: 3**

Salient features : This course will help to understand the concept of blotting and sequencing of biomolecules

Utility of course : This course will help to become skilled in DNA extraction, purification and quantification. Also understand the mechanism of transformation.

Learning objective: To improve the knowledge of genomic structure of microbes ,techniques useful in recombinant DNA technology and application of genetic engineering.

Prerequisites: Basic knowledge about molecular biology and basic techniques in molecular biology.

UNIT-I: Principles of Gene cloning
Molecular Tools of Genetic Engineering: Restriction Endonucleases- Types & Properties, DNA Ligases, Alkaline phosphatase. Vectors: Plasmids (pBR322, pUC18/19), Bacteriophages (λ Phage, M 13 Phage), Cosmids, Artificial Chromosomes-BAC.Choice of Vector. Methods of Gene Transfer- vector based and direct transfer of DNA: Gene Cloning Strategies. Markers and reporter genes in gene cloning

UNIT -II: r- DNA Techniques.
Electrophoresis: Agarose Gel Electrophoresis, Blotting techniques: Southern , Northern , Western Blotting and applications. DNA Sequencing: Sanger's and Maxam Gilbert's Method, Automated DNA sequencing.
PCR: Mechanism, Types and Application. DNA chips (Micro array) principle & application.

UNIT-III: DNA Library
Library construction, screening and applications: Genomic library, cDNA library. Nucleic Acid Probe, Chemical Synthesis of DNA, Autoradiography of DNA
Screening of library-Probe based direct and indirect methods.

UNIT - IV: Applications of r-DNA technology
Agricultural applications i) BT-Cotton, ii) Transgenic maize, iii) Golden rice etc.
Protein engineering: to improve properties of proteins and enzymes.
Pharmaceutical Applications : i) Recombinant hormones ii) Vaccines iii) Blood Clotting factors v) Tissue Plasminogen Activator vi) Erythropoietin v) Human growth hormone. Concept of Gene Therapy

Text & References:
1. Principles of Gene Manipulation and Cloning - Old & Primrose-Black well Science
2. From Genes to Clones- Winnacker- Panima
3. Molecular Biotechnology –Glick-ASM
4. ABC of Gene cloing- Wong-Springer
5. Genomes 3 - T.A.Brown-Garland Science
6. Gene cloning and DNA Analysis- T.A. Brown- Wiley- Blackwell
7. Text book of Biotechnology – U Satyanarayan –Book & Allied
8. Jogdand S.N- Gene Biotechnology-Himalaya
9. Joshi P (2002) - Genetic Engineering and its applications, Agrobios Pub
10. MitraSandhya (2006) - Genetic Engineering, MacMillan India

Practical:
1. Isolation of Genomic DNA from Plant, Animal, Bacteria

2. Isolation of Plasmid DNA
3. Isolation of Phage DNA
4. Electrophoresis of DNA
5. Restriction digestion of DNA
6. Ligation of DNA
7. Preparation of Competent Cells & Cell Transformation
8. GFP gene cloning
9. Blotting Techniques- Southern, Western
10. Principle and study of PCR based experiments
11. Experiments based on molecular markers RAPD, RFLP and SNP etc
12. Visit to Molecular Biology & Genetic Engineering Research Laboratory/ Company

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester V)
Semester Pattern effective from June 2018
Biotechnology
DSEBT – 3E Animal and Plant Development

Maximum Marks : 75 **Hours : 45** **Credits: 3**

Salient features : This course covers the concept of embryology & development.

Utility of course : To learn & enhance skills about cloning & test tube baby.

Learning objectives : To provide an understanding of basics of gametogenesis, fertilization, stem cells, cloning & embryogenesis and developmental biology aspects in plants & animals.

Prerequisites: Basic knowledge about plant gametogenesis & fertilization, basic embryogenesis.

Unit -I: Animal Development
Development: Types and patterns of cleavage, Blastulation, Gastrulation,
Neurulation, Organogenesis and Growth in frog and chick. Concepts of competence, determination, commitment and differentiation, dedifferentiation, redifferentiation, transdifferentiation.

Unit-II: Animal Development & Stem Cell
Role of gene/s in patterning and developmentl
. Concept of Stem cells stem cell technology , Progenitor cells, cell lineages in
plants and animals. Ageing and apoptosis, abnormal development and teratogenesis in plants and animals: Cancer biology

Unit -III: Plant Development
Seedling development: Photomorphogenesis, Mertistem structure and activity, Organ development: shoot and root patterning, floral patterning in Maize and Arabidopsis.

Unit –IV :Methods in Development Biology
Developmental plasticity in plant and animal development. Embryo culture and preservation, sperm bank, Cloning in mammals: Dolly and other mammals.*in vitro* fertilization, concept of test tube baby.
Transgenic technology and applications in plants and animals: Conservation, Hybrids and GMOs.

Text & Reference:

1. An Introduction to Embryology - B.I. Balinsky
2. Development Biology - S.F. Gillbert- Sinauer Associates
3. Developmental Biology-Shastri and Shukla- Rastogi Publication
4. Developmental Genetics- G.S. Miglani- IK International
5. Chordate Embryology- Varma and Agarwar- S.Chand
6. Chordate Zoology- Jordan Varma- S.Chand
7. Plant Anatomy- B.P. Pande- S.Chand
8. Text book of Angiosperms- B.P. Pande- S.Chand
9. Developmental Biology - S.C. Goel
10. Developmental Biology – Wolpert
11. Embryology of Angiosperms – S.S. Bhojwani and S.P. Bhatnagar
12. An Introduction to Plant Cell Development – J. Burgess

Practicals:
1. Study of different types of animal eggs
2. Study of staging & staining of Chick embryos
3. Study of frog development, observation of frog embryo different development stages
4. Study of different types of sperms by smear preparation.
5. Frequency of genetic traits in human
6. Study of Sex-linked inheritance, Multipleallelism
7. Study of plant development and role of hormones in plant development

8. Development of male and female gametophytes
9. Developmental stages during plant Embryogenesis
10. Analysis of histochemical changes during transition of vegetative shoot to reproductive apex
11. Histochemical analysis of the activity of cambium
12. Visit to Sperm bank/ IVF centre

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester V)
Semester Pattern effective from June 2018
Biotechnology
DSEBT – 4E Bioprocess Engineering

Maximum Marks : 75 **Hours : 45** **Credits: 3**

Salient features : This course will help to improve the knowledge concerning the intrinsic behavior of cells and life sciences.

