

**Swami Ramanand Teerth Marathwada University, Nanded**  
**Syllabus B. Sc. Biotechnology**  
**Choice Based Credit system (CBCS Pattern)**  
**(With effect from June-2017)**

**B. Sc. Biotechnology Second Year (Third Semester)**

Course Code No.	Course Title	Periods/ Week	Total Period	CA	ESE	Total Marks	Credits
AECCBT1C	English and Science Communication Skills- III	03	35	10	40	50	2
CCBT-2C	Metabolism-I	04	45	35	40	75	3
CCBT-3C	Cytology	04	45	35	40	75	3
CCBT-4C	Molecular Biology	04	45	35	40	75	3
CCCBT-5C	Mathematics, Biostatistics and Computers	04	45	35	40	75	3
CCBTP- 1C	Practical Based on CCBT-2C+3C	03+03	20	20	80	100	4
CCBTP-2C	Practical Based on CCBT-4C +5C	03+03	20	20	80	100	4
SECBT-I	Skill Enhancement course (Any one of SECBT-IA / IB) 1A-Advanced Microbiological Techniques 1B- Algal Culture Technology	01+02	-	25	25	50	2
					Total	600	24

**B. Sc. Biotechnology Second Year (Fourth Semester)**

Code No.	Paper Title	Periods/ Week	Total Period	CA	ESE	Total Marks	Credits
AECCBT-1D	English and Science Communication Skills- IV	03	35	10	40	50	2
CCBT-2D	Metabolism-II	04	45	35	40	75	3
CCBT-3D	Applied & Medical Microbiology	04	45	35	40	75	3
CCBT-4D	Immunology and Virology	04	45	35	40	75	3
CCCBT-5D	Plant and Animal Cell Culture	04	45	35	40	75	3
CCBTP- 1D	Lab Course VII Practical Based on (CCBT 2D +3D)	03+03	20	20	80	100	4
CCBTP-2D	Lab Course VIII Practical Based on (CCBT 4D+5D)	03+03	20	20	80	100	4
SECBT-II	Skill Enhancement course (Any one of SECBT-IIA / IIB) IIA-Diagnostic Biology IIB-Enzyme Technology	01+02	-	25	25	50	2
					Total	600	24

# **Swami Ramanand Teerth Marathwada University Nanded**

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- III)**

**BIOTECHNOLOGY**

**AECBT-1C      English and Science Communication Skills-III      Marks: 50**

## **Unit - I Applied Grammar**

- a) Tense & its application.
- b) Transformation of sentences: Voice, Speech & Degree.
- c) Usages of Articles, propositions, conjunctions & adjectives.
- d) Basic sentence structures based on meanings: Interrogative, exclamatory, declarative, Imperative.
- e) Common mistakes in the use of adverb, conjunctions & in general usages, Redundancies in English language.

## **Unit-II Presentation Skills**

- a) Preparing a short speech for public speaking.
- b) Presentation: pitch, pace, voice, modulation.
- c) Body Language and Voice Modulation
- d) Role playing on different situations.

## **Unit-III Soft Skills**

- a) Interpersonal skills.
- b) Negotiation skills.
- c) Time management skills.
- d) Stress management skills.

## **Unit- IV Day-to-day Conversation**

- a) Introducing one and others.
- b) Meeting friends, greetings and asking questions and answering them.
- c) Debate and extempore
- d) Story telling.

## **Reference Books:**

- 1) English grammar & Composition – Rajendra pal & Suri
- 2) Objective general English – R. S. Agrawal
- 3) Macmillan Foundation English – R. K. Dwivedi A. Kumar
- 4) Developing of Communication Skills – Krishna Monhan & Meera Banerji
- 5) Soft Skills – by K. Alex
- 6) Personality Development & Communicative English – Dr. T. Bharti

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- III)**

**BIOTECHNOLOGY**

**CCBT-2C : Metabolism-I**

**Marks 75**

**Objective:** To provide an understanding of basic thermodynamics and metabolic activities.

**UNIT I :** Thermodynamics:- Fundamentals of thermodynamics- Law of thermodynamics, endergonic and exergonic processes, enthalpy, entropy, activation energy, free energy change, phosphoryl transfer reaction, oxidation reduction reaction, redox potential, equilibrium and non equilibrium thermodynamics, high energy compounds, causes of energy richness in ATP.

