Swami RamanandTeerthMarathwada University Nanded
Choice Based Credit System (CBCS) Course Structure
Faculty of Science
B.Sc. Second Year Syllabus
Semester Pattern with effective from June - 2017
Subject: Biotechnology (Vocational)

Semester	Course No.	Name of Course	Instruction Hrs/ Week	Total Period	CA	ESE	Total Marks	Credits
III	CCBT III	**Section A** Molecular Biology (P-VI)	3	45	10	40	50	2
	CCBT III	**Section B** Biophysical Techniques (P-VII)	3	45	10	40	50	2
	CCBTP-II	Practical based On P-VI & P VIII (P-X)	3 3	8 8	5 5	20 20	25 25	1 1
	SECBT-I	SEC-I (Any one Skill from IA/I/B) **1A**-Basic techniques in molecular biology **1B**-Biopesticides Production Technology	2+1	45	25	25	50	2
IV	CCBT IV	**Section A** Immunology & Animal Cell culture (P-VIII)	3	45	10	40	50	2
	CCBT IV	**Section B** Recombinant DNA Technology (P-IX)	3	45	10	40	50	2
	CCBTP-II	Practical Based On P-VII & P-IX (P-XI)	3 3	8 8	5 5	20 20	25 25	1 1
	SECBT-II	SEC-II (Any one Skill from IIA/IIB) **IIA**-Fermentation technology, **IIB**-Plant tissue culture Technology	2+1	45	25	25	50	2

ESE- End of Semester Examination; CA- Continuous Assessment

Note – ESE of CCBTP-II, CCBTP-III & SECBT-I, SECBT-II should be annual

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Choice Based Credit System (CBCS) Course Structure
B. Sc. second year (Semester- III)
Semester Pattern effective from June -2017
B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL)
Molecular Biology (P-VI) CCBT III (Section A)

Credits 2 (Marks 50) Total periods 45

Unit-I
Structure of DNA.& different forms of DNA
DNA replication in prokaryotes and eukaryotes.
DNA recombination: Molecular mechanisms in prokaryotic and eukaryotic
DNA repair mechanism

Unit-II (12 periods)
Structure of prokaryotic genes
Prokaryotic transcription
Prokaryotic translation
Prokaryotic gene expression (*lac, his, trp*, catabolic repression)

Unit-III (11 Periods)
Genome organization in eukaryotes
Structure & types of chromosomes
Eukaryotic transcription
Eukaryotic translation
Post transcriptional modification of m-RNA, t-RNA, and r-RNA

Unit-IV (10 Periods)
Post translation modification in eukaryotes
Gene organization and expression in mitochondria and chloroplasts
Drosophila and Arabidopsis as a model organism

Text & References:
1. Molecular biology of Gene- Watson
2. Molecular Cell Biology - Lodish.
3. Molecular Biology - David Frifielder
4. Genomes – T.A.Brown
5. Molecular Biology- Upadhyay.
6.Gene VIII- Lewin

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B. Sc. second year (Semester- III)
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B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL)

BiophysicalTechniques (P-VII)
CCBT III (Section B)

Credits 2 (Marks 50) Total periods 45

Unit-I (10 Periods)
Study of compound, light, and electron microscope
Lambert –beer law, spectrophotometers, colorimeters.
Centrifuges: principle, instrumentation and applications

Unit-II (10 Periods)
Chromatographic techniques: paper chromatography, Thin layer chromatography (TLC), High performance liquid chromatography (HPLC) and gas liquid chromatography (GLC)
General principles of electrophoresis; Poly acrylamide gel electrophoresis (PAGE), Agarose gel electrophoresis, and Pulse field gel electrophoresis

Unit-III (13 Periods)
X-ray crystallography and Nuclear magnetic resonance (NMR).
General spectroscopy- UV-Visible, fluorescent, atomic absorption, Infrared spectroscopy, Raman spectroscopy.
Principle, instrumentation and applications of Geiger-Muller counter,

Unit-IV (12 Periods)
Physical methods of imaging intact biological structures:
Ultrasound
Optical filters
X-ray
Computerized Tomography (CT) scan
Electro cardio gram (ECG)
Electro encephalo gram (EEG)
NMR imaging

Text & References:
1. Biophysical Chemistry – Nath&Upadhyay
2. Instrumental Methods of Chemical Analysis – P.K.Sharma
3. Practical Biochemistry Principles & Techniques- Wilson Walker
4. Handbook of Biomedical Instrumentation- R.S. Khandpur.
5. Principles & techniques of biochemistry molecular biology - Wilson walker
6. Physical biochemistry- David Frifielder

Swami Ramanand Teerth Marathwada University Nanded
Choice Based Credit System (CBCS) Course Structure
B. Sc. second year (Semester- IV)
Semester Pattern effective from June -2017
B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL)
Immunology & Animal Cell culture (P-VIII)
CCBT IV(Section A)

Credits 2 (Marks 50) Total periods 45

Unit-I (10Periods)
The immune system and immunity along with historical perspective
Antigen –antibody and their structure
The organs and the cells of the immune system and their function
Antigen –antibody interactions

Unit-II (12 Periods)
Humoral and cell mediated immunity (role of MHC in Ag presentation)
Study of Complement system
Hypersensitivity reactions and its types
Immunity to infectious diseases, vaccines

Unit-III (12 Periods)
History of development of cell culture
Culture media, natural media and synthetic growth medium
Importance of growth factors of the serum
Primary cultures: Isolations methods, Anchorage dependence of growth.
Anchorage Independent cells.

