JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE
(AUTONOMOUS)
OOTY ROAD, MYSORE – 25.

DEPARTMENT OF BIOTECHNOLOGY

SCHEMATIC SYLLABUS UNDER CHOICE BASED CREDIT SYSTEM (CBCS)

For B.Sc., programmes

Chemistry, Zoology and Biotechnology

Biochemistry, Microbiology and Biotechnology

2019-20

B.Sc., UG SYLLABUS- PROGRAMME – CZBt

Scheme of study for B.Sc. Biotechnology under CBCS scheme from 2019-20

YEAR	SEMESTER	CORE COURSE	COURSE CODE	TITLE OF THE PAPER	NO. OF CREDITS	LECTURE/ PRACTICAL/ HOUR/WEEK	TOTAL TEACHING HOURS
I BSc	I	**DSC -I:Theory**	**DMA22005**	**Cell biology & genetics**	**4**	**4**	**60**
		DSC -I:Pract	**DMA22105**	**Cell biology & genetics**	**2**	**4**	**60**
	II	**DSC-II:Theory**	**DMB22005**	**Biomolecules and Bio-analytical techniques**	**2**	**4**	**60**
		DSC-II: Pract	**DMB22105**	**Biomolecules and Bio-analytical techniques**	**2**	**4**	**60**
II BSc	III	**DSC-III:Theory**	**DMC22005**	**Molecular biology and Genetic engineering**	**2**	**4**	**60**
		DSC-III: Pract	**DMC22105**	**Molecular biology and Genetic engineering**	**2**	**4**	**60**
	IV	**DSC-IV:Theory**	**DMD22005**	**Plant Tissue culture and Animal Cell culture**	**2**	**4**	**60**
		DSC-IV: Pract	**DMD22105**	**Plant Tissue culture and Animal Cell culture**	**2**	**4**	**60**
III BSc	V	**DSE Elective 1: Theory**	**DME22005**	**Elective 1: Immunology and Medical Biotechnology**	**2**	**4**	**60**
		Elective 1: Pract	**DME22105**	**Elective 1: Immunology and Medical Biotechnology**	**2**	**4**	**60**
		Elective 2: Theory	**DME22205**	**Elective 2: Microbial technology and Agricultural Biotechnology**	**2**	**4**	**60**
		Elective 2: Pract	**DME22305**	**Elective 2: Microbial technology and Agricultural Biotechnology**	**2**	**4**	**60**
		SEC 1	**DME22405**	**SEC 1:Microbial Techniques**	2	2	30
		SEC 2	**DME22505**	**SEC 2:Enzymology**	2	2	30
	VI	**DSE Elective 1: Theory**	**DMF22005**	**Elective 1: Environmental Biotechnology and Biostatistics**	**2**	**4**	**60**
		Elective 1: Pract	**DMF22105**	**Elective 1: Environmental Biotechnology and Biostatistics**	**2**	**4**	**60**
		Elective 2: Theory	**DMF22205**	**Elective 2: Bioinformatics and Bioprocess technology**	**2**	**4**	**60**
		Elective 2: Pract	**DMF22305**	**Elective 2: Bioinformatics and Bioprocess technology**	**2**	**4**	**60**

B.Sc., UG SYLLABUS- PROGRAMME – BMBt

Scheme of study for B.Sc. Biotechnology under CBCS scheme from 2019-20

YEAR	SEMESTER	CORE COURSE	COURSE CODE	TITLE OF THE PAPER	NO. OF CREDITS	LECTURE/ PRACTICAL/ HOUR/WEEK	TOTAL TEACHING HOURS
I BSc	I	**DSC -I:Theory**	**DMA22006**	**Cell biology & genetics**	**4**	**4**	**60**
		DSC -I:Pract	**DMA22106**	**Cell biology & genetics**	**2**	**4**	**60**
	II	**DSC-II:Theory**	**DMB22006**	Biomolecules and Bio-analytical techniques	**2**	**4**	**60**
		DSC-II: Pract	**DMB22106**	Biomolecules and Bio-analytical techniques	**2**	**4**	**60**
II BSc	III	**DSC-III:Theory**	**DMC22006**	Molecular biology and Genetic engineering	**2**	**4**	**60**
		DSC-III: Pract	**DMC22106**	Molecular biology and Genetic engineering	**2**	**4**	**60**
	IV	**DSC-IV:Theory**	**DMD22006**	Plant Tissue culture and Animal Cell culture	**2**	**4**	**60**
		DSC-IV: Pract	**DMD22106**	Plant Tissue culture and Animal Cell culture	**2**	**4**	**60**
III BSc	V	**DSE Elective 1: Theory**	**DME22006**	Elective 1: Immunology and Medical Biotechnology	**2**	**4**	**60**
		Elective 1: Pract	**DME22106**	Elective 1: Immunology and Medical Biotechnology	**2**	**4**	**60**
		Elective 2: Theory	**DME22206**	Elective 2: Microbial technology and Agricultural Biotechnology	**2**	**4**	**60**
		Elective 2: Pract	**DME22306**	Elective 2: Microbial technology and Agricultural Biotechnology	**2**	**4**	**60**
		SEC 1: Theory	**DME22406**	SEC 1:Microbial Techniques	2	2	30
		SEC 2: Theory	**DME22506**	SEC 2:Enzymology	2	2	30
	VI	**DSE Elective 1: Theory**	**DMF22006**	Elective 1: Environmental Biotechnology and Biostatistics	**2**	**4**	**60**
		Elective 1: Pract	**DMF22106**	Elective 1: Environmental Biotechnology and Biostatistics	**2**	**4**	**60**
		Elective 2: Theory	**DMF22206**	Elective 2: Bioinformatics and Bioprocess technology	**2**	**4**	**60**
		Elective 2: Pract	**DMF22306**	Elective 2: Bioinformatics and Bioprocess technology	**2**	**4**	**60**

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE
Scheme of Examination Programme – B.Sc., CZBt ; Programme code –BSC05