**UNIT II :** Carbohydrate Metabolism :EMP Pathway, HMP And ED Pathway, TCA Cycle.

**UNIT III :** Concept of respiration, Types of phosphorylation (substrate, photo and oxidative), mitochondrial electron transport chain, Electron Transport Chain: Components of the chain, sites of ATP synthesis, chemiosmotic theory of oxidative phosphorylation Regulation of ATP synthesis.

**UNIT IV :** Fattyacid oxidation, Oxidation of fatty acids, role of carnitine, oxidation of unsaturated fatty acids & odd carbon fatty acids.  
Metabolic breakdown of amino acids, Transamination (mechanism). Oxidative & Non-oxidative deamination. Urea cycle, metabolic disorders of urea cycle.

**Text and Reference:**

1. Hayne -Biological thermodynamics -Oxford
2. G Gottschalk-Bacterial Metabolism (2nd Ed ) - Springer
3. Nelson & Cox- Lehninger Principles of Biochemistry – W.H. Freeman
4. Lehninger Principles of Biochemistry- Kalyani Publication
5. Stryer- Biochemistry –W.H. Freeman
6. Voet & Voet- Biochemistry – Wiley
7. Cohn and stumpt- Outlines of Biochemistry – Wiley India
8. P.M.Dey- Plant Biochemistry-Academic Press
9. B.P. Pandey- Plant Physiology –Vikas
10. Herper -Biochemistry – McGraw Hill
11. S.K. Verma- Plant Physiology & Biochemistry- S.Chand
12. Bioenergetics by Lehninger- W. A. Benjamin

**Practicals :**

1. Problems based on Entropy, Enthalpy, Free energy and Gibbs Equation (Two of each)
2. Detection of sugars by Paper chromatography / TLC
3. Separation of Photosynthetic pigments by TLC
4. Demonstration of Hill Reaction
5. Study of Enzymatic hydrolysis of Lipids
6. Demonstration of aerobic and anaerobic respiration in microorganisms
7. Estimation of fatty acids by suitable method.

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- III)**

**BIOTECHNOLOGY**

**CCBT-3C: Cytology**

**Marks: 75**

**Objective:** To provide an understanding of structure and function of Cell and its organelles

## **Unit I: Introduction to the Cell:**

Diversity of cell size and shape, History & Evolution, Cell as the basic unit of life, cell theory, Structural organization of prokaryotes and eukaryotes. Biogenesis of Mitochondria, Chloroplast.

**Unit II: Molecular architecture of cell:** Structure and function of plasma membrane (Membrane proteins, lipids.) Structure and functions of Cell wall, Cytosol. **Cell organelles** (Structure, organization & function): Endoplasmic Reticulum (Rough & Smooth), Mitochondria (aerobic & anaerobic), Chloroplast, Ribosome, Golgi apparatus, Lysosome, Melanosome, Nucleus (Nuclear membrane & nuclear pore, Nucleoplasm, Nucleolus), **Cytoskeleton** : Microtubules, Microfilament, intermediate filaments, **Micro bodies:** Glyoxisome, Peroxisomes. **Locomotory organs:** Cilia & Flagella.

**Unit III: Cellular transport:** Transport across cell membrane, Passive transport: Simple diffusion & osmosis , Active Transport: Endo & Exocytosis, (Phagocytosis, Pinocytosis, receptor mediated, Clathrin mediated). Na / K ion Channel, Vesicular transport,

**Unit IV: Cellular regulation:** Cell division and cell cycle – General events of Mitosis and Meiosis. **Cell-cell interaction** (Plasmodesmata, GAP junction, Tight junction, Desmosome), **Cell signaling:** G protein coupled receptor, Autocrine Signaling, Brief introduction of concept of Cancer.