Utility of course : Skill enhancement in sterilization to get knowledge of upstream development.

Learning objectives :To improve the student with various designs of fermenter and related principles.

Prerequisites : basics of fermentation microbial processes knowledge and the basics of microbial growth

UNIT-I :Introduction to Concepts of Bioprocess engineering:
Definition of Bioprocesses engineering. Introduction to simple engineering calculations, Mass & Energy Balances
Fermenters, Bioreactors : Construction, Design & Operation, Materials of Constructions, Welding, Surface treatment Components of the fermenters & their specifications
UNIT-II : Air & Media sterilization :
Air Sterilization Principles, Mechanisms of capture of particles in Air, Depth & Screen Filters, Sizing, Testing & validation of filters for air
Principles of Media Sterilization, Decimal reduction, Design of sterilization cycle using kinetics of thermal death of microbes, Equipments used in sterilization.
Design of media: Constituents of media, their estimation & quantification, Media for large-scale processes& their optimization. Costing of media
UNIT-III : Types of Bioprocesses : Bioproducts and classification of bioproducts, Microbial Growth Kinetics: Batch, Fed-batch, Cell recycle & continuous. Enzyme & cell immobilization (industrial aspects) Measurement & Control of Bioprocesses Parameters: Cell growth. pH, temperature, Substrate consumption, product formation, Measurement of O2/CO2 uptake, evolution.
Strategies for fermentation control.
UNIT-IV : Scale up in Bioprocesses
Computer controlled fermentations, Foam & its control. Oxygen uptake rate (OUR), Ka, Viscosity & its control. Scale up in Bioprocesses fermentations, Factors used in scale up. Quality Control, Quality assurance, Standard Operating Procedures (SOP) & Good, Manufacturing Practices (GMP).

Text & References:
1. Principles of Fermentation Technology - Whittaker & Stanberry- Elsevier
2. Bioprocess Engineering Principles - Pauline Doran- Elsevier
3. Operational Modes of Bioreactors, BIOTOL series - Butter worth, Heinemann
4. Bioreactor Design & Product Yield, BIOTOL series - Elsevier
5. Bioprocess Engineering: Systems, Equipment & Facilities - Ed. B. Lydersen, Delia &. Nelson, John Wiley
6. Bioprocess Engineering- Shuller&Kargi -Pearson Education
7. Process Biotechnology Fundamentals-Mukopadhaya- Viva
8. Biochemical Engineering- Bailey & Bhatia- CBS
9. Biochemical Engineering Fundamentals- Bailey, Ollis- McGraHill
10. Fermentation and Biochemical Engineering Hand book-Vogel, Todaro-Strand Publisher
Practical:

1. Isolation and Screening of Industrially important Microbes-Acid, Antibiotics, Enzymes
2. Study of Strain improvement
3. Sterilization Techniques- Media, Air
4. Maintenance of pure Culture
5. Study of Growth Curve of Bacteria, Fungi
6. Growth kinetics: Effect of pH & Temp
7. Media Formulation
8. Sterilizer Design- TDP, TDT
9. Cell and Enzyme immobilization
10. Visit to Fermentation Industry

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester VI)
Semester Pattern effective from June 2018
Biotechnology
DSEBT 5E : Agricultural Biotechnology

Maximum Marks : 75 **Hours : 50** **Credits: 3**

Salient Features : Syllabus focus on current needs of agriculture sector. Details of important commercial agro products is nicely illustrated in syllabus. Provides information of important crop diseases of India.

Utility of course : Will prepare students to understand the problems of farmers and them to tackle them with recent Biotechnological advances.

Learning bjectives : To enables students to understand the role of Biotechnology in the field of agriculture and allied industry.

Prerequisites : Technical understanding of microbial culturing plant tissue culture is prerequisite to student to learn this syllabus.

UNIT- I: Nitrogen Fixation and Phytoharmones.
Symbiotic N2 fixation - Legume, Rhizobium symbiosis, Host specificity, Infection, Nodule Development, Mechanism of N2 Fixation.**Non Symbiotic N2 Fixation** - Diazotrophy, Sites of N2 Fixation, Nitrogenase Complex, Cyanobacteria, Azotobacter, Azospirillum.**Phytoharmones-** Definition, Classification, Physiological Effects, Functions of Auxin, Cytokinin,Gibberellins.Assimilation of Sulphur and Phosphorus in Plants.

UNIT- II :Biofertilizers
Concept and Types of Biofertilizer. Microbial Inoculums - Rhizobium Inoculant, Blue-Green algae, Azotobacter, Sulphur and Phosphate Solubilizing Biofertilizer.Applications of Biofertilizer.

UNIT- III:Plant Pathology
Concept of Plant Pathology. Host Pathogen Relationship. Pathogenesis mechanism- Enzymes, Toxins, Nutrition etc.Mechanism of Plant defense, resistance to disease.Classification of Plant Diseases based on Symptoms. Plant Diseases: Causative agent, Symptoms,Mechanism of Action and Control Measures (Chemical and Biological).i) Bacterial Blight of Cotton ii)Whip Smut of Sugar Cane, iii) Powdery Mildew of Wheat.iv) Citrus Canker of Lemon.

UNIT- IV :Agro-Biotechnology
Bio-pesticides- Definition and Types (Microbial and Botanical) Advantages of Biopesticides over chemical pesticides. **Biomass** : Composition , Types, Biomass as a energy Source, Biomass conversion and Utilization.Single Cell Protein and its Nutritive Value eg.Spirulina. Mushroom production.

