Chhindwara University, Chhindwara (M.P.)

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

Name of Paper	Title of paper	Max. Marks			Minimum Marks			
		Theory	CCE	Practical	Theory	CCE	Practical	Total Marks
Theory-I	Genetic Engineering	40	10		15	0		50
Theory-II	Plant Biotechnology	40	10		15	0		50
Theory-III	Immunology & Animal Biotechnology	40	10		15	0		50
Theory-IV	Immunology and Animal Biotechnology Env.	40	10		15	0		50
Practical-I	Based on Theory			50			20	50
Practical-II	Based on Theory.			50			20	50
							Total:-	300

oard of Studies :

I. Chairman – Dr. Ajay Kumar Bhardwaj A. Bhardwaj

II. Subject Expert –

1. Dr. Pratima Khare
2. Dr. Jitendra Malviya
3.
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6.
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छिन्दवाड़ा विश्वविद्यालय, छिन्दवाड़ा

Session -2020-2021

Class/कक्षा	:	**M.Sc.**
Semester/सेमेस्टर	:	**Semester III**
Subject/विषय	:	**Biotechnology**
Title of Subject Group	:	**Genetic Engineering**

Particulars/विवरण

Max. Marks 40

UNIT-I: **Introduction:** Historical background, Restriction enzymes and modifying enzymes, Restriction mapping, Construction of chimaeric DNA- staggered cleavage, Addition of poly dA and dT tails, Blunt end ligation, Gene cloning.

UNIT-II: **Cloning and Expression Vectors:** Vehicles for gene cloning, Plasmids, Bacteriophages, Cosmids and Phagemids as vectors, P1 vectors, F-factor based vectors, Plant and animal viruses as vector, Artificial chromosomes as vectors (YAC, BAC, PAC and MAC vectors), Expression vactors- use of promoters and expression cassettes, Bacculoviruses as expression vectors, Virus expression vectors, Binary and shuttle vectors.

UNIT-III: **Isolation Sequencing and Synthesis of Genes:** Methods of gene isolation, Construction and screening of genomic and cDNA libraries, Chromosome walking, Chromosome jumping, Transposone tagging, Map based cloning, DNA sequencing Techniques (Maxam Gilbert's chemical degradation methods, Sanger's dideoxy chain termination method, High thourghput sequencing and pyrosequencing), Automated DNA sequencing, and Organochemical gene synthesis.

UNIT-IV: **Molecular Probes and PCR:** Molecular probes, Labeling of probes, Radioactive vs. Non radioactive labeling, Uses of molecular probes. Polymerase Chain Reaction- basic principle, Modified PCR (Inverse PCR, Anchored PCR, PCR for mutagenesis, asymmetric PCR, Real time and reverse Transcriptase PCR, Primer walking), Gene cloning Vs. Polymerase chain reaction; Applications of PCR in biotechnology, Ligase chain reaction.

UNIT-V: **Molecular Markers and DNA Chip Technology:** Molecular-Markers-types and applications, Construction of molecular maps (genetic and physical maps), DNA chip Technology & Microarrays (a Brief account). **Genomics and Proteomics:** Whole genome sequencing and functional genomics (a brief account), Applications of genomics and Proteomics with special reference to Arabidopsis and Rice.

RECOMMENDED BOOKS:

Genomes (2002)2nd edition Brown,T.A.

Principles of Gene Manipulation (1994), Old and Primerose Gene Cloning: An introduction, Brown

A Passion for DNA: Genes, Genome & Society(2000),Watson

Genetic Engineering: An Introduction to Gene Analysis and Exploitation In eukaryotes (1998), Kingsman & Kingsman

Molecular Cloning: A Laboratory Manual (2000),Sambrook & others Molecular Genetics of Bacteria- Dale

Genes & Genomes (1991), Singer & Berg Molecular Biotechnology (1996), Glick & Pasternak

Plant Molecular Biology (Vol.I and II 2002), Gilmartin & Bowler Recombinant DNA (1992), Watson et al

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Class/कक्षा : **M.Sc.**

Semester/सेमेस्टर : **Semester III**

Subject/विषय : **Biotechnology**

Title of Subject Group : **Plant Biotechnology**

Particulars/विवरण

Max. Marks 40

UNIT-I: **Plant tissue culture:** Cleaning, sterilization, sterile handling of tissue culture of plant. Nutritional requirement for in vitro culture. Concept of cellular totipotency, single cell culture, micro propagation, somoclonal variation and its application for plant improvement, somatic embryogenesis, anther and ovule culture, haploid and double-haploid production.