## **Text and Reference:**

1. Verma Agrawal; Cell biology - S. Chand.
2. Gerld Carp- Cell and Molecular biology -Wiley
3. David Sadava; Cell and Molecular biology. Jones & Bartlett Publishers
4. P.S. Verma, V.K. Agarwal- Cytology- S. Chand
5. C.B. Powar- Cell biology - Himalaya Pub.
6. Lodish- Cell and Molecular biology- W.H. Freeman
7. Albert Bruce- Molecular Biology of The Cell- Garland
8. De Robertis; Cell and Molecular biology- Lippincott Williams & Wilkins

## **Practicals:**

1. Study of different Cell types
2. Sub cellular fractionation and isolation of Mitochondria, Chloroplast.
3. Study of Meiosis by maceration technique
4. Study of Mitosis. by maceration technique
5. Study of Karyotyping to find chromosomal position
6. Study of Osmosis, and membrane selective permeability
7. Study of Polytene Chromosome.
8. Study of Tissue/ cells by Microtomy
9. Study of Microscopy; Bright field Microscope/ Light microscope
10. Determination of cell density by turbidometry
11. Demonstration of dialysis.

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- III)**

**BIOTECHNOLOGY**

## CCBT-4C: Molecular Biology

**Marks: 75**

**Objective:** To extend understanding of the molecular mechanisms of gene expression via which genetic information are stored, expressed and transmitted among generations

### **UNIT I: DNA structure, replication & repair:**

**DNA structure:** Structure of DNA, Properties of DNA, Cot curve

**DNA replication:** Replication in prokaryotic and eukaryotic cells, models & mechanism of DNA replication, Enzymes involved in DNA replication –Primosome, Replisome, Topoisomerase, DNA polymerase, SSBP & Ligase. **DNA Repair-** Direct repair – Photo Reactivation, Excision, mismatch, Recombination repair, SOS repair

### **UNIT II: Transcription and RNA processing**

**Transcription in Prokaryotes:** Initiation, Elongation & Termination. Structure of RNA polymerase,

Role of sigma factor, Promoter.

**Transcription in Eukaryotes:** Initiation, Elongation & Termination. Upstream & downstream Promoters, Enhancer. RNA Polymerase I, II & III., Co & Post transcriptional modification in m-RNA- 5'capping, Intron Splicing, polyadenylation. RNA processing & Transport.

### **UNIT III: Translation**

Prokaryotic and Eukaryotic- Mechanism, initiation, elongation, termination.

Co & post translational modifications in proteins, Heat shock proteins, Chaperons & Chaperonins.

Properties of genetic code , Role of mRNA, tRNA, rRNA.

### **UNIT IV: Regulation of gene expression**

Regulation of transcription in prokaryotes , Operon concept, trp-operon, lac- operon, ara- operon.

### **Text and Reference :**

1. Kakoli and Upadhya- Molecular Biology- Himalaya
2. Watson – Molecular biology of gene- Pearson
3. David Freifelder - Microbial Genetics – Narosa
4. David Freifelder – Molecular Biology – Jones and Bartlett /Narosa
5. Gardner – Principals of Genetics – Wiley international pub.
6. Simmonds & Snustad – Principles of Genetics IV ed- Wiley international
7. T.A. Brown – Genomes – Garland Science
8. Albert Bruce- Molecular biology of the cell- Garland Science.
9. Loddish - Molecular cell biology – W-H. freeman
10. B. Lewin – Genes- IX- Oxford

### **Practicals:**

1. Study of Ames test
2. Study of fluctuation test
3. Isolation and quantization of DNA from Bacteria, Yeast,
4. Effect of UV radiation on yeast / bacteria
5. Study of DNA repair mechanism by photo reactivation.
6. Agarose gel electrophoresis of genomic DNA & plasmid DNA
7. Isolation of Lac mutants by using Replica plate method.
8. Determination of T<sub>m</sub> value of DNA/ Cot curve.

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- III)**

**BIOTECHNOLOGY**

**CCBT-5C:Mathematics, Biostatistics and Computers**

**Marks: 75**

**Objective:** To develop skills of Mathematics, Statistics and Computers in the field of biology

## **Unit- I:Set Theory**

Set, types of set, subset, universal set Venn diagram, set operation. Examples.

