Biotechnology

Chhindwara University, Chhindwara (M.P.)

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

2020-2021

Name of Paper	Title of paper	Max. Marks			Minimum Marks			
		Theory	CCE	Practical	Theory	CCE	Practical	Total Marks
Theory-I	Cell Biology	40	10		15	04		50
Theory-II	Biomolecules Structure Function Metabolism	40	10		15	04		50
Theory-III	Instrumentation & Analytical techniques	40	10		15	04		50
Theory-IV	General & Applied Microbiology	40	10		15	04		50
Practical-I	Based on theory			50			20	50
Practical-II	Based on theory			50			20	50
						Total Marks-		300

Board of Studies :

I. Chairman – Dr. Ajay Kumar Bhardwaj

II. Subject Expert –

1. Dr. Pratima Khare
2. Dr. Jitendra Malviya
3.
4.
5.
6.
7.

छिन्दवाड़ा विश्वविद्यालय, छिन्दवाड़ा

Session -2020-2021

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

Particulars/विवरण

Max. Marks 40

UNIT-I: General structure of Cell. Historical origins of cell biology: The discovery of cell, development of the cell theory. The molecular evolution. Chemical bonds and functional groups in biological molecules.

UNIT-II: The structural and functional organization of cell membrane, ionic transport (Passive and active transport) the extra cellular matrix of eukaryote's cell wall.

UNIT-III: Structure and functions of endoplasmic reticulum, golgi complex, ribosome lysosomes, peroxisomes (glyoxysomes), plastids and mitochondria. Biogenesis of mitochondria and chloroplast.

UNIT-IV: Steps in cell cycle, cell cycle check points, yeast as model system, cell division control and regulation yeast cdc gene. Genes for social control of cell, proto-oncogenes.

Cell signaling: Exocrine, Endocrine, Paracrine and Synaptic strategies of chemical signaling, surface receptor mediated transduction (G-Proteins, Tyrosine kinases, steroid receptor and mediators: DAG, Ca^{+2}, c-AMP)

UNIT-V: Cytoskeleton and cell motility: Microtubules, microfilaments and intermediate elements. Nuclear ingredients: Nuclear membrane, Organization of Chromatin: chromosome structure. Nature of the genetic material, proteins associated with nuclei. Packaging of genetic material: nucleosome model,

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RECOMMENDED BOOKS:

Molecular Biology of Cells, (2002), 4th Edition; Albert's et al.

Molecular Cell Biology (2004),Lodish et al.

Cell and Molecular Biology; Concepts & Experiments (2004).Karp, G.

The Cell: A molecular Approach (2004), Cooper, G.M

Cell & Molecular biology, de Robertis & df Robertis.

Cell proliferation and apoptosis (2003); Hughes & Mehnet.

Biochemistry & Molecular Biology of plants (2004); Buchanan et al.

Lehninger Principles of Biochemistry, (2005) Nelson & Cox.

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Subject/विषय	:	**Biotechnology**
Title	:	**Biomolecules: Structure, Function & Metabolism**

UNIT-I: **Some important properties of water:** The law of Mass action; Dissociation of water and its ion product. pH, Bronsted Acids, ionization of weak acids and bases; Henderson-Hasselbalch equation, Titration curves and buffering action, physiological buffers. Principle of Thermodynamics.

UNIT-II: **Carbohydrates:** Classification, structure, function and properties of sugars, storage polysaccharides and cell walls. Glycolysis, gluconeogenesis, HMP shunt and glycogen metabolism. Synthesis of cellulose and starch. Oxidative phosphorylation, compartmentation of respiratory metabolism. Regulation of carbohydrate metabolism.

UNIT-III: **Proteins-Amino Acids:** essential and non essential amino acids; common, rare and non-protein amino acids; acid base properties and chemical reactions of amino acids; stereochemistry and absorption spectra of amino acids.Biosynthesis and degradation of following amino acids: alanine, serine, lysine cysteine, arginine, methionine, tryptophan, phenylalanine glutamine. Proteins: Primary, secondary, tertiary and quaternary structure of proteins. Optical and chemical properties of peptides and small proteins. Hydrolysis of proteins: Action of different proteases. Regulation of amino acid metabolism.