Year	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment				Exam Duration	
					L:T:P	IA(Theory)			Total	Th	Pr
						C-1	C-2	C-3			
I B.Sc	I	DSC-I :Theory	DMA22005	Cell Biology and Genetics	4: 0: 0	15	15	70	100	3h	3h
		DSC-I: Pract	DMA22105	Cell Biology and Genetics	0: 0: 2	7.5	7.5	35	50		
	II	DSC-II:Theory	DMB22005	Biomolecules and Bio-analytical techniques	4:0:0	15	15	70	100	3h	3h
		DSC-II: Pract	DMB22105	Biomolecules and Bio-analytical techniques	0:0:2	7.5	7.5	35	50		
II B.Sc	III	DSC-III:Theory	DMC22005	Molecular biology and Genetic engineering	4:0:0	15	15	70	100	3h	3h
		DSC-III: Pract	DMC22105	Molecular biology and Genetic engineering	0:0:2	7.5	7.5	35	50		
	IV	DSC-IV: Theory	DMD22005	Plant Tissue culture and Animal Cell culture	4:0:0	15	15	70	100	3h	3h
		DSC-IV: Pract	DMD22105	Plant Tissue culture and Animal Cell culture	0:0:2	7.5	7.5	35	50		
III B.Sc.	V	DSE: Elective 1:Theory	DME22005	Elective 1: Immunology and Medical Biotechnology	4:0:0	15	15	70	100	3h	3h
		Elective 1: Pract	DME22105	Elective 1: Immunology and Medical Biotechnology	0:0:2	7.5	7.5	35	50		
		Elective 2: Theory	DME22205	Elective 2: Microbial technology and Agricultural Biotechnology	4:0:0	15	15	70	100		
		Elective 2: Pract	DME22305	Elective 2: Microbial technology and Agricultural Biotechnology	0:0:2	7.5	7.5	35	50		
		SEC 1: Theory	DME22405	SEC 1:Microbial Techniques	2:0:0	7.5	7.5	35	50	2h	-
		SEC 2: Theory	DME22505	SEC 2:Enzymology	2:0:0	7.5	7.5	35	50	2h	-
	VI	DSE: Elective 1:Theory	DMF22005	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100	3h	3h
		Elective 1: Pract	DMF22105	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100		
		Elective 2: Theory	DMF22205	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100		
		Elective 2: Pract	DMF22305	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100		

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSORE
Scheme of Examination Programme – B.Sc., BMBt ; Programme code –BSC06

Year	Semester	Core course	Course code	Title of the paper	credits	Maximum Marks in exam/Assessment				Exam Duration	
					L:T:P	IA(Theory)			Total	Th	Pr
						C-1	C-2	C-3			
I B.Sc	I	DSC-I :Theory	DMA22006	Cell Biology and Genetics	4: 0: 0	15	15	70	100	3h	3h
		DSC-I: Pract	DMA22106	Cell Biology and Genetics	0: 0: 2	7.5	7.5	35	50		
	II	DSC-II:Theory	DMB22006	Biomolecules and Bio-analytical techniques	4:0:0	15	15	70	100	3h	3h
		DSC-II: Pract	DMB22106	Biomolecules and Bio-analytical techniques	0:0:2	7.5	7.5	35	50		
II B.Sc	III	DSC-III:Theory	DMC22006	Molecular biology and Genetic engineering	4:0:0	15	15	70	100	3h	3h
		DSC-III: Pract	DMC22106	Molecular biology and Genetic engineering	0:0:2	7.5	7.5	35	50		
	IV	DSC-IV: Theory	DMD22006	Plant Tissue culture and Animal Cell culture	4:0:0	15	15	70	100	3h	3h
		DSC-IV: Pract	DMD22106	Plant Tissue culture and Animal Cell culture	0:0:2	7.5	7.5	35	50		
III B.Sc.	V	DSE: Elective 1:Theory	DME22006	Elective 1: Immunology and Medical Biotechnology	4:0:0	15	15	70	100	3h	3h
		Elective 1: Pract	DME22106	Elective 1: Immunology and Medical Biotechnology	0:0:2	7.5	7.5	35	50		
		Elective 2: Theory	DME22206	Elective 2: Microbial technology and Agricultural Biotechnology	4:0:0	15	15	70	100		
		Elective 2: Pract	DME22306	Elective 2: Microbial technology and Agricultural Biotechnology	0:0:2	7.5	7.5	35	50		
		SEC 1: Theory	DME22406	SEC 1:Microbial Techniques	2:0:0	7.5	7.5	35	50	2h	-
		SEC 2: Theory	DME22506	SEC 2:Enzymology	2:0:0	7.5	7.5	35	50	2h	-
	VI	DSE: Elective 1:Theory	DMF22006	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100	3h	3h
		Elective 1: Pract	DMF22106	Elective 1: Environmental Biotechnology and Biostatistics	4:0:0	15	15	70	100		
		Elective 2: Theory	DMF22206	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100		
		Elective 2: Pract	DMF22306	Elective 2: Bioinformatics and Bioprocess technology	4:0:0	15	15	70	100		

Programme Outcomes for Bachelor of Science in Chemistry, Zoology and Biotechnology:

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate the ability to justify, explain, and/or approach the concept both in written and oral forms

PO2. Demonstrate the ability to present clear, logical and succinct arguments

PO3. Develop state-of-the-art laboratory skills and professional communication skills.

PO4. Apply the scientific method to design, execute, and analyze an experiment.

PO5. Appreciate the central role of chemistry in the society and use this as a basis for ethical behaviour in issues facing chemists/drugs.

PO6. Understand Chemistry as an integral part for addressing social, economic, and environmental problems.

PO7. Identify the major groups of organisms with an emphasis on animals and plants.

PO8. Compare and contrast the characteristics of animals that differentiate themselves from other living and non-living creatures.

PO9. Give specific examples of physiological adaptations.

PO10. Design and develop solution to Biotechnology problems keeping in mind the safety measures for environment and society.

PO11. Support Biotechnology research activity with strong technical background knowledge.

Programme Outcomes for Bachelor of Science in Biochemistry, Microbiology and Biotechnology:

After completing the graduation in the Bachelor of Science the students are able to:

PO1. Demonstrate the ability to justify and explain their thinking approach, both written and oral.

PO2. Develop state-of-the-art laboratory skills and professional communication skills.

PO3. Apply the scientific method to design, execute, and analyze an experiment, to explain their scientific procedures and experimental observations.

PO4. Demonstrate an understanding of fundamental biochemical principles, structure and biological function and metabolic pathways.

PO5. Work as a laboratory technician, biochemists or medical scientist.

PO6. Describe/ explain the processes used by microorganisms for their replication, survival, and interaction with their environment and host populations.

PO7. Explain the theoretical basis of the tools, technologies and methods common to microbiology.

PO8. Design and develop solution to Biotechnology problems by applying appropriate tools while keeping in mind safety factor for environment & society.

PO9. Create, select, and apply appropriate techniques, resources, and modern tools with an understanding of the limitations.