## **Unit- II :Graphical representation and measures of central tendency**

Definition of Biostatistics, Data& types. Graphical representation (Histogram, frequency polygon, frequency curve).Diagrammaticrepresentation (simple Bar, Subdivided bar, pie chart)

Central Tendency: Concepts, definition, formulas of ungrouped andgrouped data examplesof Mean,Median,Mode.

## **Unit- III :Measures of Variation**

Concept, Definition,formula,examplesof Range, Standard Deviation. Definition,examplesof Variance and Coefficient of Variation

## **Unit IV : Basics of Computer**

Introduction to computer system, Binary Number System, Introduction to O.S. Windows & Linux.Introduction to MS word,Excel, Power point.

Internet concept, WWW,URL, http, Browsers, Search engines etc.

## **Text Reference**

1. Introduction of Mathematics for Life science - E. B atschet – Springer
2. Discrete Mathematics-SemyourLipschutz&Marc Lipson –McGrawHill
3. Statistical Methods – Gupta - Himalaya
4. Fundamental of Biostatistics–P.Hanamantrao
5. Introduction to Biostatistics Dr. Pranabkumar Banerjee
6. Introduction of Computer Science-Pcushman& R. Mata Toledo,McGraw Hill
7. Computer fundamentals – P.K. Sinha – BPBNew Delhi.
8. Microsoft Office – 2000Complete – BPBPracticals

## **Practicals**

1. Problem based on Measures of central tendency.
2. Problem based on Measures of variation.
3. Problem based on set theory.
4. Study of word processing MS-word.
5. Preparation of chart & graphs by MS – Excel and MS word.
6. Making presentation in MS power point.
7. Internet – E-mail, Search Engines.

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- III)**

**BIOTECHNOLOGY**

**SEC – IA Advanced Microbiological Techniques**

**Credits-2 Maximum Marks:50 Internal-25 Marks External-25 Marks**

## **UNIT 1:**Introduction and safety aspects of microbiology lab

Instructions and handling of microbiology equipments& tools such as

- Colony counter
- Shaker with incubator

### **Practicals:** Safety rules of Microbiology Laboratory

Counting of colony by using Colony Counter

## **UNIT 2:**Microbial culture media and its importance

- Isolation of microorganisms from soil, Air and water
- Soil – Serial dilution Method

### **Practicals:** Isolation of microorganisms from air.

Isolation and enumeration of microorganisms from soil sample by using serial dilution method.

## **UNIT 3:**Sub culturing of microbes in solid and liquid media

- Morphological behavior of microbes
- Identification by Biochemical test

### **Practicals:** Morphological study of isolated microorganisms.

Biochemical study of isolated microorganisms.

## **UNIT 4:**Antibiotic sensitivity assay

- Disc diffusion
- Well diffusion

### **Practicals:** Evaluation of antiseptics by filter paper disc method.

To study antimicrobial activity of plant extract by using well diffusion method.

### **References:**

1. Experiments in Microbiology, Plant Pathology and Biotechnology by K.R.Aneja., New age International Publishers.
2. Experiments in Microbiology by R.C.Dubey

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- III)**

**BIOTECHNOLOGY**

**SEC IB Algal Culture Technology**

**Credits-2 Maximum Marks:50**

**Internal-25 Marks**

**External-25 Marks**

## **Unit I**

-Introduction to the Algae (Habitat, cell structure and reproduction)

-Roles of Algae in Biogeochemistry

-Role of Algae in Food Webs and other biotic Associations

### **Practicals**

1. Collection and microscopic observation of algae.

2. Quantification of cultured algae.

## **Unit II**

-Algal culturing techniques in the laboratory

-Introduction of Photobioreactor and raceway ponds.