Unit-IV (11 Periods)
Secondary cultures transformed animal cells, established / continuous cell lines
Commonly used animal cell lines-their origin and characteristics
Growth kinetics of cells in culture
Application of animal cell culture for studies on gene expression
Organ culture
Transfection of animal cells: selectable markers, HAT selection,
Antibiotic resistance etc
Transplantation of cultured cells

Text & References:
1. Immunology – Kuby
2. Textbook of Microbiology – R.Anantnarayan
3. Essentials of Immunology- Roitt.I.M
4. Immunology – Nagoba
5. Biotechnology-R.C Dubay
6. Biotechnology –B.D.Singh
7. Animal Tissue Culture- Paul
8. Cell Biology –Rastogi
9. Animal cell culture – Freshney

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Choice Based Credit System (CBCS) Course Structure
B. Sc. second year (Semester- IV)
Semester Pattern effective from June -2017
B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL)

RecombinantDNA Technology(P-IX)

CCBT IV (Section B)

Credits 2 (Marks 50) Total periods 45

Unit-I (12 Periods)

What is gene cloning and why do we need to clone a gene?
Tools & techniques plasmids and other vehicles genomic DNA, handling of DNA, RNA, cDNA, RT enzymes & other reagents techniques, laboratory requirement.
Safety measures and regulations for Recombinant DNA work
Choice and selection of the tools and the techniques.

Unit-II (11Periods)

Vectors; Plasmids, cosmids, phagmids& bacteriophages, BAC, YAC
Introduction of DNA in to living cells.
Cloning vectors for *E.coli*.
Cloning vectors for organisms other than *E.coli yeast, fungi*, and animal viruses.
Agrobaterium mediated gene transfer in plants, plant viruses,

Unit-III (12Periods)

Techniques of gene expression: Southern, Northern, Western blotting,
DNA foot printing, gel retardation technique,
DNA and RNA Probes
DNA sequencing methods
PCR and its applications

Unit-IV (10Periods)

Production of proteins from cloned genes
Gene cloning in medicines
-pharmaceutical compounds
-Artificial insulin gene
-Recombinant vaccines
-Diagnostic tests

Text & References:

1. Gene cloning –T.A. Brown
2. Biotechnology – R.C.Dubey
3. Biotechnology – P.K. Gupta
4. Biotechnology- Kumarsen
5. Biotechnology- B.D.Singh
6. Molecular biology of the gene – Watson J.D
7. Genetic engineering – Sandhya Mitra

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B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL)

Practical basedOn P-VI & P VIII (P-X)

CCBTP-II

Credits 2 Marks 50

Practical 1: Isolation of DNA from Bacteria.

Practical 2: Estimation of DNA by DPA method

Practical 3: U.V Spectroscopic analysis of DNA

Practical 4: Isolation of RNA from *S. cerevisiae.*

Practical 5: Estimation of RNA by Orcinol method.

Practical 6: Estimation of protein by Folin –Lowry method.

Practical 7:. Replica plating for transfer of bacterial colony

Practical 8: Isolation of streptomycin resistant mutant of *E.coli.*

Practical 9: Study of mutations by physical and chemical methods.

Practical 10: Agarose gel electrophoresis of extracted DNA

Practical 11: Isolation of Plasmid DNA.

Practical 12: Transformation of *E.coli.*

Practical 13: Restriction digestion of DNA.

Practical 14: Isolation of Ampicillin resistant bacteria.

Practical 15: Study of PCR

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Practical BasedOn P-VII & P-IX (P-XI)

CCBTP-III

Credits 2 Marks 50

Practical 1: Study of Blood Group.

Practical 2: Determination of Rh factor.

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Practical 3: Total RBC count.

Practical 4: Total WBC count.

Practical 5: Differential leucocytes count.

Practical 6: Determination of clotting time and bleeding time of Blood.

Practical 7: Estimation of Hemoglobin.

Practical 8: VDRL Test.

Practical 9: RA Test.

Practical 10: WIDAL test

Practical 11: Cell count by Haemocytometer.

Practical 12: Preparation of Animal cell culture media

Practical 13:.Isolation of primary cell culture by enzymatic method

Practical 14: Separation of amino acids by TLC & paper chromatography

Practical 15: Principle & working of X-ray.