PO10.Support biotechnology research activity with strong technical background knowledge.

Programme Specific Outcomes

Bachelor of Science in Chemistry, Zoology and Biotechnology:

After completing the graduation in the Bachelor of Science the students are able to:

PSO1. Find jobs at all level of chemical, pharmaceutical, food products and life oriented material Industries

PSO2. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PSO3. Recognize the relationship between different structures and functions at different levels.

PSO4. Characterize the biological, chemical and physical features of environments that Animals inhabit.

PSO5. Demonstrate effectively the applications of biochemical and biological sciences.

PSO6. Know and apply appropriate tools and techniques in biotechnological manipulation

PSO7. Understand his or her responsibilities in biotechnological practices.

Programme Specific Outcomes

Bachelor of Science in Biochemistry, Microbiology and Biotechnology:

After completing the graduation in the Bachelor of Science the students are able to;

PSO 1: Gain and understand biochemical and molecular processes that occur in and between cells to expand understanding of biology

PSO2: Be knowledgeable in proper procedures and regulations in handling and disposal of chemicals.

PSO3: Communicate scientific information effectively, especially relating to microbes and their role in ecosystem and health related issues.

PSO4: Acquire, articulate, retain and demonstrate laboratory safety skills applicable to microbiological research or clinical methods.

PSO5: Demonstrate effectively the applications of biochemical and biological sciences

PSO6: Decide and apply appropriate tools and techniques in biotechnological manipulation.

POS7: Justify societal, health, safety and legal issues and understand his or her responsibilities in biotechnological practices.

DMA22005/ DMA22006

SEMESTER I
CELL BIOLOGY AND GENETICS (4 CREDITS)

Course Outcomes:
After completing the course students are able to:
CO1. Develop an understanding of the structure and functions of organelles.
CO2. Understand the structure of chromosomes, types, cell differentiation and features of cancer cells.
CO3. Gain comprehensive understanding of the chemical basis of heredity and methods.
CO4. Understand effect of mutation, mechanism and Chromosomal Aberrations.

CELL BIOLOGY **NO. HOURS**

UNIT I **15**
Cell: Introduction and Historical perspective, the cell theory, ultra structure of plant and animal cell.
Cell organelles: Structure and functions of – cell wall, plasma membrane, membrane protein, cytoplasm, mitochondria, chloroplast, Golgi complex , endoplasmic reticulum, ribosome, lysosomes, peroxisomes, nucleus.
Cell division: Cell cycle and phases, regulation of cell cycle and significances of cell cycle. Mitosis and meiosis, interphase nucleus, achromatic apparatus, synaptomal complex and significances of mitosis and meiosis.

UNIT II **15**
Eukaryotic chromosomes: Types, chromatin structure, nucleosomes, and higher order chromatin organization.
Special chromosomes – Polytene and B chromosome, lamp brush chromosome.
Cell interaction and motility: Cell motility flagellar and ciliary motion .Structure and function of muscle cells, muscle contraction, nerve cell structure and function.
Stem cells, differentiation of stem cells (eg: Haematopoitic stem cells) and their application. Special cells : Blood cells, identification, structure and different types of blood cells and cancer cells.

GENETICS

UNIT III **15**
Introduction: Historical developments in the field of genetics. Organisms suitable for genetic experimentation and their genetic significance. Mendelian Theory: Law of dominance, Mendel's experimental on monohybrid and di-hybrid crosses, Law of segregation & Principle of independent assortment. Verification of segregates by test and back crosses. Deviation to Mendelian inheritance of genes (13:3 ratio), incomplete dominance (Flower colour in sweet peas) , co dominance (Blood groups in human beings), epistasis(Dominant &recessive epistasis). Sex-linked inheritance (colour blindness), linkage, crossing over and cytoplasmic inheritance (Plastid inheritance in Mirabilis).

UNIT IV **15**
Mutation: Natural and induced mutations, chemical, physical and biological mutagens with an example each.
Structure and characteristics of bacterial and eukaryotic chromosome, chromosome morphology, concept of euchromatin and heterochromatin.
Chromosomal aberrations: Deletion, duplication, inversion and translocation. Chromosomal disorders in human beings, abnormalities– Aneuploidy and Euploidy.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1. Cell counting methods: using Haemocytometer.
2. Measurements with the help of light microscope.
    a. Calibration of ocular micrometer
    b. Measurement of biological materials (cells/spores etc.).
    c. Demonstration-Separation of cell organelles by differential centrifugation
3. Study of Mitosis -onion root tips.
4. Study of Meiosis –onion flowers buds/rheo flowers
5. Demonstration of plasmolysis and deplasmolysis
6. Isolation of chloroplast from leaves
7. Study of at least five simple mutants of Drosophila-Photographic demonstration
8. Preparation of polytene chromosome from salivary glands of Drosophila
9. Genetic Problems; Monohybrid, Di hybrid and interactions of Genes
10. Special Chromosomes; Lampbrush and Polytene chromosomes
11. Comment (Types of chromosome (slide/picture), chromosomal disorders in humans- Humans -Down's Turner's and Klinefelter's Syndrome

REFERENCES

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.

2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition.Lippincott Williams and Wilkins, Philadelphia.

3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASMPress& Sunderland, Washington, D.C.; Sinauer Associates, MA.

4.Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.

5.Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.

6.Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.

DMB22005/ DMB22006

SEMESTER II
BIOMOLECULES & BIO-ANALYTICAL TECHNIQUES (4 CREDITS)

Course Outcomes:
After completing the course students are able to:
CO1. Understand the properties, mechanisms and biological importance of Bio-molecules .
CO2. Comphrend the mechanism of enzyme action, factors affecting it and its applications.
CO3. Understand and able to relate the principles underlying various instruments in the field of Biology.
CO4. Compare and contrast the role of bio -molecules and enzymes.

BIOMOLECULES **NO. HOURS**

UNIT I: **15**
Carbohydrates: Structure (Fischer and Haworth structure), function and properties of Monosaccharide's (Glucose, Fructose), disaccharides (Sucrose, Maltose and Lactose) and
Heteropolysaccharide's- hyaluronic acid and heparin. Reducing and Non reducing Sugars, Stereochemistry- Epimers, Enantiomers, Anomers and Isomers.
Proteins: Amino acids- General steucture , essential and non essential amino acids, , classification based on polarity , zwitter ionic structure, pka value. D and L amino acids, optical activity. Peptide bond, primary, secondary, tertiary and quaternary structural organization of proteins. Globular and fibrous proteins with special reference to structure of haemoglobin and collagen.