-Indoor and mass culture methods of economically important algae

### **Practicals:**

1. Isolation, identification of economically important algae

2. Inoculum development and pilot scale production of any one economically important algae.

## **Unit III**

-Products of Algae: SCP, Vitamins, Essential fatty acids

-Algae as a biofertilizer

### **Practicals:**

1. Quantitative estimation proteins from algae.

2. Chromatographic separation of essential biomolecules from algal extract

## **Unit IV**

-Recent developments and future of algal biotechnology: Algal biofuels – algal biodiesel, bio-ethanol and biological hydrogen production,

-Role of Algae in global warming

### **Practicals:**

1. Visit to nearby industry actively engaged in algal technology.

2. Project on algal biotechnology.

### **References:**

1. Algal Culturing Techniques (1st Edition) Elsevier Publication

2. Handbook of Microalgal Culture: Applied Phycology and Biotechnology, (2nd Edition) Authors: Amos Richmond, Qiang Hu (Wiley Publication)



# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- IV)**

**BIOTECHNOLOGY**

**AECCBT-1D: English and Science Communication Skills-IV**

**Marks: 50**

Objective: To have effective communication & preparation of different competitive exam.

Unit - I Sentence Building – (Advanced Level)

- 1)Conditionals
- 2) Modals
- 3) Time expressions
- 4)Describing places, things, talking more about actions

Unit – II Personality Development (Grooming )

- 1) Developing Confidence and killing nervousness.
- 2) Attitude management and personality enhancement
- 3) Grooming for professional etiquettes and manners.

Unit – III Creative writing

- 1) Narrating the situations / Describing different situations
- 2) Elaborating pictures
- 3) Business E-mail : Invitation, Complaint, Appreciation , For Job.

Unit – IV Real life conversation

- 1) Talking about self and expressing feelings
- 2) Oratory Skills (Public speaking skills / techniques )
- 3)Body language & Dress code

Reference Books :

- 1)Developing of communication skills – Krishna Mohan & Meera Banerji
- 2)A Practical English Grammar – A.J.Thomson-Oxford
- 3)Soft Skills – by K. Alex
- 4)English Grammar and Composition – Rajendra Pal & Suri
- 5)Macmillan foundation English – R.K. Dwivedi A.Kumar

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- IV)**

**BIOTECHNOLOGY**

## **CCBT-2D : Metabolism-II**

**Marks 75**

**Objective:** To understand principles of biosynthesis of building blocks of living system.

**UNIT I: Enzymes:** Definition, Nomenclature, Classification of enzymes, Specificity of active sites, E units Enzymes Kinetics: - Michaelis-Menton Equation, significance of  $K_m$  and  $V_{max}$ , factors affecting enzyme activity.

**UNIT II: Biosynthesis of Carbohydrate:** Trapping of solar energy into chemical energy (PS-I & PS-II) in green plants, utilization of this energy to synthesize carbohydrate (Calvin cycle, cycle in C-4 and CAM plants), photorespiration (C-2 cycle). Gluconeogenesis, glycogenesis, and glycogenolysis, glucosides, peptidoglycan

**UNIT III: Nucleotide and Amino acid Biosynthesis:** Purines, Pyrimidines, deoxynucleotides, Salvage and de novo pathway. Synthesis of amino acids (Lysine, Arginine & Tryptophan)

**UNIT IV: Biosynthesis of Fatty acids:** fatty acid synthase complex, regulation, Microsomal & Mitochondrial system of chain elongation and synthesis of unsaturated fatty acids. Cholesterol and phospholipids

**Biosynthesis of Secondary metabolites:** Plants :- Synthesis of Alkaloids, Flavonoids Hormone IAA, Cytokine, Gibberlic acid. Microorganisms :- Antibiotics Beta lactum, tetracycline and macrolides

### **Text and Reference:**

1. G Gottschalk-Bacterial Metabolism (2nd Ed) - Springer
2. Nelson & Cox- Lehninger Principles of Biochemistry – W.H. Freeman
3. Lehninger Principles of Biochemistry- Kalyani Publication
4. Stryer- Biochemistry –W.H. Freeman
5. Voet & Voet- Biochemistry – Wiley
6. Cohn and Stumpf- Outlines of Biochemistry – Wiley
7. G Carp- Cell and Molecular Biology –Wiley
8. P.M.Dey- Plant Biochemistry-Academic Press
9. B.P. Pandey- Plant Physiology –Vikas
10. Harper -Biochemistry – McGraw Hill
11. S.K. Verma- Plant Physiology & Biochemistry- S.Chand