UNIT-II: **Protoplast culture:** Isolation ,fusion and culture, somatic hybridization, selection system for hybrids , cybrid production and their application in crop improvement, cryobiology of plant cell culture and establishment of gene banks, production of virus free plants using meristem culture.

UNIT-III: **Plant cloning vectors:** Ti and Ri plasmid and viral vectors (CaMV based vectors, Gemini virus, TMV based vectors). Mechanism of DNA transfer, role of virulence genes, use of 35S promoters, use of reporter genes, methods of nuclear transfer, particle bombardment, electroporation, microinjection, transformation of monocots, transgene stability and gene silencing for herbicide, insect and salt resistance , Plant DNA fingerprinting - Hybridization , Genetic markers, molecular markers, PCR based markers (RFLP, SSRs, RAPD, QTLS , SCARS , AFLP etc.)

UNIT-IV: Biological nitrogen fixation and biofertilization, molecular mechanism of nitrogen fixation, genetics of nif gene. Plant diseases- general account, biological control of pests and disease, biopesticides, seed production technique, plant cell culture for the production of useful secondary metabolism-pigments, perfumes, flavor, pharmacologically important compounds, biodegradable plastics. Automation in Plant Tissue Culture for its commercial application.

UNIT-V: Transgenic plants, commercial status and public acceptance, Bio-safety guidelines for research involving GMO's, benefits and risks. Socio economic impact and ecological consideration of GMO's, Gene flow, IPR and IPP. Patenting of biological.

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RECOMMENDED BOOKS:

Plant Tissue Culture: Theory & practice a revised edition(2004) Bhojwani & Rajdan
Plant Biotechnology (2000),Hammond et al Plant Tissue Culture –Bhojwani, S.S.
Plant Cell & Organ culture(2004) Gamberg, O.L
Principles of Plant Biotechnology, Montell, et al
Plant Cell Culture (2003) Evans D.A.
Plant Molecular Biology- vol.I and II, Gimartin & Bowler Genetic
Engineering of Crop Plants, Lycett G.W. & Grierson D.

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Class/कक्षा	:	**M.Sc.**
Semester/सेमेस्टर	:	**Semester III**
Subject/विषय	:	**Biotechnology**
Title of Subject Group	:	**Immunology & Animal Biotechnology**

Particulars/विवरण

Max. Marks 40

UNIT-I: **Immunization**. Routes of immunization, adjutants; Equilibrium dialysis to measure antibody affinity and avidity, Precipitation reaction, Immunoelectrophoresis, ELISA, ELISPOT assay, Phage display libraries for antibody V-region production. Immunofluorescence microscopy; Immunoelectron microscopy; Immunohistochemistry; Immunoblotting (Western blotting).

UNIT-II: Isolation of lymphocytes by Ficoll-Hypaque gradient, Flow Cytometry, Flurescence Activated Cell Sorting (FACS), Congenic mice, SCID-HU mice and their use in immunology.

UNIT-III: **Autoimmunity**: Mechanism and therapeutic approaches, immunodeficiency syndrome and their diagnosis, vaccines-active and passive immunization, whole organism vaccines, macromolecules as vaccines, recombinant vector vaccines, synthetic peptide vaccines and subunit vaccines, DNA vaccines. Immunodiagnostic: precipitation techniques, agglutination, fluorescence techniques.

UNIT-IV: **Animal cell culture:** An introduction, concept of aseptic techniques, animal tissue culture media, cell propagation, preservation and storage of cells, detection of contamination, safety consideration in laboratory cell culture.

General cell culture techniques: Dispersion and disruption of tissue, monolayer culture technique, measurement of growth and viability of cell, determination of 50% end point titer, Bulk culturing of animal cells, Concept of bioreactors for mass culture of mammalian cell, Micro carrier culture, harvesting and purification methods for end products recovery.

UNIT-V: **Specialized Techniques:** Cell immobilization techniques, cell transmission, Amniocentesis, CEA production and its clinical application, Interferons derived from human cells, 3-D animal cell culture and tissue engineering, FISH and application of animal cell culture.

RECOMMENDED BOOKS:

Immunology-Roitt et.al.

Immunochemistry- Kear and Thorpe.

Immunology-Abbas.

Cellular and Molecular Immunology-Abbs, Lichtman and Pober.

Immunology-Tizzard.

Principle & Practice of Immunoassay 2nd Ed. – Christopher & David Animal Cell Culture (1987) – Freshney, R.T. Culture of Animal Cell (2003) – Freshney, R.T.

Animal Cell Culture & Technology – Basic from Background to Bench (2004) Taylor & Fracis.