Text &References :

1. Bilgrami K.S and Dube H.G.- Textbook of Modern Plant Pathology, Vikas
2.Gupta P.K. - Genetics and Biotechnology in Crop Improvement, Rastogi Publications
3.Pathak V.N, Khatri N.K.,Pathak M. - Fundamentals of Plant Pathology, Agrobotanical Publications,
4. R.C. Dubey – Text book of Biotechnology-S.Chand publications.
5. SubbaRao- Soil Microbiology- Oxford IBH
6. Melhotra and Agarwal- Plant Pathology- TataMcGraw Hill
7.VyasS..,and Modi H.A.(1998) - Biofertilizer and Organic Farming, AktaPrakashan
8. Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation, New age
9. Lehninger-Biochemistry- Kalyani

10. Aneja K.R. – Experiments in Microbiology, Plant pathology & Biotechnology- New Age.
12. Schmauder Hans Peter (1997) - Methods in Biotechnology, Taylor and Francis, London.

Practical:

1. Isolation of *Rhizobium* sp.from root nodule of leguminous plant.
2. Isolation & Study of non symbiotic nitrogen fixing organims
3. Isolation and study of PSBs.
4. Estimation of leg haemoglobin from root nodule of leguminous plant.
5. Determination of IAA Oxidase activity.
6. Cultivation and study of Spirulina algae, Mushrooms
7. Isolation & identification of plant pathogen (*Xanthomonas)* from infected citrus fruit /leaf.
8. Study of Bio pesticides: *Trichoderma*
9. Study of community by quadrate method (Frequency, Density and Abundance of Species)
10. Visit to Cell Culture Facilities /Production /Biofertilizer Industry.

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester VI)
Semester Pattern effective from June 2018
Biotechnology
SECBT IIIA :Mushroom Cultivation Technology

Maximum Marks : 50 **Hours : 30** **Credits: 2**

Salient features : The syllabus covers the Structural Layout of mushroom cultivation Laboratory and also focus on the mushroom production technology

Utility of course : Become skilled in various commercially used mushroom cultivation techniques.

Learning objectives : To understand the basics of mycology.

Prerequisites : Basics knowledge of fungal cell, bacterial cell and life cycle of mushroom Also should familiar with sterilization techniques.

Unit: I

Introduction, history of mushroom cultivation; biology of mushrooms; Nutritional value: (Proteins, amino acids, mineral elements, carbohydrates, fibers, vitamins); Medicinal value of mushrooms; Poisonous and edible mushrooms. Scope and importance of mushroom

Unit II

Cultivation Technology: Infrastructure, equipments and substrates in mushroom cultivation: Polythene bags, vessels etc. Mushroom unit or mushroom house, pure culture, Spawn: types of spawn, preparation of spawn, mushroom bed preparation and factors affecting mushroom bed preparation; compost technology in mushroom production

Unit III

Casing; raw material used for casing, preparation of casing material; important sanitation during various stages of mushroom cultivation. Cultivation of important mushrooms: General process for the cultivation of Agaricusbisporus and Volvariellavolvaceae

Unit IV

Storage and food preparation from mushrooms: Methods of storage of mushroom cultivation, Long term and short term storage of mushrooms Foods/recipes from mushrooms.

References

1. Kannaiyan, S. Ramasamy, K. (1980). A hand book of edible mushroom, Today & Tomorrows Printers & Publishers, New Delhi.
2. Pandey B P 1996. A textbook of fungi.Chand and Company N Delhi.
3. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology.Agrobios, Jodhpur.
4. Mushroom Cultivation, Tripathi, D.P.(2005) Oxford & IBH Publishing Co. PVT.LTD, New Delhi.
5. Mushroom Production and Processing Technology, PathakYadavGour (2010) Published by Agrobios (India). 6. Harander Singh 1991. Mushrooms-The art of cultivation- Sterling Publishers.

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester V)
Semester Pattern effective from June 2018
Biotechnology
SECBT – IIIB Techniques in Plant Tissue Culture (Micropropagation)

Maximum Marks : 50 **Hours : 30** **Credits: 2**

Salient features : The syllabus covers the Structural Layout of Plant Tissue Culture Laboratory, Sterilization techniques, Culture Medium and its components and appplications of PTC.

Utility of course : Become skilled in Micro propagation of various commercially used plants.

Learning objectives :To understand the basics of plant tissue culture techniques

Prerequisites : Basics knowledge of plant cells, role of hormones, sterilization techniques and the basics of microbial growth.

Unit I

Structural Layout of Plant Tissue Culture Laboratory, Sterilization techniques, Culture Medium and its components and appplications of PTC.

Practicals

1) Sterilization techniques.
2) Preparation of stock solutions and MS medium.

Unit II

Micropropogation:-Defination,Importance and Micropropogation phases (Selection and maintenance, Initiation, Multiplication (Subculture), Rooting and Hardening (Primary & Secondary)

Practicals

1) Surface sterilization of explants
2) Callus culture

Unit III

Banana Micropropogation:-Introduction,Micropropogation phases (Selection and maintenance,Initiation,Multiplication(Subculture),Rooting and Hardening (Primary & Secondary)

Practicals

1) Micropropogation of Banana

Unit IV

Gerbera Micropropogation:-Introduction,Micropropogation phases (Selection and maintenance,Initiation,Multiplication(Subculture),Rooting and Hardening (Primary & Secondary).

Practicals

1) Micropropogation of Gerbera

Text and references

1) Plant Tissue Culture :- Bhojwani and Razdan
2) Methods in Plant Tissue Culture :- U kumar
3) Plant Cell and Tissue culture:-A Tool in Biotechnology-Karl-Hermann

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester VI)
Semester Pattern effective from June 2018
Biotechnology
DSEBT 1F: Pharmaceutical Biotechnology

Maximum Marks : 75 **Hours : 50** **Credits: 3**

Salient features : syllabus course all important aspects of pharmaceutical science. Multidimention syllabus having chapters from tradition to modern pharmaceutical industry.

Outcome : Will prepare students to understand the role of different herbal and chemical pharma products in cure of diseases. It will also help students to learn the application of computational approaches in drug discovery.