### **Practical s:**

1. Study of Enzyme activity: Amylase/ Cellulase
2. Effect of pH /temperature/ Substrate concentration on Enzyme activity
3. Study of Michaelis-Menten equation
4. Production of Plant hormones from biological sources
5. Extraction and Purification of Flavonoids, Alkaloids
6. Estimation of Cholesterol, bilirubin
7. Extraction and Purification of lipids; Thin layer Chromatography
8. Extraction and Purification of amino acids ; Thin layer Chromatography
9. Identification of production of antibiotics by bioassay

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- IV)**

**BIOTECHNOLOGY**

**CCBT-3D: Applied and Medical Microbiology**

**Marks 75**

**Objective:** To understand applications of microorganisms in different areas.

**UNIT I: Soil Microbiology:** Importance of Biogeochemical cycles: Carbon Cycle: - Carbon assimilation, mineralization, Nitrogen Cycle: Ammonification, Nitrification, Denitrification, and Dinitrogen fixation in symbiotic and non- symbiotic microorganism. Sulphur Cycle: - Sulphur mineralization, oxidation and reduction of sulphur Phosphorus Cycle: - Solubilisation of inorganic phosphorus, Mineralization of organic phosphorus, immobilization, oxidation and reduction of phosphorus.

**Air Microbiology:** - Significance of microorganisms in air, enumeration of microorganisms and control of airborne microorganisms

**UNIT II: Water Microbiology:** Types of water, bacteriological examination of water (presumptive confirmative, complete test) MPN, SPC, membrane filter technique, indicator of fecal pollution, significance of index organism (*E. coli*), fecal/ non fecal coli forms (IMViC)

**Food Microbiology:** Scope of food microbiology, microbial spoilage of food, microbial examination of food, preservation of food by high temperature, chemicals, irradiation, physical techniques. Major food born infections and toxins.

**UNIT III: Medical Microbiology:** Etiological Agent, Virulence, Pathogenesis epidemiology (Sporadic, endemic, pandemic) Reservoirs of infection, Normal flora, commensals, opportunistic pathogens, carriers, septic shock, septicaemia, pathogenicity, virulence factors, toxins, bio safety levels. Concept of waterborne, airborne, nosocomial infections

**UNIT IV:** Morphology, pathogenesis, symptoms, laboratory diagnosis, preventive, Measures and chemotherapy for Typhoid, Tuberculosis, Malaria and AIDS.

**Plant Pathology:** Concept, Host- Pathogen Relationships in plants.

**Text and Reference:**

1. Alexander – Soil Microbiology-John Wiley
2. N.S. Subbarao – Soil Microbiology – Oxford
3. Atlas & Bartha – Microbial Ecology IV Ed., Tata McGraw Hills Pub.
4. A.J. Salle- Fundamental Principles of Bacteriology IIEd., Tata McGraw Hill Pub.
5. Adams & Moss- Food Microbiology Royal Society of Chemistry
6. Frazier- Food Microbiology- Tata Mc Graw Hill
7. Text book of Microbiology- Anantnarayan & Panikar-Orient Longman
8. General Microbiology- Powar and Daginawala- Himalaya

**Practicals :**

1. Enumeration of microorganisms from Soil.
2. Isolation of Symbiotic and Non Symbiotic N<sub>2</sub> fixing microorganisms/ PSB from soil.
3. Enumeration and Study of air Micro flora
4. Microbial examination of water, enteric pathogen form water sample. (IMViC test)
5. Isolation & Enumeration of microorganisms from food sample.
6. Isolation of micro flora from human skin and throat etc
7. Analysis of contaminated food material and analysis of toxins
8. Visit to food and Dairy Industry.

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- IV)**

**BIOTECHNOLOGY**

## **CCBT-4D : Immunology and Virology**

**Marks 75**

**Objective:** To understand concepts of immune system and virology and basic techniques used

### **Unit I :Immunology**

General concept of Immunity, Innate and Acquired Immunity, cellular & Humoral Immunity, Primary Secondary lymphoid organs, hematopoiesis. Types and role of Cells of Immune System.

