Chhindwara University, Chhindwara (M.P.)

SYLLABUS OF M.A./M.Com./M.Sc./M.H.Sc. PREVIOUS/FINAL OR SEMESTER II

Name of Paper	Title of paper	Max. Marks			Minimum Marks			
		Theory	CCE	Practical	Theory	CCE	Practical	Total Marks
Theory-I	Molecular Biology	40	10		13	04		50
Theory-II	Macromolecules & Basic Enzymology	40	10		15	04		50
Theory-III	Biostatistics, Computer Application & Basic of Bioinformatics	40	10		15	04		50
Theory-IV	Bioprocess Engineering and Technology	40	10		15	04		50
Practical-I	Based on theory			50			20	50
Practical-II	Based on theory			50			20	50
							Total	300

Board of Studies :

I. Chairman – Dr. Ajay Kumar Bhardwaj

II. Subject Expert –

1. Dr. Ratima Khare
2. Dr. Jitendra Malviya
3.
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छिन्दवाड़ा विश्वविद्यालय, छिन्दवाड़ा

Session -2020-2021

Class/कक्षा	:	**M.Sc.**
Semester/सेमेस्टर	:	**Semester II**
Subject/विषय	:	**Biotechnology**
Title of Subject Group	:	**Molecular Biology** Paper I

Particulars/विवरण

Max. Marks 40

UNIT-I: **Nucleic Acid Structure:** DNA as genetic material, Chemical structure and base composition of nucleic acids, Double helical structures. Different forms of DNA, Forces stabilizing nucleic acid structure. DNA Supercoiling. Properties of DNA, Renaturation and denaturation of DNA - Tm and Cot curves. RNA – structure, types and function.

UNIT-II: **DNA Replication:** General features of DNA replication, Enzymes and proteins of DNA replication. Models of replication – Conservative, semi-conservative and dispersive. Regulations of DNA replication, Prokaryotic and eukaryotic replication mechanism. Replication in phages. Reverse transcription

UNIT-III: **Transcription:** Mechanism of transcription in prokaryotes and eukaryotes. RNA polymerases and promoters. Post-transcriptional processing of tRNA, rRNA and mRNA (5' capping, 3' polyadenylation and splicing). RNA as an enzyme- Ribozyme.

UNIT-IV: **Translation**: Genetic code, General features, Deciphering of genetic code, Code in mitochondria, Translational mechanism in prokaryotes and eukaryotes, Post translational modifications (acetylation, glycosylation, phosphorylation etc.) and transport, Protein targeting, Non ribosomal polypeptide synthesis - Antibiotic inhibitors and translation.

UNIT-V: **Regulation of Gene Expression in Prokaryotes and Eukaryotes**: Operon concept, Positive and negative control, Structure and regulation of lac, trp and arb operon, regulation of gene expression in eukaryotes (a brief account), anti-sense RNA, RNAi

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RECOMMENDED BOOKS:

1. Gene VIII (2005) - Benjamin Lewin
2. Molecular Biology- Turner et al
3. The Biochemistry of Nucleic Acid 11th Ed. (1992) – Adams et al
4. Molecular Biology of Gene (2004) – Watson et al.
5. Microbial Genetics – Friedflelder
6. Molecular Cell Biology 5th Ed. (2004) – Lodish et al.
7. Human Molecular biology (2004) – Stefan, S.
8. Biochemistry & Molecular Biology of Plants (2000) – Buchanan et al
9. Plant Biochemistry & Molecular Biology – Lea & Leegood. Cell & Molecular Biology- Karp G.

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Semester/सेमेस्टर	:	**Semester II**
Subject/विषय	:	**Biotechnology**
Title of Subject Group	:	**Macromolecules & Basic Eznymology** Paper II

Particulars/विवरण

Max. Marks 40

UNIT-I: **Introduction to Enzymes:** Enzyme nomenclature, enzyme commission numbers, and classification of enzymes. Isolation and purification of enzymes, preparation of purification chart, Enzyme activity, Specific activity and turn over number, Marker enzymes.

UNIT-II: **Enzyme Kinetics:** Steady state, pre-steady state, equilibrium kinetics. Michaelis and Menten Equation and its derivation. Different methods to calculate the K_m and V_{max} and their significance.

UNIT-III: **Factor affecting enzyme activity and catalysis:** pH, substrate and enzyme concentration, temperature, coenzyme and cofactors, Mechanism of action of enzymes involving two/more substrates. Role of metal ions in enzyme catalysis. Enzyme inhibition, different types of inhibitors and activators.