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Class/कक्षा : **M.Sc.**

Semester/सेमेस्टर : **Semester III**

Subject/विषय : **Biotechnology**

Title of Subject Group : **Environmental Biotechnology**

Particulars/विवरण

Max. Marks 40

UNIT-I: Environment: Basic concepts and issues; environmental pollution: types and methods for the measurement; methodology of environmental management-problem solving approach, its limitations; air pollution and its control through biotechnology, air sampling techniques; biodiversity: conservation and management. Biodiversity in India: Status, Threats, Utility & Conservation; Indian Biodiversity ACT 2002 and Biodiversity Rules 2004.

UNIT-II: Water pollution and its control: Water as a scarce natural resource, need for water management, sources and measurement of water pollution, waste water treatment-physical, chemical and biological treatment processes; algal blooms and human health.

UNIT-III: Microbiology of waste water treatment: Aerobic process-activated sludge, oxidation ditches, trickling filter, towers, rotating discs, rotating drums, oxidation ponds; anaerobic processes anaerobic digestion, anaerobic filters, upflow anaerobic sludge blanket reactors; treatment schemes for waste waters of dairy, distillery, tannery industries; biotechnological application of microbes form extreme environment.

UNIT-IV: Microbial degradation of xenobiotics in the environment- micological considerations, decay behaviour & degradative plasmids, hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides; bioaccumulation of metals and radio-nucleids and detoxification; bioremediation.

UNIT-V: Biological N2 fixation, H2 production, biofertilizers and biopesticides; solid wastes; sources and management (composting, vermiculture and methane production). Single cell protein (Spirulina, yeast, mushroom); global environmental problems-ozone depletion, UV-B green house effect and acid rain, their impact and biotechnology approaches for management

Recommended Books :

Wastewater Engineering- Treatment, disposal and Reuse. Metcalf and Eddy, Inc,. Tata McGraw Hill, New Delhi.

Comprehensive Biotechnology. Vol. 4, M. Moo-young (Ed-in-chief), Pergamon Press, Oxford.

Environmental Chemistry, A.K. De. Wiley Eastern Ltd. New Delhi.

Introduction to Biodeterioration. D. Allsopp and K.J. Seal, ELBS/Edward Arnold

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

Practical Based on Theory Paper I & II

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

Practical Based on Theory Paper III & IV

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

1. Bacterial culture and antibiotic selection media. Preparation of competent cells.
2. Isolation of phage DNA.
3. Restriction mapping of plasmid DNA.
4. Preparation of single stranded DNA template.
5. Gene expression of *E.coli* and analysis of gene product.
6. Preparation of helper phage and its titration.
7. PCR.
8. Calculation of the mean, median, mode and standard deviation using MS –Excel.
9. Graphical representation of various types of biological data using MS – Excel.
10. Biological data resources and data retrieval.
11. Sequence analysis using BioEdit software tools and other online tools.
12. Structural bioinformatics.
13. Protein structure prediction.
14. Isolation of industrially important microbes from environment.
15. Determination of TDP and TDT of microorganisms for design of a sterilizer.
16. Determination of growth curve of industrial organism and substrate degradation profile, also compute specific growth rate and growth yield.
17. Comparative study of ethanol production using different substrates.
18. Microbial production of citric acid using *Aspergillus niger*.
19. Preparation of media for plant tissue culture.
20. Sterilization of plant tissue.
21. Study of the effect of different tissue sterilizing agents.
22. Study of antifungal properties of plant extracts.
23. Callus induction from different explants: - seed, root & shoot.
24. Determination of organogenesis in mulberry.
25. Isolation of protoplast and culture.
26. Agrobacterium culture, selection of transformants, receptor genes (GUS) assays
27. Genomic DNA isolation from seed and plant tissue and their electrophoretic analysis
28. Restriction digestion of plant genomic DNA
29. Viability testing of seeds under different environmental conditions
30. Isolation of nitrogen fixing organisms like Cyanobacteria and Rhizobium and their characterization.
31. Measurement of nitrate reductase from *Nostoc muscorum*.
32. Analysis of total protein content of seeds by TCA precipitations method.
33. Isolation of VAM from soil by wet sieving and decanting method.
34. Isolation and cultivation of mushroom.
35. Determination of pesticide /metal detoxification by microbial species
36. Isolation of bacteriophage from sewage water.
37. Isolation and study of fungus responsible for food spoilage.
38. Detection of coliforms from determination of purity of potable water.
39. Determination of BOD of a sewage sample.
40. Determination of COD of a sewage sample.
41. Survey of degradative plasmid in microbes growing in polluted environment
42. Bioinsecticide isolation, purification and assay.

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