**Unit II:** Antigen and Antibody: Immunogenicity, Antigenicity, Adjuvants, Epitopes, Haptens. Structure and functions of Immunoglobulins. Antigen- Antibody interactions. Precipitation and Agglutination reactions. Complement fixation.

### **Unit III : Virology**

Brief introduction / outline on discovery of viruses. Nomenclature & classification of Viruses (ICTV), ultra structure, viral nucleic acid, nucleocapsid, structure and envelope viroids, prions, modes of propagation.

**Unit IV :** Life cycle and replication of RNA and DNA Viruses. Bacteriophages  $\lambda$ , T M13.

Animal

Viruses- Adenovirus, Retrovirus. Plant Viruses- TMV CaMV. Brief outline of Vaccines, antivirals, Interferon.

### **Text and Reference:**

1. Immunology – Kuby- W.H. Freeman
2. Essentials of Immunology- Roitt I. M.- Blackwell
3. Immunology- Nandini Shetty- New Age International
4. Textbook of Microbiology – Anantnarayan and Panikar-Orient Longman
5. Immunology- A.K. Abbas- Elsevier
6. An Introduction to Viruses- Amita Biswas- Vikas Publication
7. Bacterial and Bacteriophage Genetics– Edward Birge- Springer
8. Microbial Genetics-David Freifelder- Narosa
9. Virology Principles and Applications- John Carter, Venetia A. Saunders-Wiley
10. Introduction to Modern Virology IV 1 edition- Dimmock, Primrose
11. Plant Virus- M.V. Nayudu- Tata McGraw Hill

### **Practicals:**

1. Immunodiagnostics ( demonstration using Kits- Widal, VDRL, Blood Group etc)
2. Immunodiffusion, Immuno Electrophoresis, Western Blotting, Differential Leukocyte Count
3. Lymphoid organ, Cell and their microscopic observation
4. Immunization, collection of Serum
5. Purification of Ig G from Serum
6. Isolation of bacteriophage from sewage/Titration / one step growth curve of bacteriophage
7. Enumeration of Bacteriophage by PFU method
8. Cultivation of Virus in Embryonated egg, Hemagglutination test
9. ELISA study and demonstration
10. Isolation and study of plant virus

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- IV)**

**BIOTECHNOLOGY**

**CCBT-5D: Plant and Animal Cell Culture**

**Marks 75**

**Objective:** To understand the basic techniques and applications of Plant and Animal cell culture

**Unit I : Plant Tissue Culture:** Introduction and Principles of plant tissue culture, history, Laboratory Organization, Sterilization Techniques, Cleanliness and care, Nutrition and physiology, Media components, Stock solutions, Totipotency, Callus culture, micro propagation, Types of cultures: Cell suspension culture, embryo culture, organ culture, Anther and Pollen Culture, Plant protoplast culture, De Differentiation, Redifferentiation.

**Unit II: Applications of Plant Tissue Culture:** Somatic Embryogenesis and artificial seed, Mass propagation, Protoplast fusion and somatic hybridization, Cybridisation, Improved crop varieties through somaclonal variation, Plant improvement for agriculture, horticulture and forestry, production of secondary metabolites, Preservation of plant genetic resources and germplasm conservation.

**Unit III: Animal Cell Culture:** Principle and Laboratory organization, Sterilization Techniques, Cleanliness and care, Nutrition and physiology. Media components, balanced salt solutions, Serum, serum free media. Cell separation viability and Counting techniques, Primary cell culture, Secondary cell culture and concept of cell lines. Types of animal cell cultures, Organ culture, contact inhibition, cell senescence. Cryopreservation, Flow cytometry.

**Unit IV: Applications of Animal Cell Culture:**

Commercial application of animal tissue culture, concepts of Stem cells and application, Diagnostics, cytotoxicity, monoclonal antibody production, Recombinant proteins and vaccine production, Tissue engineering, Cloning.