UNIT-IV: **Structure and function of enzymes:** Lysozyme, chymotrypsin, DNA polymerase, RNase, proteases. Enzyme regulation and control of their activity. Introduction to allosteric enzymes and isozymes.

UNIT-V: **Enzyme Technology:** Immobilization of enzymes and their application, commercial production of enzymes, RNA-catalysis, Catalytic antibodies - abzymes, Protein and Enzyme engineering: Design and construction of novel enzymes. Structure and Application of protease, lipases, papain.

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RECOMMENDED BOOKS:

1. Enzyme Kinetics (1995) – Palmer
2. Enzyme Kinetics - Dixon
3. Fundamental of Enzymology – Price & Steven
4. The Enzymes Vol. 1 & 2 – Boyer
5. Enzyme Structure & Mechanism – Alan Fersht
6. Enzyme Biotechnology – Tripathi, G.
7. Industrial Enzyme & their Application (1998) –Uhlig, H.
8. Enzyme 3rd Ed. (1979) – Dixon M. & Webb, E.C.
9. Enzyme Kinetics –Voet & Voet

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Session -2020-2021

Class/कक्षा : **M.Sc.**

Semester/सेमेस्टर : **Semester II**

Subject/विषय : **Biotechnology**

Title of Subject Group : **Biostatistics, Computer Appliction & Basics of Bioinformatics** Paper III

Particulars/विवरण

Max. Marks 40

UNIT-I: **Introduction and definition of Biostatistics.** Measures of central tendency: Arithmetic, geometric & harmonic means; Measures of dispersion: range, quartile deviation, variance, standard deviation, coefficient of variation, confidence limits of population mean. Tests of significance hypotheses and errors; student t statistics- population mean equals a specified value; equality of 2 independent means (equal & unequal variance), equality of 2 means (paired samples). Concept of populations and sample. Simple random sampling without replacement. Definition of simple random sample. Chi-square (X^2), student's t and f-distributions (derivations not required) their properties and uses.

UNIT-II: **Fundamentals of Computer.** Introduction to Computers, Basic architecture, generations of computer hardware and software; operating systems-WINDOWS and UNIX; system and application software; introduction to internet-LAN, MAN, WAN.

UNIT-III: **Introduction to Bioinformatics:** Definition, role, scope different areas, and limitation of Bioinformatics. Data mining techniques and its applications– hidden morkov model, neural network. Database management system (basic idea). Biological data & databases: Classification of biological database. Nucleic acid sequence database: GenBank, EMBL, DDBJ. Protein Resources: UniProt KB.

UNIT-IV: **Sequence Comparison:** Pairwise alignment – Dot matrix methods, Dynamic programming. Concept of gap penalty and scoring matrix- PAM and BLOSUM, Significance, Significance of alignment.Sequence Homology Search: BLAST and FASTA algorithm, various programs and application. Multiple sequence alignment: Concept, Algorithm, tools and importance. Phylogenetic analysis: concept of tree, methods and tools. Gene Prediction methods and tools, primer designing tools, codon usage analysis and tools. Pattern and motif analysis.

UNIT-V: **Structural Bioinformatics:** Introduction & Importance. Coordinate systems. Visualization & presentation of structure. Molecule Visualization models, Molecular visualization and modeling software (Introductory notes and feature application) – SPDBV, RASWIN, ChemSketch, PyMOL, ArgusLab, AutoDock, Discovery Studio, LeadIT-FlexX.
Protein Structure Prediction: Chau-Fasman, GOR, Neural Network, Homology modeling, Threading method. Protein Folding: Interacting forces, theories of protein folding, methods of protein folding study, protein folding in-vivo.

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RECOMMENDED BOOKS:

Statistics:

An Introduction Biostatistics Glover

An Introduction Biostatistics- Mishra & Mishra, Kalyani Publication

Bioinformatics:

Bioinformatics: Sequence and Genome Analysis – Cold Spring Harbor Laboratory Press – by David Mount

Emerging trends in Bioinformatics - **The Book Syndicate Publications** - Edited by Irfan A. Khan and Atiya Khanum, Ukaaz.

Introduction to Bioinformatics (3rd Edi) – Oxford University Press - by Arther Lark.