Objectives : To enables the students to understand the role of various pharmaceutical product in cure and presentation of human diseases and to provide knowledge of drug discovery and designing.

Prerequisites : Technical understanding of Microbiology, Molecular Biology, Bio-informatics is required to learn this subject.

UNIT -I : Secondary Metabolites.
Introduction to Secondary Metabolites.Types and Medicinal Applications of Secondary metabolites. Production of Secondary metabolites in Plants Through hairy Root Culture.Factors affecting Secondary metabolite production (Precursors, Growth Factors and Nutrients)

UNIT-II : Chemotherapy
Types of Antibiotics: Classification of antibiotics with example. General characteristics of an Antimicrobial Drug.Mechanism of action of antimicrobial agent (General account).
Microbial Resistance to antibiotics and antimicrobial agents (Types and Mechanism).
Application of antibiotics in various fields. Assaying antimicrobial activity: Principle and Methods of microbial assay (MIC and Different types of agar diffusion.)

UNIT-III: Chemotherapeutics Agents
Structure, Mechanism of Action and Applications of Antibacterial drug: Sulfonamides, Quinolones.
Antiviral drug: Amantadine, Azidothymidine. Antifungal drug: Nystatin, Griseofulvin.
Mechanism of action of Anticancer drugs, Antidiabetic drugs and Antihypertensive drugs

UNIT IV: Protein Engineering and Drug Discovery
Protein engineering: Principles and Application.
Discovery and Development: History, drug targetting, Molecular Biology and Combinatorial drug discovery, Rational Drug designing. Concept of Pharmacokinetics, Pharmacodynamics. Drug delivery systems, Liposomes. Introduction to Indian and International Pharmacopoeia.Chemoinformatics

Text &References :
1. Gupta P.K. - Biotechnology and Genomics, Rastogi Publication.
2. Hugo W. B. and Russell A. D. - Pharmaceutical Microbiology -Wiley India

3. FSK Barar- Pharmaceutical- Essentials of Pharmaceuticals- S.Chand
4. S.P. Vyas, Dixit- Pharmaceutical Biotechnology-CBS
5. B.Razdan-Medicinal Chemistry-CBS
6. Satoskar, Bhandarkar- Pharmacology and Pharmacotherapeutics- Popular
7. Purohit, Saluja- Pharmaceutical Biotechnology-Student Edition
8. M. Doble- Drug Designing-McGraw Hill
9. Ed. R.H. Thomson-Chemistry of Natural Products-Springer
10. AshutoshKar-Pharmacology and Pharmacobiotechnology-New Age
11. Jogdand S.N - Biopharmaceuticals, Himalaya Publishing
12. Ramawat K.G; Merillon J.M - Biotechnology: Secondary Metabolites-Oxford

Practical:

1. Assay of antimicrobial activity of Penicillin, Chloramphenicol, streptomycin and Quinolones
2. Determination of Minimum Inhibitory Concentration (MIC) of Antibiotic
3. Determination of shelf life of antibiotics (Expired drugs)
4. Bioassay of antifungal compounds
5. Testing of antibiotic resistance
6. Sterility testing of commercial pharmaceuticals.
7. Sterility testing of injectable as per IP.
8. Effect of chemical disinfectant on growth of bacteria
9. Study of microbial spoilage of pharmaceuticals.
10. Visit to Pharmaceutical industry

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester VI)
Semester Pattern effective from June 2018
Biotechnology
DSEBT 2F: Industrial Biotechnology

Maximum Marks : 75 **Hours : 50** **Credits: 3**

Salient features : the course covers the knowledge of microbial processes and product formation

Utility of Course : To enhance production techniques and to get knowledge of downstream processing and optimization.

Learning objectives : To provide knowledge of many procedures in industries, role of microorganisms in industries and techniques used to improve product formation in industries.

Prerequisites : Should known basic design of fer knowledge about quality control and quality assurance.

UNIT- I : Strain Improvement
Selection of Mutants producing improved level of Primary Metabolites with suitable Example.
Isolation of mutants which do not produce feedback inhibitors or repressors. Mutants that do not recognize presence of inhibitors or repressors. Modification of Permeability.

UNIT - II : Down Stream Processing.
Removal and Recovery of cell mass (Precipitation, Filtration and Centrifugation)
Cell disruption - Physical and Chemical methods. Purification of Product Liquid-liquid extraction : Solvent Recovery.Chromatography : Adsorption, Ion-exchange, HPLC
Membrane processes: Ultrafiltration and Reverse Osmosis. Drying and Crystallization.

UNIT -III : Fermentation Processes.
Fermentation processes: Microorganisms involved, Inoculum preparation, Medium used and product Recovery. Enzyme: Protease, pectinase. Organic acid: Citric acid. Antibiotic: Penicillin, erythromycin. Vitamin: Vitamin B12, vitamin B2.

UNIT- IV : Quality Control, Process Economics and GLP.
Sterility testing.Pyrogen testing.Carcinogenicity testing.Toxicity testing.
Fermentation Economics: Cost Estimates ,Process Design ,Capital Cost Estimates, Operating Cost Estimates.Concept of QC, QA, Good Laboratory Practices, GMP.