UNIT II: **15**
Lipids: Classification of lipids with examples. Simple and compound lipids, unsaturated and saturated fatty acids, physical and chemical properties of fats and oils. Structure and biological importance of phospholipids and cholesterol.
Nucleic acids: Structure of bases, nucleosides, nucleotides and secondary structure of DNA and different forms of DNA. Types and functions of RNA, cloverleaf structure of tRNA.

UNIT III: **15**
General characteristics of enzymes, nomenclature and classification of enzymes. Mechanism of enzyme action: active site, enzyme substrate complex formation-lock and key and induced fit theory. Concept of co-enzymes and cofactors with an example. Factors influencing enzyme activity: pH, temperature, substrate concentration, metal ion, inhibitors (allosteric) and activators, energy of activation. Isozymes, multienzyme complex and multifunctional enzymes with an example to each

BIO-ANALYTICAL TECHNIQUES
UNIT IV: **15**
Bio-analytical Techniques: Lambert-Beer Law, working principles of UV-Visible spectrophotometry and colorimetry.
Centrifugation: Basic principle of centrifugation, ultracentrifuge and its application.
Chromatography: Principles of chromatography, Types- Partition chromatography- paper and thin layer chromatography & Adsorption chromatography - column chromatography, ion exchange& molecular sieve (principle &application).
Isotopes: Their importance in biological studies, measure of radioactivity, GM counters

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1. Qualitative analysis of Carbohydrates.
2. Qualitative analysis of Lipids.
3. Estimation of reducing sugar by DNS method.
4. Estimation of Protein by Biuret method.
5. Estimation of amino acid by ninhydrin method /formal titration
6. Determination of activity and specific activity of enzyme-Salivary amylase.
7. Effect of pH on enzyme activity
8.. Effect of temperature on enzyme activity.
9. Effect of metal ions on enzyme activity.
10. Preparation of buffer solution.
11. Identification of amino acids by circular paper chromatography.

REFERENCES

1.Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4 th edition, W.H. Freeman and Company, New York, USA.

2. Biochemistry, LubertStryer, 6th Edition, WH Freeman, 2006.
3. Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.

4. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley andSons, 1995.

5. Biochemistry by Mary K.Campbell& Shawn O.Farrell, 5th Edition, Cenage Learning,2005.

6. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999

7. Fundamentals of Enzyme Kinetics Athel Cornish-Bowden Portland Press 2004

8. Practical Enzymology Hans Bisswanger Wiley–VCH 2004

DMC22005/ DMC22006

SEMESTER III
MOLECULAR BIOLOGY & GENETIC ENGINEERING (4 CREDITS)

Course Outcomes:
After completing the course students are able to:
CO1. Display a broad understanding of core molecular Biology.
CO2. Discuss and differentiate the process of Transcription and Translation
CO3 Explain key concepts of genome organization and manipulation.
CO4. Demonstrate working knowledge in a defined skill set of molecular biology and biotechnology protocols.

MOLECULAR BIOLOGY NO. HOURS

UNIT I **15**

DNA as genetic material: Experiments of Griffith and Hershey & Chase. Central Dogma of Molecular biology.
Concept of gene: Definition, generalized structure of Prokaryotes and Eukaryotes.
DNA Replication: Modes of DNA replication- Semiconservative, conservative and dispersive method. Replication of DNA in prokaryotes and eukaryotes. Components of replication –lagging strand leading strand Okazaki fragment, role of SSBP, gyrase, helicase, RNA polymerase, DNA polymerase. Inhibitors of replication- role of actinomycin,acriden, novobioci, novobiocin, amphidicolin and N-ethyl maleimide.
Genetic code: Major features of genetic code, outline of Deciphering of genetic code and Wobble hypothesis.

UNIT II **15**

Transcription and RNA processing : RNA structure and types of RNA, Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains. Inhibitors of Transcription- rifampicin, actinomycin, alpha amanitin and platinum antitumor drugs. Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing.
Translation: Activation of amino acids, ribosome (composition & components), formation of initiation complex. Initiation, elongation and termination, inhibitors of protein synthesis.

GENETIC ENGINEERING

UNIT III **15**

Enzymes in Genetic engineering and its importance-Restriction endonucleases-types of restriction enzymes, ligases, alkaline phosphatases, polynucleotide kinase, terminal deoxynucleotidyltransferase, S1 nuclease, Klenow fragment, taq DNA polymerases, ribonuclease, reverse transcriptase
Gene cloning vectors: Types of vectors –Cloning vector and expression vector . Plasmids (pBR322, pUC 19) and cosmids (pLFR5, pJB8). Importance of plasmids as cloning vectors, stability of plasmids, different forms of plasmid, concepts of YAC and BAC.

UNIT IV **15**

Recombinant DNA technology: Isolation of gene, construction and preparation of complementary DNA. Probes- types, preparation and hybridization, genomic library.
Genetic engineering techniques: Gel electrophoresis, southern and northern blotting techniques, PCR and

its types, Sanger's, Maxam& Gilbert method of DNA sequencing.
Applications of Genetic Engineering: Therapeutic products produced by genetic engineering-blood proteins, human hormones.Genetic engineering in plants: Use of Agrobacterium tumefaciens and A. rhizogenes, Ti plasmids, Direct DNA transfer to plants.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1.Preparation of stock solution for molecular biology experiments.
2. Colorimetric estimation of DNA.
3. Colorimetric estimation of RNA.
4. Demonstration of Tm value of DNA.
5. Extraction of DNA from plant and microbial source.
6. Quantification of DNA by spectrophotomery.
7. Determination of purity of DNA.
8. Agarose gel electrophoresis of DNA.
9. Southern blotting (demonstration).
10. Isolation of plasmid DNA.

REFERENCES

1. Russell, P.J. 2009 Genetics – A Molecular Approach. 3rdedition. Benjamin Co. 7. Sambrook&Russel. Molecular Cloning: A laboratory manual. (3rd edition) 8. Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.

2. Brown, T.A. (1998). Molecular biology Labfax II: Gene analysis. II Edition. Academic Press, California,USA.

3. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An introduction to genetic analysis. IX Edition. Freeman & Co., N.Y., USA.

4. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNAgenes and genomes- A short course. III Edition. Freeman and Co., N.Y., USA.