**Text and Reference:**

1. Elements of Biotechnology- Gupta P.K.-Rastogi publication
2. Introduction to plant tissue culture – M.K. Razdan-Oxford and IBH
3. Biotechnological innovations in crop improvement- Butterworth Heinemann, BIOTOL, Elsevier
4. Plant Cell and Tissue Culture: A Tool in Biotechnology- Karl-Hermann, A. Kumar-Springer
5. Plant Tissue Culture-Bhojwani and Razdan-Elsevier
6. Methods in Plant Tissue culture- U Kumar- Agrobios India
7. Culture of Animal Cells- R Ian Freshney- John Wiley
8. Animal Cell Culture – John Masters- Oxford University Press
9. Animal Biotechnology –R Sasidhara- MJP Publisher
10. In Vitro Cultivation of Animal cells- Butterworth- Heinemann, BIOTOL, Elsevier
11. Biotechnological Innovations in Animal Productivity- Butterworth- Heinemann, BIOTOL,

**Practicals :**

1. Introduction, general operations, aseptic handling and precautions at cell culture laboratory
2. Stock solution and media preparation for animal cell culture / PTC
3. Callus culture technique, Suspension culture technique, Organ culture: Anther, Pollen culture.
4. Aseptic seed germination.
5. Somatic Embryogenesis and preparation of artificial seed
6. Micropropagation Stage I to IV- Initiation to acclimatization and hardening
7. Animal Cell separation-Trypsinization, Cell viability count by Neuber Chamber
8. Primary cell culture and secondary cell culture techniques
9. Visit to a Animal /Plant Tissue culture laboratory

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- IV)**

**BIOTECHNOLOGY**

**SEC- IIA Diagnostic Biology**

**Maximum Marks: 50**

## **Unit I**

-Introduction to Immunology. Cells of the immune systems.

-Blood, compositions, blood cells, plasma, serum etc..

-Anticoagulants

## **Practical**

1. Separation of plasma and serum from blood.

2. Differential leukocyte count.

3. Staining of blood cells.

## **Unit II**

-Antigen, antibody- Structure and function.

-Antigen – Antibody interaction: Precipitation and agglutination reactions.

-Indoor and mass culture methods of economically important algae

## **Practical:**

1. WIDAL Test

2. ELISA Test

## **Unit III**

-Different Biochemical Tests

-Liver tests, Kidney function test, Endocrine function tests, Lipid profile, Blood Glucose test etc..

## **Practical:**

1. Liver tests/ Kidney function test/ Endocrine function tests/Lipid profile/ Blood Glucose test

(Any two tests)

## **Unit IV**

-Instrumentation in Medical diagnostics.

-Use of Molecular diagnostics in disease identification.

## **Practical:**

1. PCR

2. PAGE/ Immunoelectrophoresis

3. Colorimetry/ Spectrophotometry

## **References:**

1. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition, Freeman, 2002.

2. Gerald Collee J, Andrew G Fraser, Barrie P Marmion, Mackie and McCartney's Practical Medical Microbiology, Elsevier. 2006.

# **Swami Ramanand Teerth Marathwada University Nanded**

Choice Based Credit System (CBCS) Course Structure

**B. Sc. Second year (Semester- IV)**

**BIOTECHNOLOGY**

## **SEC- IIB Enzyme Technology**

**Maximum Marks: 50**

### **Unit I- Introduction to Enzymes**

General introduction:- Nomenclature and Classification of Enzymes, Chemical nature of enzymes. Factors affecting the enzyme activity.

#### **Practical**

1. Isolation of Alpha/Beta Amylase
2. Determination of enzyme activity

### **.Unit II- Enzyme Catalysis**

Enzyme Inhibition and Enzyme Regulation pathway.

#### **Practical**

1. Effect of temperature on Enzyme kinetics.
2. Effect of time on Enzyme kinetics
3. Effect of pH on Enzyme kinetics

### **Unit III**

#### **Industrial Enzymes**

Production, recovery, stability and formulation of enzymes

Enzymes used in various fermentation processes:- Amylase and proteases

#### **Practical**

1. Production and recovery of amylase
2. Production and recovery of Proteases.

### **Unit IV**

#### **Clinical enzymes**

Production, recovery, stability and formulation of enzymes:- , Transaminases and Cholinesterases,

#### **Practicals**

1. Production and recovery of transaminase
2. Production and recovery of Cholinesterases.