Text &References :

1. Casida L.E - Industrial Microbiology- New Age
2. Crueger W and Crueger A - Biotechnology: A Textbook of Industrial Microbiology-Panima Publishing
3. Patel A.H. - Industrial Microbiology, Macmillan India
4. Peppler H.J and Perlman D - Microbial Technology, Vol I and II-Elsevier
5. Stanbury P.F., Whitaker A. and Hall S.J - Principles of Fermentation Technology-Elsevier
6. Prescott and Dunn's- Industrial Microbiology-CBS
7. Ed. G. Subramaniam- Bioseparation& Bioprocessing - Wiley –VCH
8. Product Recovery in Bioprocess Technology, 'BIOTOL series, Butter worth Heinemann 1992
9. Paul A. Belter, Cussler- Bioseparation :Downstraem Processing for Biotechnology - Academic Press
10. LarlSchuger-Solvent Extraction in Biotechnology - Spinger
11. Roger Harrison-Bioseparation Science & Engineering-Oxford
12. N.K. Prasad-Downstream Process Technology-PHI

Practical:

1. Isolation and Screening of Industrially important Microbes-Acid, Antibiotics, Enzymes
2. Isolation & identification of bacteria from different milk & water samples.
3. Fermentative production purification and estimation of antibiotics/ vitamins
4. Fermentative production purification and estimation of Citric Acid
5. Fermentative production purification and Estimation of alcohol. using*Sacharomycescerevisiae*
6. Estimation of fermentative product (Acetic acid from vinegar).
7. Qualitative estimations of fermentation products by analytical instruments
8. Wine production & estimation of alcohol
9. Production of cheese using different substrate fro microorganism.
10. Study of fermentation economics with any one example
11. Visit to Fermentation Industry

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester VI)
Semester Pattern effective from June 2018
Biotechnology
DSEBT 3F: Environmental Biotechnology

Maximum Marks : 75 **Hours : 50** **Credits: 3**

Salient Features : Syllabus focus on current needs of environmental sector. Details of important commercial agro products is nicely illustrated in syllabus. Provides information of important microbes for cleaning the environment.

Outcome : Will prepare students to understand the problems of environments and they can tackle environmental problems using recent Biotechnological advances.

Objectives : To understand aspects of environmental science and techniques implemented to solve environmental problems.

Prerequisites : Technical understanding of environment and its componants is prerequisite to student to learn this syllabus.

UNIT- I : Waste Water Treatment.
Domestic (Municipal) and Industrial Waste Water Treatments: Primary, Secondary and Tertiary. Important microorganisms in waste water treatment, Principles of their growth and Plasmid Borne Metabolic Activities. Aerobic Biological Treatments: Activated sludge process Rotating Biological Contactors. Anaerobic Biological Treatments: Air Lift Membrane Bioreactors Packed Bed (Column Reactor.)

UNIT- II : Biodegradation techniques
Biodegradation: Definition and Concept, Ready Biodegradation, Ultimate Biodegradation and Inherent Biodegradation.Aerobic and Anaerobic degradation pathways in Microbes.
Biodegradation of Hydrocarbon with Suitable Example. Concept of Municipal Solid Waste management

UNIT -III : Bioremediation
Introduction, Definition and Concept, Methods of Bioremediation (*in situ* and *ex situ* Methods) Bioremediation of Soil (Saline Soil and Alkaline Soil) Phytoremedation: Concept and Types. Applications of Bioremediation.

UNIT –IV: Xenobiotics
Xenobiotics and Recalcitrancy.Xenobiotics Degradation: Pesticide Degradation (Principle with suitable example) Herbicide Degradation (Principle with suitable example) Metabolism of Xenobiotics: Cytochrome P450 System, Phase I, Phase II, Metabolic reactions

Text &References :

1. Asthana D.K. and Asthana M.,-Environment : Problems and Solutions- S. Chand
2. Chatterji A.K., Introduction to Environmental Biotechnology, Prentice Hall of India Pvt. Ltd
3. Jogdand S.N.- Environmental Biotechnology- Himalaya Publishing House
4. Kalaichelvan P.T., I Arul Pandi- Bioprocess Technology, MJP Publishers
5. Murugesan A. G.andRajakumari C-Environmental Science and Biotechnology: Theory &Techniques, MJP
6. Rajendran, Gunashekaran- Microbial Bioremediation-MJP
7. Hammer & Hammer-Water & Waste water Technology-PHI
8. Metcaf& Eddy-Waste water Engineering-TMH
9. Indushekhar Thakur- Environmental Biotechnology-I K International
10. P. Mohapatra-Text book of Environmental Biotechnology-I K International

11. Rittmann B. E. And McCarty P. L.- Environmental Biotechnology Principles & Applications, McGraw Hill

Practicals

1. Determination of Dissolved Oxygen and Biological Oxygen Demand of polluted water.
2. Determination of Chemical Oxygen Demand of polluted water.
3. Bacterial Examination of Water by MPN Test: Presumptive and Confirmed Coliform test.
4. Determination of soil pH and Total organic carbon.
5. Determination of Total Carbohydrates and Phosphorus of soil.
6. NPK determination of soil samples
7. Determination of Alkalinity and Hardness of water.
8. Demonstration of Total Nitrogen estimation by Kjeldahl's Method.
9. Biodegradation of polymer compounds
10. Biodegradation of textile dyes
11. Visit to STP, MSW treatment/ Industrial effluent treatment plants.

Swami Ramanand Teerth Marathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester VI)
Semester Pattern effective from June 2018
Biotechnology

DSEBT- 4FA Herbal Drug Development

Maximum Marks : 75 **Hours : 45** **Credits: 3**

Salient features : Syllabus covers all important aspects of pharmaceutical science. And traditional use of medicinal plants. Also covers the extraction of plant drugs.

Outcome : Will prepare students to understand the role of different herbal and chemical pharma products in cure of diseases. It will also help students to learn the preparation and application of drugs from plants.

Objectives : To enables the students to understand the role of various pharmaceutical product in cure and quality control of processed products

Prerequisites : Technical understanding of Microbiology, Molecular Biology, plants metabolites is required to learn this subject.

UNIT-I: FUNDAMENTALS OF HERBAL MEDICINE (13 PERIODS)

Introduction, Scope and importance of herbal medicine; Traditional Use of Medicinal Plants; Ancient Systems of Medicine; Traditional Indian Medicine, Sources of drugs: Biological, marine, mineral and plant tissue culture as sources of drugs. Definition of Herbal drug, Importance of Herbal therapies, Herbal verses conventional drugs, Safety in herbal drugs.

UNIT-II: THERAPEUTIC POTENTIAL OF BIOACTIVE MOLECULES (12 PERIODS)

Exploration of Medicinal Plants ;Approaches to Drug Discovery ; Definition, occurrence, chemistry, isolation, estimation of Bioactive Molecules of Medicinal Plants –Alkaloids, glycosides, Phenolics , resins, Terpenes and terpenoids, phospholipids and steroids.