5. Brown, T. A. Gene cloning and DNA analysis: An Introduction. Blackwell Publication.

DMD22005/ DMD22006

SEMESTER IV

PLANT TISSUE & ANIMAL CELL CULTURE (4 CREDITS)

Course Outcomes:
After completing the course students are able to:
CO1. Develop concept of plant tissue and animal cell culture techniques and their application in biotechnology.
CO2. Comprehend the knowledge of transgenic plants in industrial and agricultural applications.
CO3. Establish and maintain various cell lines used in tissue culture.

PLANT CELL CULTURE **NO. HOURS**

UNIT I **15**
Plant tissue culture introduction: History and development, Importance of plant tissue culture.
Laboratory organization and culture techniques: general requirements and aseptic conditions. Media preparation, culture media, sterilization, and pre-treatment to explants.
Principles of tissue culture: Callus culture- Definition of callus, initiation, maintenance, sub culture and organogenesis .Factors affecting organogenesis .
organ culture- culture protocols and importance of root and meristem culture.
Micropropagation in plants: stages of micropropagation, methods, advantages, applications.

UNIT- II **15**
Somaclonal variation for disease resistance and agronomic traits.
Somatic embryogenesis: Embryoid and embryogenesis. Protocol and importance of somatic embryogenesis, Synthetic seeds and its applications, germplasm conservation and preservation.
Suspension culture: Batch and continuous cell suspension culture. Importance of suspension culture in production of secondary metabolites. Protoplast culture and fusion: Definition of protoplast, isolation principle, culture protocol, action of enzymes, regeneration of plants, protoplast fusion, somatic cell hybridization and its application.

ANIMAL TISSUE CULTURE

UNIT - III **15**
Introduction: History, developments and importance of animal cell culture. Characteristics of animal cell growth, Advantages and disadvantages of tissue culture methods and laboratory facilities.
Culture procedure and culture media: Preparation and sterilization of glasswares and media. Culture media containing naturally occurring ingredients, blood plasma, blood serum, serum-free media, tissue extracts, complex natural media, chemically defined media, and basal salt solution –HBSS.

UNIT – IV **15**
Primary culture, cell lines and cloning: Preparation of primary culture –mechanical and enzymatic method. Primary and established cell lines, somatic cell fusion.
Tissue cultures- cover slip method, watch glass method and use of agar.
Whole embryo culture. (e.g. Chick embryo).
Hybridoma technology: Production of monoclonal antibodies.

Animal propagation –Artificial insemination, superovulation, embryo transfer, in-vitro fertilization, embryo splitting.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1. Media preparation and sterilization techniques.
2. Callus cultures: choice of explants, preparation of explants, callus induction, subculture and maintenance.
3. Regeneration of plants from growth hormones.
4. Meristem culture for pathogen free plants.
5. Preparation synthetic seed
6. Suspension culture – initiation of suspension culture from callus.
7. Plant protoplast Isolation.
8 . Cell viability test by tryphan blue method.
9. Preparation of HSS and glasswares of cell culture experiments
10.Isolation of PMN leucocytes from human peripheral blood sample and staining and identification.(lishman stain).
11. Demonstration of dissegration of cells by mechanical and enzymatic methods.
12. Photographic Demonstration of Animal Cell culture Lab equipments

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1. Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons.

2. Mauseth, J.D. 1988 Plant Anatomy. The Benjammin/Cummings Publisher, USA.

3. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.

4. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientific publishers. 3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.

5. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.

DME22005/DME22006

SEMESTER V
DSE: IMMUNOLOGY AND MEDICAL BIOTECHNOLOGY (4 CREDITS)

Course Outcomes:
After completing the course students are able to:
CO1. Understand the role of different types of Cells in immune system .
CO2. Discuss the principles and applications of immunological techniques.
CO3. Understand to diagnose diseases.
CO4. Comprehend the knowledge of therapeutic applications of enzyme and hormone.

IMMUNOLOGY **NO. HOURS**

UNIT I **15**

Historical account and chronological events of EdwardJenner and Louis Pasture.
Antigens: Definition, chemical nature, hatpins, epitops, antigenicity, blood group antigens.
Antibodies: Definition, types, structure of IgG.
Types of immunity – Innate- mechanism of innate immunity. Adaptive immunity – active and passive and adoptive immunity.
Cells and organs involved in immune system – T- cells, B-cells, antigen presentation and macrophages, their role in antigen recognition, clonal selection, and immunological memory. Immunological aspects of viral (HIV), bacterial and parasitic infection (one example each)

UNIT II **15**

Immune disorders: Hypersensitivity, auto immune disorders- organ specific and systemic specific Grave's diseases, Hashimoto's disease , systemic lupus erythematosus.
Immuno techniques: Precipitation reaction, immuno diffusion-ODD and RID, RIA, Heamagglutination, ELISA, immunofluroscent, Western blotting. Major Histocompatibility complexes – class I & class II MHC antigens, antigen processing. Vaccines& Vaccination – adjuvants, cytokines, DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines, vaccines to other infectious agents, passive & active immunization.

MEDICAL BIOTECHNOLOGY

UNIT III **15**

Vaccine production: Introduction, new developments, types of vaccines – Inactivate, Attenuated and Recombinant Vaccines-Peptide and DNA, production of vaccines using genetically engineered microorganisms (Ex:HBV).
Enzymes in diagnosis: Enzymes used to detect and quantify blood glucose, cholesterol, triglycerides, urea and uric acid. Immobilized enzymes as diagnostic tools.
Nucleic acid analysis: Features of DNA probes and its applications in diagnosis, identification of *Mycobacterium tuberculosis* in clinical samples using PCR.
Enzymes in therapy: List of enzymes and their therapeutic applications.(Ex: DNase, debriding enzymes, asparginase, superoxide dismutase, rennin, streptokinase, urokinase ,lipase and adenosine deaminase)

UNIT IV **15**

Hormone therapy: List of hormones and their therapeutic applications (Ex: Insulin, human growth hormone, erythropoietin, calcitonin, lipocortin, somatotropin and alpha melanocyte stimulating hormone), production of humulin by recombinant DNA technology.

Therapeutic proteins: Cytokines as therapeutic proteins, production of interferon by recombinant DNA technology.
Human gene therapy: Definition, differences between somatic and germ line gene therapy, embryo, exvivo, in vivo and antisense gene therapy -one example each, principle and applications.
Transgenic plants for production of biopharmaceutical (tobacco, tomatoes, and potatoes)

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1 Determination of blood group
a) ABO blood grouping
b) Rh blood grouping.
2 Immuno diffusion :
a) ODD
b) RID.
3 Separation of serum from blood
4 Demonstration of ELISA
5Demonstration of Western blotting
6 MIC assay
7 Isolation of antibiotic resistant strains using gradient plate method
8 Estimation of urea by BAMO method
9 Qualitative analysis of normal and abnormal constituents of urine
10 Photographic demonstration of transgenic animals and plants for production of biopharmaceutical

REFERENCES

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6 th edition Saunders Publication, Philadelphia.