UNIT-IV: **Nucleic acids:** general structure and functions of purines, pyrimidines, nucleosides, nucleotides; hydrolysis of nucleic acids. Biosynthesis of purines and pyrimidines, nucleosides and nucleotides. Degradation of purines and pyrimidines. Salvage pathway.

UNIT-V: **Lipids:** Classification, nomenclature and structure of fatty acids, triacylglycerols, sphingolipids and phospholipids, waxes, glycolopids and sterols. Beta-oxidation of fatty acids, biosynthesis of fatty acids and triacylglycerols. Lipid proteins system and transport of lipoproteins of blood plasma. Regulation of lipid metabolism.

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RECOMMENDED BOOKS:

Lehninger Principles of Biochemistry (2005), Nelson & Cox.

Biochemistry (2004); Stryer, L.

Text book of Biochemistry (1997), Devlin,Thomas, M.

Biochemistry (1993) Zubay,G.

Biochemistry Fundamentals, Voet et al.

Biochemistry, Friedfider,D.

Practical Biochemistry, Plummer.

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Semester/सेमेस्टर	:	**Semester I**
Subject/विषय	:	**Biotechnology**
Title of Subject Group	:	**Instrumentation Analytical Techniques.**

Particulars/विवरण

Max. Marks 40

UNIT-I: **Microscopic Techniques**: Principles and Applications of Light, Phase Contrast, Fluorescence Microscopy, Scanning and Transmission Electron Microscopy, Confocal Microscopy, Cytophotomatry and Flow Cytometry, patch clamping, advances of microscopy. Microtomy and its application.

Centrifugation: Preparative and Analytical Centrifuges, Sedimentation analysis RCF, Density Gradient Centrifugation.

UNIT–II: **Chromatography Techniques**: Theory and Application of Paper Chromatography, TLC, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, GLC and HPLC.

UNIT–III: **Electrophoretic Techniques**: Theory and Application of PAGE (SDS and native), Agarose Gel Electrophoresis 2 Dimenssional Electrophoresis, Iso-electric Focusing, Immuno diffusion, Immuno Electrophoresis, ELISA, RIA. Southern, Northern and Western Blotting.

UNIT–IV: **Spectroscopic Techniques**: Theory and Application of UV and Visible Spectroscopy, Fluorescence Spectroscopy, MS, NMR, ESR, Atomic Absorption Spectroscopy, X-ray Spectroscopy, LASAR, Raman Spectroscopy. MALDI.

UNIT–V: **Radio-isotopic Techniques**: Introduction to Radioisotopes. Radioactive Decay – Types and Measurement, Principles and Applications of GM Counter , Solid and Liquid Scintillation Counter, Autoradiography, RIA, Radiation Dosimetry. Biological Applications of Radioisotopic techniques.

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RECOMMENDED BOOKS:

Physical Biochemistry: Application to Biochemistry and Molecular Biology- Freilder.

Biochemical Technique : Theory and Practice , - Robyt & White

Principle of Instrumental Analysis – Skoog & West

Principle & Technique – Practical Biochemistry 5th Ed. (2000) - Walker J. & Wilson K.

Principle of Instrumental Analysis – Skoog et al.

Microbiology – Fundamental & Application (1995) -Atlas, R.M.

Biophysical Chemistry – Upadhyay & Nath.

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Semester/सेमेस्टर	:	**Semester I**
Subject/विषय	:	**Biotechnology**
Title of Subject Group	:	**General and Applied Microbiology**

Particulars/विवरण

Max. Marks 40

UNIT-I: **Introduction to Microbiology:** Historical background & scope, Difference between prokaryotic and eukaryotic organisms, structure of cell wall and peptidoglycan, Methods of Microbiology: Pure culture techniques, sterilization techniques, principle of microbial nutrition, preparation of culture media, enrichment culture techniques for isolation of microbes.