UNIT-III: APPLICATION OF HERBAL MEDICINES (12 PERIODS)

Making and using herbal medicines for common ailments like cold, skin infections and Diarrhea; Antimicrobial, anti-inflammatory and antibiotic drugs Screening procedures for herbal drugs

UNIT-IV: PROCESSING OF HERBS AND QUALITY CONTROL (13 PERIODS)

Different methods of processing of herbs like collection, harvesting, garbling, packing and storage conditions, Methods of drying – Natural and artificial drying methods with their merits and demerits; Quality Control and Quality Assurance of Herbal ingredients as per WHO Guidelines, Determination of tannins, Ash value, Extractable matter and Pesticide residues.

Practicals:

1. Separation of sugars, amino acids, phenols from plant extracts by Paper chromatography/TLC
2. Preparation of plant extracts and their standardization by analytical profiles
3. Qualitative test for alkaloids, tannins, glycosides from raw materials used in Herbal preparation
4. Antibacterial activity of selected drugs
5. Antifungal activity of selected drugs
6. Antioxidant activity of selected drugs
7. Determination of ash values of drugs.
8. Estimation of pesticide residues in herbal products.

References :

1. Trease and Evan's Pharmacognosy 15th edition

2. Indian Herbal Pharmacopeia Vol-I and II

3. Quality Control methods for medicinal plant material by W.H.O., Geneva.

4. Quality Control of Herbal drugs by Dr. Pulak K. Mukherjee

5. Botanical safety hand book by Michael Meguffin, Christopher Hobbs published by American Herbal Product Association.

6. Herbal drugs by P.Mukherjee

Swami RamanandTeerthMarathwada University, Nanded

Choice Based Credit system (CBCS Pattern)

B. Sc. Third Year (Semester VI)

Semester Pattern effective from June 2018

Biotechnology

DSEBT-4FB Food Biotechnology

Maximum Marks : 75 **Hours : 45** **Credits: 3**

Salient features : syllabus courses all important aspects of food ingredients and aspects of food production.

Outcome : Will prepare students to understand the biotechnological techniques for food preservation and food maintenance. It will also help students to learn the application of fermented foods and its speciality.

Objective: To understand the basic concepts of food, fermented foods and methods of food preservations.

Prerequisites : Technical understanding of Microbiology, fermentation techniques is required to learn this subject.

.

UNIT I: Biotechnology for Food Ingredients

Impact of Biotechnology on the nutritional quality of foods, Technologies used for microbial productions of food ingredients, Biotechnology of microbial polysaccharides in food.Causes of food spoilage and methods to preserve food.

UNIT II: Aspects of food production

Food safety: HACCP system to food protection, Food additives: Definition, Types and functional characteristics, Advantages of natural colour over artificial, Sweeteners: Types and applications.

UNIT III: Fermented Foods

Fermented dairy products: Cheese and youghurt, Spoilage of fermented dairy products and their control, Prodution of Baker's yeast, Food enzymes and food additives. Fermentative production of wine. Biotechnological approaches to improve nutritional quality and shelf life of fruits and vegetables.

UNIT IV: Food Speciality

Functional foods and probiotics, Beneficial effects of spices, Spirulina, antioxidants and other food constituents. Biosensors for food quality assessment,

Reference Books:

1. Industrial Microbiology by Prescott and Dunn.
2. Industrial Microbiology by L.E. casida
3. General Microbiology, Vol. II by Power and Daginawala
4. Biotechnology by U. Satyanarayana
5. Outlines of dairy technology by Sukumar De
6. Nutrition and dietetics foods by Arnold E. Bender

7. Nutrition and dietetics by Shubhangini A. Joshi
8. Basic nutrition in health and disease by P. S. Howe,W.B.Saunders

Practicals:

1. Preparation of different vegetable based soups.
2. Production of fermented products like vinegar / cider / wine.
3. Qualitative and quantitative analysis of milk.
4. Analysis of ghee – RM value, Boudomin's and other tests for adulterations
5. Production of Idli, Dosa etc.
6. Evaluation of quality of dairy products: Specific gravity of milks.
7. Microbial production of Polysachharides.

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester V)
Semester Pattern effective from June 2018
Biotechnology
DSEBT-4FCAdvanced Bioinformatics

Maximum Marks : 75 **Hours : 45** **Credits: 3**

Salient features : This course covers the study of basic tools used in bioinformatics.

Utility of course : Students become expert in proteins & genes sequence databases & prediction of protein structure.

Learning objectives : To give knowledge of sequence alignment, to study the genomic & structural bioinformatics prerequisites.

Prerequisites: Basic concept of molecular biology, genetic engineering, biochemistry, basic fundamental knowledge about computer.

UNIT I - HISTORY, SCOPE AND IMPORTANCE

Various definitions of Bioinformatics - Important contributions - aims and tasks of Bioinformatics - applications of Bioinformatics - challenges and opportunities - internet basics- HTML,URLs, Role of internet and www in Bioinformatics - advance fields in bioinformatics(Genomics – Proteomics – Transcriptomics)

UNIT II - GENOMES AND THEIR ORGANIZATION

Prokaryotic and eukaryotic genomes- structure- organization-Genomics: Genome Sequencing- Human Genome Project- Aims- goals and achievements. General principles of Gene Therapy.

Unit III - SEQUENCE ALIGNMENTS AND VISUALIZATION

Introduction to Sequences, alignments and Dynamic Programming; Local alignment and Global alignment (algorithm and example), Pairwise alignment (BLAST and FASTA Algorithm) and multiple sequence alignment (Clustal W algorithm).

Methods for presenting large quantities of biological data: sequence viewers (Artemis, 3D structure viewers (Rasmol, Cn3D, PyMol)

Unit IV - GENE EXPRESSION AND REPRESENTATION OF PATTERNS AND RELATIONSHIP

General introduction to Gene expression in prokaryotes and eukaryotes, transcription factors binding sites. SNP, EST, STS. Introduction to Regular Expression, Hierarchies, and Graphical models.Genetic variability and connections to clinical data.