2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.

3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

4. Murphy K, Travers P, Walport M. (2008). Janeway'sImmunobiology. 7th edition Garland Science Publishers, New York.

5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.

6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

DME22205/DME22206

SEMESTER V

DSE: MICROBIALTECHNOLOGY & AGRICULTURAL BIOTECHNOLOGY (4 CREDITS)

Course Outcomes:

After completing the course students are able to:

CO1. Develop skills associated with screening of Industrially Important Strains.

CO2. Understand principles underlying design of Fermentor, Fermentation Process and downstream processing

CO3. Discuss the various aspects for the improvement of crop plants.

CO4. Understand the application of r-DNA technology to enhance the production of crop plant .

MICROBIALTECHNOLOGY **NO. HOURS**

UNIT I **15**

Introduction to biotechnological importance of microorganisms.

Metabolic pathway involved in microbial products (EMP,PPP and ED), primary and secondary metabolites, enzymes and microbial biomass.

Microbial production: Use of microbes in production of vitamins (vit-C), enzymes (Amylase), organic acids (citricacid),amino acids (glutamicacid),polysaccharides (xanthan),growth regulators (auxins), colorants (phycocyanin) ,flavors (diactyl), antibiotics (penicillin).

UNIT II **15**

Kinetics of microbial growth and product formation: Phase of cell growth in batch cultures and continuous culture. Growth associated and non-growth associated product formation kinetics, substrate and product inhibition on cell growth and product formation.

Bioreactors- Types and functions. Purification & characterization of proteins, Upstream and downstream processing, solids and liquid handling. Disruption of microbial cells- centrifugation, filtration of fermentation broth, ultra centrifugation, liquid extraction, ion-exchange recovery of biological products.

Immobilization of cell- Introduction and methods of microbial cell immobilization.

AGRICULTURAL BIOTECHNOLOGY

UNIT III **15**

Introduction: Biotechnology for crop improvement, future prospects of biotechnology for agriculture.

Biological nitrogen fixation: Nitrogen fixing microorganisms, role of nitrogenase, genetics of nitrogen fixing microorganisms, regulation of nif gene expression and mechanism of nitrogen fixation.

Bio fertilizers and phyto-stimulations: Mechanism of growth promotion by microbial inoculants-microbial production and application methods of microbial inoculants- *Rhizobium, azospirillum, azotobacter, mycorhizae.*

UNIT IV **15**

Genetic engineering of crop plant: Gene transfer technique for desirable traits in crop plants. Agro bacterium mediated gene transfer, Direct gene transfer methods to protoplast. Few examples of transgenic plants, plants obtained through gene transfer techniques –BT cotton, herbicide tolerant soybean, virus resistance (papaya ring spot).

Microbial pesticides: Fungicides and herbicides. Bacterial, fungal and viral bio agents- *Bacillus*

Thurengensis (BT) and *BeaveriaBassiana*. Mechanism of control of plant disease-hypo virulence, competition antibiosis, induced resistance, mycoparasitism.

PRACTICALS (2 CREDITS)

HOURS : 4 HOURS /WEEK

1 . Identification of important microorganisms relevant to biotechnology: E.coli, sacchromycescervisiae, spirulina.
2 .Demonstration of commercial products-single cell proteins microbial flavours.
3 .Entrapment of yeast for enzyme action & estimation of invertase activity
4. Preparation of wine.
5. Estimation of percentage of alcohol by Specific gravity method .6 .Seed inoculation with rhizobium culture and observation for root nodulation.
7. Preparation of bio control formulations.
8. Biofertilizers formulation.
9. Isolation and identification of *Rhizobium.*
10. Isolation and identification of *azospirillum.*Isoalation and Identification of *azotobacter*.Study of morphology of*mycorhizae.*

11. Photographic demonstration of BT cotton, herbicide tolerant soybean, virus resistance (papaya ring spot).

12. Demonstration of steps involved in large scale production of biofertilizers.

REFERENCES

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.

2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.

3. Mauseth, J.D. 1988 Plant Anatomy. The Benjammin/Cummings Publisher, USA.

4. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.

5. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientific publishers. 3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.

6. Agricultural Biotechnology, S.S. Purohit

DMF22005/ DMF22006

SEMESTER VI

DSE: ENVIRONMENTAL BIOTECHNOLOGY AND BIOSTATISTICS (4 CREDITS)

Course Outcomes:

After completing the course students are able to:

CO1. Gain an understanding of the causes, types and control methods for Environmental Pollution.

CO2. Differentiate the application of different life forms in Environmental Remediation.

CO3. Apply Statistical Tools for Analysis of Biological Data.

ENVIRONMENTAL BIOTECHNOLOGY NO. HOURS

UNIT I 15

Introduction: Major issues in environment pollution. Role of Biotechnology to solve the problems.
Biotechnological methods of pollution detection: General bioassay, cell biological methods, immunoassay, DNA based methods, use of biosensor.
Biotechnological methods in pollution abatement: reduction of CO2 emission, Waste water treatment – conventional waste treatment, Use of Algae, Eutrophication, Use of Cell Immobilization.

UNIT II 15

Biotechnology and biodegradation: Degradation of Xenobiotic compounds-organic (chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides and surfactants.
Biohydrometallurgy and Biomining: Bioleaching, biosorption, oil degradation and creation of super bugs.
Treatment of Industrial wastes: Pulp, Dye, leather and solid waste management. Genetically engineered microbes for waste treatment.
Ecofriendlybioproducts: Biomass resources, biogas, and alcohol as a fuel, biological hydrogen generation and biodegradable plastics.

BIOSTATISTICS

UNIT III 15

Introduction, Basic concepts- population, data, sample and variable. Types of data-primary and secondary, methods of data collection- direct personal interview, indirect oral interview, through correspondence, questionnaire and census. Classification of data- qualitative, quantitative and simple classification. Sampling methods- random and non-random. Tabulation of data- structure of a table, simple and complex table.