Practical 16: Principle & working of Ultrasound / Sonography.

Practical 17: Principle & working of ECG.

Practical 18: Principle & working of EEG.

Practical 19: Principle & working of UV-spectrophotometer.

Practical 20: Principle & working of IR-spectroscopy.

Practical 21: Study of SDS-PAGE

Practical 24: Study of centrifuges

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Semester Pattern effective from June -2017
B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL) Semester III

SECBT-IA Basic techniques in molecular biology

Unit I

UV-Visible spectroscopy: Principle and applications
Centrifugation: Principle, types and applications

Unit II
Agarose gel electrophoresis and SDS PAGE: Principle, working and applications
Chromatography:Principle, types and applications

Unit III

PCR: Principle types and applications
Biosensor:Principle, construction and applications

Unit IV
ELISA, Southern blotting, western blotting, Northern blotting, Flow cytometry

Practicals

1. Extraction of genomic DNA from bacteria, yeast
2. Separation of Pigments/ Biomolecules by Chromatography
3. Principals and working of different centrifuges
4. Spectrophotometric analysis of DNA, RNA and proteins
5. Agarose gel electrophoresis of DNA
6. SDS-PAGE.
7. ELISA

References

1. Biophysical Chemistry- Upadhyay, Upadhyay and Nath-Himalaya
2. Practical Biochemistry- Wilson & Walker -Cambridge
3. Practical Biochemistry- David Plummer- Tata McGraw Hill
4. Physical Biochemistry- David Friefelder
5. Instrumental Methods of Chemical Analysis- Chatwal Anand- Himalaya
6. Instrumental Methods of Chemical Analysis –B.K. Sharma-Goel

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SECBT -IB Biopesticides Production Technology

Unit I

Introduction to biopesticides, Types, Applications, Advantages and disadvantages of biopesticides.

Unit II

*B.thuringiensis*and *Trichoderma* asbiopesticide, Biological pest control, Integrated pest management

Unit III

Bioinsecticide, Biofungicide, Bioherbicide.

Unit IV

*Pseudomonas fluorescens*as biocontrol agent. Present status and future needs of biopesticides.

Practicals
1.Isolation of *B.thuringiensis*
2.Isolation of *Trichodermaherzianum*
3.Inoculum preparation of *Trichodermaherzianum*
4. Inoculum preparation of *Pseudomonas fluorescens*

References
1. Biotechnology:R.C.DubeyS.Chand publications
2. Biotechnology:B.D.Singh
3. Elements of Biotechnology: P.K.Gupta, Rastogi publications
4. Microbiology: R.C.DubeyS.Chand publications

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B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL) Semester IV
SECBT-IIA Fermentation technology

Unit I

Fermenters, Bioreactors: Construction, Design & Operation, Materials of ConstructionsProperties of ideal fermenter.

Unit II

Fermentation Processes.
Fermentation processes: Microorganisms involved, Inoculum preparation, Medium used and product Recovery ofProtease, pectinase, Alcohol

Unit III

Fermentation Processes.
Fermentation processes: Microorganisms involved, Inoculum preparation, Medium used and product Recovery Organic acid: Citric acid. Antibiotic: Penicillin

Unit IV
Fermentation Economics, Concept of QC, QA, Good Laboratory Practices, GMP.

Practicals
1. Isolation and Screening of Industrially important Microbes-Acid, Antibiotics, Enzymes
2. Fermentative production purification and estimation of antibiotics/ vitamins
3. Fermentative production purification and estimation of Citric Acid
4. Fermentative production purification and Estimation of alcohol using *Sacharomyces cerevisiae*

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

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B. Sc. SECOND YEAR BIOTECHNOLOGY (VOCATIONAL) Semester IV
SECBT-IIB Plant tissue culture Technology

Unit I
Introduction and History of plant tissue culture Techniques, structure and organization of plant tissue culture laboratory

UnitII
Tissue culture media: Types, composition and preparation, maintenance of callus and suspension culture, sterilization techniques.

Unit III
Micropropagation: Introduction, meristem culture, stages of micro propagation, Applications of micro propagation. Haploid production.

Unit IV
Protoplast isolation, protoplast culture, protoplast fusion
Commercial applications of tissue culture technology.

Practicals
1. Introduction, general operations, precautions at cell culture laboratory
2. Preparation of tissue culture media
3.Sterilization of explants
4. Callus culture and organ culture
5. Protoplast isolation
6. Meristem culture.

Text & References:
1. Elements of Biotechnology. P.K. Gupta
2. Plant biotechnology - B.D.Singh
3. An introduction to Plant biotechnology –H.S. Chawla.
4. An introduction to Plant tissue culture – A.K.Razdhan
5. Biotechnology - B.D.Singh
6. Introduction to plant tissue culture – M.K. Razdan
7. Plant tissue culture: Theory and practice- S.S. Bhojawani and M.K.Razdan