Unit VI - STRUCTURAL BIOINFORMATICS

Protein secondary structure classification databases - Protein secondary structure prediction methods - Motif and Domain - Protein Tertiary structure prediction methods - Molecular Docking of Protein

TEXT BOOKS

1) Baxevanis, A.D. and Francis Ouellellette, B.F. (1998) "Bioinformatics– a practical guide to the analysis of genes and proteins" John Wiley and Sons
2) Mount, D. (2004) "Bioinformatics: Sequence and Genome Analysis"; Cold Spring Harbor Laboratory Press, New York. (ISBN 0-87969-712-1)
3) Sharma, V. Munjal, A. and Shankar, A. (2008) "A text book of Bioinformatics" first edition, Rastogi Publication, Meerut – India.
4) Bergman N. H. (2007),"Comparative genomics" Volume 2, Humana Press
5) Cantor C.R., Smith C.L., (1993) "Genomics: the science and technology behind the Human Genome Project" John Wiley and Sons

REFERENCES

1) Choudhuri S., Carlson D. B. (2008), "Genomics: fundamentals and applications" Informa Healthcare
2) Clark M (2000), "Comparative genomics" Springer
3) T.A. Brown, "Genome", John Wiley & sons, 2006
4) Primrose S. B., Twyman R. M. (2004), "Genomics: applications in human biology" Wiley-Blackwell
5) Primrose S. B., Twyman R. M. (2006), "Principles of gene manipulation and genomics" Wiley-Blackwell
6) David W. Mount, "Bioinformatics: Sequence and Genome Analysis", Cold Spring Harbor Laboratory Press, I edition, 2001.

Practical's List:

1) Knowledge of different biological database
2) Different file formats –Genbank, Genpept, FASTA, EMBL, NBRF/PIR, , PDB file format.
3) Protein and gene sequence data bases (NCBI, DDBJ, EMBL, SWISS PROT, PIR)
4) Prediction of primary, secondary and 3D structure of proteins.
5) Visualization of tertiary structure of proteins
6) Accessing existing databases on www – Artemis
7) Sequence alignment
8) Homology search tools like BLAST and modeller.
9) Genomics- Genome databases, Annotation of genome, Perdition of ORFs
10) Gene prediction GENSCAN and GeneMark.
11) Molecular Docking

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester VI)
Semester Pattern effective from June 2018
Biotechnology
DSEBT- 4FD Fundamentals of Nanobiotechnology

Maximum Marks : 75 **Hours : 45** **Credits: 3**

Salient features : This course covers the study of basic tools used in nano science.

Utility of course : Students become expert in preparation of nanomaterials & prediction of biomolecules structure.

Learning objectives : To give knowledge of sequence alignment, to study the genomic & structural bioinformatics prerequisites.

Prerequisites: Basic concept of physics, physical chemistry, organic chemistry, molecular biology, genetic engineering, biochemistry, basic fundamental knowledge about computer.

Unit-I

Introduction, The Science of Nano. The concept of nanoscale, Types of nanomaterials and their classifications. D, 2D and 3D etc. Quantum dot, Quantum Wire and Quantum Well etc

Unit-II

Introduction to Nanostructures: Carbon Nanotubes (CNT), Graphenes, Fullerenes, Nanocrystal, Nanoparticle, Polymer, Carbon etc. Physical and Chemical Fundamentals of Nanomaterial

Unit-III

Preparation methods of Nanomaterials: Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling etc. Concept of Nano-biotechnology.Introduction to Self-assembled Biological Nanomaterials in Nature.

Unit-IV

Applications of Nanotechnology/ Nanobiotechnology in various areas like agriculture, medicine, cosmetics and environment.

Intellectual Property Rights:- Concept of IPR, Patents, Trademarks, Copyrights, Secrets. Patenting of biological materials.

Text & References

1. MadhuriSheron, Sunil Pande- Bio-Nano technology concept and applications Ane Books New Delhi
2. Mark Ratner, Daniel Ratner-Nanotechnology-Pearson
3. Ramsden-Nanotechnology- an Introduction-Elsevier
4. Ed. Vincent Rotello – Nanoparticles- Springer
5. C.M.Niemeyer- Nanobiotechnology, C.A. Mirkin, Wiley VCH, 2004
6. T. Pradeep, ―Nano: The Essentials‖, McGraw – Hill education, (2007).
7. P. Boisseau, P. Houdy and M. Lahmani - Nanoscience :Nanobiotechnology and Nanobiology, Springer, 2007.
8. S. M. Lindsay - Introduction to nanoscience, OXFORD publication
9. Anke Krueger- Carbon materials and nanotechnology –Wiley- VCH publication
10. S. K. Kulkarni- Nanotechnology- (3rd Edition)

11. M.H. Fulekar- Nanotechnology: Importance and Applications, IK International 2010.

Practicals

1. Demonstration of techniques for isolation and synthesis of nanoparticles
2. Isolation and detection of nano particles from plant extract (silver nano particles)
3. Extraction and estimation of protein
4. Isolation of DNA from Bacteria/Plant/Animal material.
5. Spectrophotometric analysis (UV/IR) of nano particles
6. To study antibacterial/antifungal activity of nanomaterial
7. Study of IPR , Patent applications process

Swami RamanandTeerthMarathwada University, Nanded

Choice Based Credit system (CBCS Pattern)

B. Sc. Third Year (Semester VI)

Semester Pattern effective from June 2018

Biotechnology

DSEBT-4FE Medical Biotechnology

Maximum Marks : 75 **Hours : 45** **Credits: 3**

Salient features : Syllabus covers all important aspects of medical science including Immunization and antibody based diagnosis .

Outcome : Will prepare students to understand the role of different immunization techniques of diseases. It will also help students to learn the application of biotechnology in drugs discovery.