UNIT IV 15

Graphical and diagrammatic representation of data- histogram, bar graph and pie diagram. Frequency of distribution- without class intervals, with class intervals and cumulative frequency distribution. Measures of central tendency- mean, median and mode. Measure of dispersion- range, mean deviation, co-efficient of deviation and standard deviation.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1 & 2. Analysis of sewage water for BOD & COD.
3 Estimation of Hydrogen sulphides in the sewage water.
b. Estimation of chloride in sewage water sample.
c. Estimation of residual chloride in sewage water sample.
d. Estimation of carbon dioxide in sewage water sample.
4. Identification of microbial flora in the given water sample.
5 . Estimation of percentage of alcohol by specific gravity bottle method
6 a. Photographic demonstration of septic tank, sand filters, Imhoff's tank and biosensors.
b. Photographic demonstration of creation of superbug.
c. Photographic demonstration of genetically modified microbes.
d. Photographic demonstration of genetically modified plants.
e. Photographic demonstration of genetically modified animals.

Biostatistics problems
7 Problems on graphical and diagrammatic representation of data
(histogram, bar graph and pie chart)
8 Calculation of mean, median, mode, standard deviation

REFERENCES

1. Environmental Science, S.C. Santra

2. Environmental Biotechnology, Pradipta Kumar Mohapatra

3. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter

4. Le CT (2003) Introductory biostatistics. 1st edition, John Wiley, USA

5. Glaser AN (2001) High YieldTM Biostatistics. Lippincott Williams and Wilkins, USA

6. Edmondson A and Druce D (1996) Advanced Biology Statistics, Oxford University Press.

7. Danial W (2004) Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and Sons Inc.

DMF22205/ DMF22206

SEMESTER VI

DSE: BIOINFORMATICSAND BIOPROCESS TECHNOLOGY (4 CREDITS)

Course Outcomes:

After completing the course students are able to:

CO1. Understand the basic concepts and tools used in Bioinformatics.

CO2. Comprehend the knowledge of Genomics and Proteomics.

CO3. Develop an understanding of the various aspects of Bioprocess Technology.

CO4. Enhance the skills associated in Fermentation Process.

BIOINFORMATICS **NO. HOURS**

UNIT I **15**

Bioinformatics and the Internet: Introduction, Internet basics, connecting to the internet electronic mail, File transfer protocol, The World Web.

Database- DNA, protein, genomic mapping database, sequence alignment software-pair wise& multiple alignments, gene families

UNIT II **15**

Information retrieval from databases: Databases similarity searching, FASTA, BLAST SEARCH, Clustal W, Clustal X,DIALIGN2,Multalign Navigating the NCBI web site.

Genomics and Proteomics: Types of genomes, bacterial genome sequence project.

Human genome project, Micro array technologies-types and applications.

BIOPROCESS TECHNOLOGY

UNIT-III **15**

Introduction to bioprocess technology. Range of bioprocess technology and its chronological development. Basic principle components of fermentation technology. Types of microbial culture and its growth kinetics– Batch, Fed batch and Continuous culture.

UNIT IV **15**

Design of bioprocess vessels- Significance of Impeller, Baffles, Sparger; Types of culture/production vessels- Airlift; Cyclone Column; Packed Tower and their application in production processes. Principles of upstream processing – Media preparation, Inoculation, development and sterilization. Introduction to oxygen requirement in bioprocess; mass transfer coefficient; factors affecting KLa. Bioprocess measurement and control system with special reference to computer aided process control.

PRACTICALS **(2 CREDITS)**

HOURS : 4 HOURS /WEEK

1. Sequence information resource
2. Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)
3. Understanding and using: PDB, Swissprot, TREMBL
4. Using various BLAST and interpretation of results.
5. Retrieval of information from nucleotide databases.
6. Sequence alignment using BLAST.
7. Multiple sequence alignment using Clustal W.
8. Bacterial growth curve.
9. Production and analysis of ethanol.
10. Production and analysis of amylase.
11. Production and analysis of lactic acid.
12. Isolation of industrially important microorganism from natural resource.

REFERENCES

1. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.

2. Salisbury, Whitaker and Hall. Principles of fermentation Technology,

4. Waste Water Engineering, Metcalf and Eddy, Tata McGraw hill

5.Wong, K.C.92016). Computational bilolgy and bioinformatics: gene regulation, CRC press/ Taylor & Francis Group.

6. Joyce, A. P.; Zhang, C.; Bradley, P.; Havranek, J. J. (2015). "Structure –based modeling of protein : DNAspecificity". Briefings in Functional Genomics.

DME22405/ DME22406

SEC

MICROBIAL TECHNIQUES (2 CREDITS)

Course Outcomes:

After completing the course students are able to:

CO1. Understand and demonstrate basic sterilization techniques.

CO2. Analyze the anatomy of prokaryotic cell and structural detail of eukaryotic cell.

CO3. Acquire the knowledge of Culture media and their applications.

CO4. Assess the growth measurement and pattern of microorganism.

MICROBIAL TECHNIQUES **NO. HOURS**

UNIT I **07**

General introduction. Concept of Prokaryotes and Eukaryotes. General account on Structure, Classification & Reproduction of Bacteria, Fungi & Viruses.

UNIT II **08**

Microbial Techniques: Sterilization: Principles and applications of

a. Physical Methods: Autoclave, Hot air oven, Laminar airflow, Seitz filter, Sintered glass Filter, membrane filter.

b. Chemical Methods: Alcohol, Aldehydes, Phenols, Halogens and Gaseous agents.

c. Radiation Methods: UV rays and Gamma rays.

UNIT III **08**

Microscopy: working principle and applications of Light microscopy, phase contrast microscopy and electron microscopy.

Staining-Types, Simple and differential (Gram's and acid fast)

UNIT IV **07**

Microbial nutrition and growth: nutritional classes of microorganisms, culture media, pure culture, microbial growth pattern and methods of growth measurements, method of maintenance and preservation of cultures.

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REFERENCES

1 Prescott L.M. Harley J.P and Klein D.A (Microbiology 5th Edition)

2. Pelzar Jr, M.J. Chan, E.C.S. and Krieig N.R (Microbiology)

3. Salle. A.J Fundamental Principles of Bacteriology .

4. Caldmell, D.R. Microbial Physiology and metabolism

DME22505/ DME22506:

SEC

ENZYMOLOGY (2 CREDITS)

Course Outcomes:

After completing the course students are able to:

CO1. Understand relationship between the structure and function of enzymes.

CO2. Interpret mechanisms of enzymatic action kinetics and molecular interactions and specifies importance of enzymes.