Molecular Modeling and Drug Design – Topics in Molecular and Structural Biology. CRC Press. J. G. Vinter and Mark Gardner (Edi)

Molecular Modeling in Drug Design, Academic Press. N. Claude Cohen (Edi)

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Class/कक्षा : **M.Sc.**
Semester/सेमेस्टर : **Semester II**
Subject/विषय : **Biotechnology**
Title of Subject Group : **Bioprocess Engineering and Technology** Paper IV

Particulars/विवरण

Max. Marks 40

UNIT-I: Introduction to Bioprocess Engineering. Isolation, Preservation & maintenance of Industrial microorganisms. Factor that influence solid-state fermentation. Kinetics of microbial growth and death, Media for industrial fermentation.

UNIT-II: Air and media sterilization, safety in fermentation laboratory. Strain improvement of industrially important microorganism. Bioreactors: Principle, Kinetics, types, design, analysis and application. Types of fermentation processes: analysis of batch, Fed-batch and continuous Bioreactions, stability of microbial reactions.

UNTT-III: Aeration and Agitation systems for bioreactor. Flow behavior of fermentation fluids. Gas-Liquid mass transfer, Solid and Liquid-phase mass transfer and Heat transfer. Measurement and control of bioprocess parameters.

UNIT-IV: Downstream processing: Introduction, removal of microbial cells and solid matter. Foam reparation, precipitation, centrifugation, cell disruption, chromatography. Product recovery processes and Unit operations. Safety consideration in down stream processing Bioprocess economics

UNIT-V: Classification of product formation, Product synthesis kinetics. Mass balance in bioprocesses system, Energy balance in Bioprocess system.

RECOMMENDED BOOKS:

1. Biochemical Engineering, Aiba et al
2. Biochemical Engineering Fundamentals, Baily and Ollis
3. Principles of Fermentation Technology (1997),Stanebury P.F, and Whitaker
4. Fermentation Biotechnology-Principles, Process and Products(1998),Ward,O.P
5. Process Engineering in Biotechnology, Jackson A.T.
6. Bioreaction Engineering Principles, Nielson & Villadson
7. Industrial Microbiology (1992)4th edition,Prescott & Dunn
8. Microbial Biotechnology (1998) Glazer & Nikaido
9. A Text Book of Industrial Microbiology,2nds edition (2002),Cruger and Cruger
10. Manual of Industrial Microbiology & Biotechnology 2nd edition (1999), Arnold et al

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Class/कक्षा	:	**M.Sc.**
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Title of Subject Group	:	**Practical's I**

Practical Based on Theory Paper I & II

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Semester/सेमेस्टर	:	**Semester II**
Subject/विषय	:	**Biotechnology**
Title of Subject Group	:	**Practical's II**

Practical Based on Theory Paper III & IV

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Suggested Practical Based on Theory Paper I, II, III & IV

1. Assay of antibiotics and demonstration of antibiotic resistance.
2. Study of mutation by Amu test.
3. Isolation of antibiotic resistant bacterial population by gradient plate method.
4. UV induced auxotrophic mutant production and isolation of mutant by replica plating technique.
5. Effect of UV radiation on bacteria.
6. Demonstration of UV repair mechanisms.
7. Immobilization of microorganisms and enzyme.
8. Amylase and urease production in the microorganisms.
9. Assay of acid phosphatase in plant seeds.
10. Assay of alkaline phosphatase in kidney and liver.
11. Determination of Km value of alkaline phosphatase. st.
13. Preparation of standard curve of DNA by DPA method.
12. Measurement of relative enzyme activity of cellulose by reducing sugar assay te
14. Preparation of standard curve of DNA by orcinol method and qualification of RNA from yeast.
15. Isolation of DNA from prokaryotic cell.
16. Isolation of DNA from eukaryotic cell.
17. Determination of Tm of nucleic acid.
18. Electrophoresis of DNA-linear, circular and super coiled.
19. Protein-DNA interaction.
20. Isolation of plasmid DNA.
21. Preparation of competent cells from *E.coli.*
22. Demonstration of Blotting techniques.
23. Blood film preparation and identification of cells.
24. Double diffusion and Immuno-electrophoresis.
25. Radial Immunodiffusion.
26. Detection of antigen through ELISA.
27. Preparation of antibody-enzyme conjugates.
28. Purification of IgG from serum.
29. Cell counting and cell viability.
30. Preparation of serum free media.
31. Culturing continuous cell lines.
32. Extraction/estimation of DNA/RNA/protein from animal tissues.
33. Preparation of single cell suspension from spleen and thymus.

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