Learning Objectives : To improve the knowledge on medical techniques used to identify the diseases. To enables the students to understand the role of antigen antibody reactions and role of carcinogenic agents

Prerequisites : Technical understanding of Microbiology, immunology and basics of cancer is required to learn this subject.

Unit I

Immunization, live, killed, attenuated, Sub unit vaccines; Recombinant DNA and protein based vaccines, plant-based vaccines and reverse vaccinology; Peptide vaccines, conjugate vaccines; Passive Immunization; Antibody, Transfusion of immuno-competent cells, Stem cell therapy; Cell based vaccines.

Unit II

Antibody based diagnosis; Monoclonal antibodies as diagnostic reagents; Production of monoclonal antibodies with potential for diagnosis; Diagnosis of bacterial, viral and parasitic diseases by using; ELISA and Western blot.

Unit III

Cellular therapy; Stem cells: definition, properties and potency of stem cells; Sources: embryonic and adult stem cells; Concept of tissue engineering; Role of scaffolds; Role of growth factors; Role of adult and embryonic stem cells; Clinical applications; Ethical issues.

Unit IV

Oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis,

interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

Primary immunodeficiency (SCID, X-linked agammaglobulinemia, Defects in complement system), Secondary immunodeficiency (AIDS)

Reference Books

1. Kuby Immunology- Goldsby, Kindt, Osborne.-W,H Freeman

2. Cellular & Molecular Immunology- Abbas, Lichtman, Pillai.-Elsevier publications.

3. Roitt's Essential Immunology- Deives, Martin, Burton, Roitt-Blackwell publications.

4. Cellular interactions &Immunobiology- Butterwort & Heinemann.

5. Review of Medical Microbiology & Immunology- Warren Levinson.-McGraw Hill

6. David Sadava; Cell and Molecular biology- Jones & Bartlett Publishers

7. Cell & molecular biology - Gerald karp :John Wills

8. Developmental biology- SF Gilbert Sinauer associates.

9. T.A. Brown – Genomes – Garland Science

Practicals

1) SDS PAGE ,
2) 2D Gel electrophoresis capillary,
3) ELISA, Immunoblotting
4) Study of Ag-Ab reactions Widal, VDRL
5) Immuno electrophoresis
6) Latex agglutination

7) ELISA, Western Blotting

8) Rocket immuno electrophoresis

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester VI)
Semester Pattern effective from June 2018
Biotechnology
SECBT IVA :Biofertilizers and Biopesticides

Maximum Marks : 50 **Hours : 30** **Credits: 2**

Salient Features : Syllabus focus on current needs of agriculture sector with respect to fertilizers.

Outcome : Will prepare students to understand the problems of farmers and tackle them with recent Biotechnological advances. Become skilled in Biofertilizer production.

Objectives : To enables students to understand the role of Biofertilizers in the field of agriculture and allied industry.

Prerequisites : Technical understanding of microbial culturing, fermentation techniques is prerequisite to student to learn this syllabus.

Unit I

Introduction to Biofertilizers
Introduction to Biopesticides
Advantages of biofertilizers over chemical fertilizers
Practical

1. Cite selection and sample collection for isolation of agriculturally important micro-organism
2. Identification and characterization of Micro-organism
3. Media preparation

Unit II

Types and application of Biofertilizers and Biopesticides
Media composition and screening of superior strains
Scale up of Inoculum
Practical

1. Screening of superior strains using some *in vitro* techniques
2. Inoculum development
3. Check for cross contaminations

Unit III

Mass scale production of Bio-inoculant
Selection of carrier
Factors affecting mass production of Bio-inoculant
Practical

1. Large scale production of Bio-inoculant by using Lab fermenter
2. Preparation of carrier
3. Mixing of Inoculum and carrier

Unit IV

Curing of Inoculum and carrier mixture
Norms for Packaging and Labelling of Bio-inoculant
Efficacy study of developed inoculant

Practical

1. Effect of packaging on viability of inoculants
2. Study of shelf life of inoculant
3. Efficacy check of developed inoculant by using Pot experiment and its comparison with already available commercial Biofertilizers

References:

1. Textbook of Biotechnology : R C Dubey (S. Chand Publication)
2. Biofertilizer Technology: Singh and Purohit (Agrobiose Publication)

Swami RamanandTeerthMarathwada University, Nanded
Choice Based Credit system (CBCS Pattern)
B. Sc. Third Year (Semester V)
Semester Pattern effective from June 2018
Biotechnology
SECBT – IVB Fermentation technology

Maximum Marks : 50 **Hours : 30** **Credits: 2**

Salient features : The syllabus covers the various fermentor design and fermentation techniques.

Utility of course : Skill enhancement in sterilization and fermented product development.

Learning objectives :To improve the student with various designs of fermenter and related principles.

Prerequisites : Basics knowledge of basic microbiology, fermentation processes and the basics of microbial growth

Unit I: Introduction to Fermentation technology, basic principles of food fermentation

Biological agents responsible for fermentation (bacteria, yeasts, molds, enzymes)

- Basic requirements in the laboratory
- Isolation of industrially important microorganisms
- Preservation of microbial culture

Unit II: Design of Fermenter, Types of Fermenter, Selection of microorganism used in industry

- Basic design of fermentor
- Lactic acid Production
- Production of technology of fermented alcoholic beverages (wine)

Unit III: Design of Media, Optimization of media, Sterilization of media

- Design of fermentation media
- Optimization of media
- Ethanol fermentation

Unit IV: Microbial growth kinetics, anaerobic respiration, metabolism and fermentation mechanism

- Growth curve of bacteria
- Enzyme Production (alpha amylase)
- Visit to fermentation industry

Text & References:

1. Principles of Fermentation Technology - Whittaker & Stanberry
2. Casida L.E - Industrial Microbiology- New Age

3. Crueger W and Crueger A - Biotechnology: A Textbook of Industrial Microbiology-Panima Publishing
4. Patel A.H. - Industrial Microbiology, Macmillan India
5. Peppler H.J and Perlman D - Microbial Technology, Vol I and II-Elsevier
6. Biochemical Engineering Fundamentals- Bailey, Ollis- McGraHill