CO3. Characterise the inhibitor affects on enzyme kinetics.

CO4. Enumerate methods in immobilization of enzymes.

ENZYMOLOGY **NO. HOURS**

UNIT – I **7**

Enzyme classification . Enzyme substrate complex: concept of E-S complex, binding sites, active site, specificity, factors affecting initial rate, E, S, temp. &pH.

UNIT – II **8**

Kinetics of enzyme activity, Michaelis-Menten equation, Different plots for the determination of Km and Vmax and their physiological significance. Enzyme inhibition types of inhibition, Mechanism of enzyme action: General mechanistic principle.

UNIT – III **7**

Allosteric enzymes with special reference to phosphofructokinase. Kinetics of allosteric enzymes. Isoenzymes– multiple forms of enzymes with special reference to lactate dehydrogenase. Multienzyme complexes. Ribozymes. Multifunctional enzyme- eg Fatty Acid synthase.

UNIT – IV **8**

Enzyme Technology: Methods for large scale production of enzymes. Immobilized enzyme and their comparison with soluble enzymes, Methods for immobilization of enzymes. Immobilized enzyme reactors. Application of Immobilized and soluble enzyme in health and industry.

REFERENCES

1.Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4 th edition, W.H. Freeman and Company, New York, USA.

2. Biochemistry, LubertStryer, 6th Edition, WH Freeman, 2006.

3. Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M.Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. 28th Edition, McGrawHill, 2009.

4. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley andSons, 1995.

5. Biochemistry by Mary K.Campbell& Shawn O.Farrell, 5th Edition, Cenage Learning,2005.

6. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999

Pattern of Question Paper
Semester I to VI
Paper I to VI (DSC)

Time : 3 Hrs Max Marks: 70

I. Answer all the questions 5 X 1 = 5

1 ----------
2----------
3----------
4----------
5----------

II. Answer any five questions 5 X 3 = 15

6----------
7----------
8----------
9----------
10----------
11----------

III. Answer any four questions 4 X 5 = 20

12 ----------
13----------
14----------
15----------
16----------

IV. Answer any three questions 3 X 10 = 30

17----------
18----------
19----------
20----------

(Note- 10 Marks may be divided in to 6+4 or 5+5)

Pattern of Question Paper
Semester V
(SEC)

Time : 2 Hrs Max Marks: 35

I. Answer all the questions 5 X 1 = 5

1 ----------
2----------
3----------
4----------
5----------

II. Answer any five questions 5 X 3 = 15

6----------
7----------
8----------
9----------
10----------
11----------

III. Answer any four questions 4 X 5 = 20

12 ----------
13----------
14----------
15----------
16----------

IV. Answer any one question 1 X 10 = 10

17----------
18----------

(Note- 10 Marks may be divided in to 6+4 or 5+5)

Scheme for Practical Examination

I B.Sc., I Semester

CELL BIOLOGY & GENETICS

Duration : 3 hours **Max. Marks :35**

Practical paper :30 and Record:05

1. Determine the total no. of cells in the given sample by haemocytometer **18**

or

Measure the length of the given material by micrometry

or

Identify any three mitotic stages from root tip squash preparation.

2. Identify and comment on the spotter A, B and C. **3x4=12**

I B.Sc., II Semester

BIOMOLECULES & BIO-ANALYTICAL TECHNIQUES

Duration : 3 hours **Max. Marks :35**

Practical paper :30 and Record:05

1. Estimate the amount of glucose in the given sample by DNS method. **18**

or

Estimate the amount of protein in the given sample by biuret method.

or

Determine the optimum ph for the given enzyme.

or

Identify the given biomolecule by performing qualitative analysis.

2. Identify and comment on the spotter A, B and C. **3x4=12**

II B.Sc., III Semester

MOLECULAR BIOLOGY &GENETIC ENGINEERING

Duration : 3 hours **Max. Marks :35**

Practical paper :30 and Record:05

1. Estimate the amount of DNA in the given sample by DPA method. **18**

or

Estimate the amount of RNA in the given sample by orcinol method.

or

Isolate DNA from the given material .

2. Identify and comment on the spotter A, B and C. **3x4=12**

II B.Sc., IV Semester

PLANT TISSUE & ANIMAL CELL CULTURE

Duration : 3 hours **Max. Marks :35**

Practical paper :30 and Record:05

1. Determine the total no. of living and dead cells in the given sample by tryphen blue exclusion method. **18**

or

Demonstrate the production of synthetic seeds. Write the principle and procedure for the same.

or

Demonstrate the initiation of suspension culture from callus. Write the principle and procedure for the same. Or

Demonstrate the surface sterilization of explants. Write the principle and procedure for the same.

2 . Identify and comment on the spotter A, B and C. **3x4=12**

III B.Sc., V Semester

IMMUNOLOGY & MEDICAL BIOTECHNOLOGY

Duration : 3 hours **Max. Marks :35**

Practical paper :30 and Record:05

1. Determine the blood group of the given sample. **18**

or

Determine the antigen antibody reaction by conducting ODD.

or

Demonstrate MIC assay. Write the principle and procedure for the same.

2. Identify and comment on the spotter A, B and C. **3x4=12**

III B.Sc., VI Semester

MICROBIALTECHNOLOGY & AGRICULTURAL BIOTECHNOLOGY

Duration : 3 hours **Max. Marks :35**

Practical paper :30 and Record:05

1. Estimate the invertase activity from the given immobilised cells. **18**

or

Estimate the percentage of alcohol in the given sample by specific gravity bottle method.

2. Identify and comment on the spotter A, B and C. **3x4=12**

III B.Sc., VI Semester

ENVIRONMENTAL BIOTECHNOLOGY & BIOSTATISTICS

Duration : 3 hours **Max. Marks :35**

Practical paper :30 and Record:05

1. Determine the BOD of the given water sample. **10**

or

Estimate the amount of hydrogen sulphide present in the given water sample.

Or

Estimate the amount of carbon di oxide and chloride present in the given water sample.

Or

Estimate the percentage of alcohol in the given sample by specific gravity bottle method.

2. Identify and comment on the spotter A, B and C. **3x4=12**

3. Statistics problem

III B.Sc., VI Semester

BIOINFORMATICS AND BIOPROCESS TECHNOLOGY

Duration : 3 hours **Max. Marks :35**

Practical paper :30 and Record:05

1. Estimate the amylase activity. **18**

Or

Identiyf and write critical note on the given microorganism.

2. Identify and comment on the spotter A, B and C. **3x4=12**