UNIT-II: **Classification of Bacteria:** Basic principle and techniques used in bacterial classification. Phylogenetic polyphasic taxonomy and numerical taxonomy. New approaches of bacterial taxonomic classification including genetic methods, Ribotyping, Ribosomal RNA sequencing, characteristic of primary domains.

UNIT-III: **Viruses:** General characteristics, Morphology, Classification and structure of plant, animal and bacterial viruses, Cultivation of viruses, a brief account of Adenoviruses, Herpes, Retrovirus, Viroids and prions.
Microbial Growth: The definition of growth, bacterial generation and doubling time, specific growth rate and yield measurement, Monoauxic, Diauxic and synchronized growth curve. Factors affecting microbial growth. Culture collection & maintenance of culture. Sporulation in bacteria.

UNIT-IV: **Control of Microorganism by Physical & chemical agents:** Antimicrobial agents, Sulfa drugs, Antibiotics (penicillin and cephalosporin) Broad Spectrum antibiotics, antibiotics from prokaryotes, Anti fungal antibiotics, Mode of action (a brief account), resistance of antibiotics (a brief account)

UNIT-V: Microbial Ecology: Microbial flora of soil, Interaction among soil microorganisms. Nitrogen fixation (a brief account), Symbiotic association-types, functions and establishment of symbiosis. A. niger, yeast, Pseudomonas putida,

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RECOMMENDED BOOKS:

Alcamo's Fundamental of Microbiology, (2004); Pommerville et al.

Microbiology (1996); Prescott, Harley & Klein

Microbiology (2004); Tortora,F.

Foundation in Microbiology (1996);Talaro & Talora.

Food Microbiology (2004); Adam , M.R.

Principles of Microbiology (1994); Atlas,R.M.

Pharmaceuticals Microbiology (2003); Purohit & Saluja.

Microbiology: A Lab Manual, Cappuccino et al.

Brock Biology of Microbiology, Martinko,M.T & Parker,J.

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Title of Subject Group	:	**Practical's I**

Suggested Practical Based on Theory Paper I & II

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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. Chromosome preparation: mitosis-onion root tip, rat/mouse cornea/ human lymphocyte.
2. Chromosome preparation meiosis- rat / mouse testis, grasshopper testis.
3. Polytene chromosome preparation from Drosophila salivary gland.
4. Histochemical localization of DNA and RNA in onion peel.
5. Demostration of microbiological technique-sterilization, autoclaving and incubation etc.
6. Preparation of liquid and solid media for growth of microorganism.
7. Preparation of different stain –simple stain, gram stain and differential stain.
8. Isolation and maintenance of microorganism by plating, streaking and serial dilution method. slants and sub culture for storage of microorganism.
9. Isolation of pure culture from air, soil, water and study of colony characteristic.
10. Staining of bacterial culture –endospores and capsule.
11. Measurement of growth by colony forming unit and turbidometry.
12. Biochemical characterization of selected microbes.
13. Analysis of water for potability and determination of MPN.
14. One step growth curve of coliphage.
15. Determination of lambda max, verification of Beer's law.
16. Titration of amino acid.
17. Colorimetric determination of pk.
18. Quantitive assay of protein by Lowry, Biuret and Bradford method.
19. Quantitive assay of sugar by DNSA and Benedict reagent.
20. Separation of amino acid and sugar by paper and thin layer chromatography.
21. Electrophoresis of protein, native and under denaturing condition.
22. Separation of sub-cellular organelles by diffential centrifugation.
23. Analysis of oil, iodine number, saponification & acid number.
24. Quantitative analysis of amino acids.
25. Quantitative analysis of carbohydrates.
26. Quantitative estimation of lecithins.
27. Calculation of ratio of ionized & unionized dye with known pK value after the pH of the solution is altered.

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