

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

M. Sc. BIOTECHNOLOGY SEMESTER –IV (2016-17)

A. Industrial Training: Major Research Project at research laboratory or institute of repute (5 months)

OR

B. Discipline Specific Elective (DSE)

DSE1: MINOR RESEARCH PROJECT

TOTAL HOURS: 60

CREDITS: 4

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

M. Sc. BIOTECHNOLOGY SEMESTER –IV (2016-17)

DSE2: a. AGRICULTURE BIOTECHNOLOGY(THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit I

Credit hours: 15

Micropropagation and its application in forestry, floriculture, agriculture and conservation of biodiversity and threatened plants. Hardening and acclimatization – success and bottlenecks. Greenhouse: design, management and operation. Quality control, packaging and shipment, cost-benefit analysis. Global market, commercial opportunities in plant tissue culture with special reference to plant tissue culture industries in India.

Unit II

Credit hours: 10

Scaling-up production and automation in plant propagation. Use of robotics in plant production. Mass scale plant production facilities: design and planning, media preparation, storage, dispensation and examination and control. Air conditioning, air handling and purification, evaporative cooling, water treatment: softening, demineralization, distillation, reverse osmosis.

Unit III

Credit hours: 10

In vitro approaches to genetic manipulations of plants. Development of transgenic plants for crop improvement, molecular farming, and study of regulated gene expression. Commercial status and biosafety concern of transgenic plant and ethical issues. Plantibodies, plant-derived vaccines.

Unit IV

Credit hours: 10

Application of plant genetic engineering: current status and commercial opportunities for genetically engineered plants for stress tolerance: drought, salt, flooding and temperature, biotic and abiotic stress tolerance-insects, fungi, bacteria, viruses, weeds, herbicide and pesticide. Development of male sterile plants. Applications of plant tissue culture in plant pathology: development of virus free plant and development of disease resistant plants, growth of obligate parasites in culture.

Unit V

Credit hours: 15

Genetic engineering for increasing crop productivity by manipulation of photosynthesis, nitrogen fixation, nutrient uptake efficiency. Quality improvement of protein, lipids, carbohydrates, vitamins and mineral nutrients. Molecular breeding and molecular tagging of genes. Brief idea of gene synteny, map based cloning and their use in transgenesis.

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DSE 2: b. BIOSAFETY, BIOETHICS AND IPR (THEORY)

TOTAL HOURS: 60

CREDITS: 4

UNIT I**Credit hours: 12**

Introduction to ethics and bioethics : Personal ethics: profession and professionalism – Moral Reasoning – Ethical theories – person as an experimenter – Moral leadership (integrity and ingenuity) - framework for ethical decision making.

UNIT II**Credit hours: 12**

Biotechnology and ethics: Biotechnology in agriculture and environment: benefits and risks – benefits and risks of genetic engineering – ethical aspects of genetic testing – ethical aspects relating to use of genetic information – genetic engineering and biowarfare.

UNIT III**Credit hours: 12**

Ethical implications of cloning: Reproductive cloning , therapeutic cloning ; Ethical, legal and socio-economic aspects of gene therapy, germ line, somatic, embryonic and adult stem cell research- GM crops and GMO's – biotechnology and biopiracy – ELSI of human genome project.

UNIT IV**Credit hours: 12**

Introduction to biosafety: Biosafety issues in biotechnology – risk assessment and risk management – safety protocols: risk groups – biosafety levels – biosafety guidelines and regulations (National and International), types of biosafety containment. Ethical issues for animal cell culture.

UNIT V**Credit hours: 12**

Introduction to intellectual property and intellectual property rights: Types, patents, copy rights, trade secrets and trade marks, design rights, geographical indications – importance of IPR – patentable and non patentables – patenting life – legal protection of biotechnological inventions – world intellectual property rights organization (WIPO)

Suggested Readings

1. Principles of cloning, Jose Cibelli, Robert P. Ianza, Keith H. S . Campbell, Michael

- D. West, Academic Press, 2002 Glimpses of Biodiversity – B. Blotsetti
2. Ethics in engineering, Martin. M.W. and Schinzinger. R. III Edition, Tata McGraw-Hill, New Delhi. 2003.

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M. Sc. BIOTECHNOLOGY SEMESTER –IV (2016-17)

DSE3: a. FOOD AND DAIRY BIOTECHNOLOGY (THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit – I

Credit hours: 12

Starter cultures and their biochemical activities; production of alcoholic beverages; production of Single cell protein and Baker's yeast; Mushroom cultivation, Food and dairy products: Cheese, bread and yogurt. Fermented vegetables – Saurkraut; Fermented Meat – Sausages

Unit - II

Credit hours: 12

Novel microorganisms eg. LAB (Probiotics), Cyanobacteria, methylotrophs, enzyme biotransformations, Role of Plant tissue culture for improvement of food additives; color and flavor, Genetic modifications of microorganisms; detection and rapid diagnosis. Genetically modified foods and crop.

Unit - III

Credit hours: 12

Food borne infections and intoxications; with examples of infective and toxic types-Clostridium, Salmonella, Staphylococcus Mycotoxins in food with reference to *Aspergillus* species.

Unit - IV

Credit hours: 12

Food preservation: canning, dehydration, ultrafiltration, sterilization, irradiation. Chemical and naturally occurring antimicrobials. Fermented foods and beverages. Use of biosensors in food industry.

Unit - V

Credit hours: 12

Quality assurance: Microbiological quality standards of food Intellectual property rights and animal welfare, Government regulatory practices and policies. FDA, EPA, HACCP, ISI Risk analysis; consumer and industry perceptions.

Suggested Readings:

1. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
2. Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
3. Davidson PM and Brannen AL. (1993). Antimicrobials in Foods. Marcel Dekker, New York.
4. Dillion VM and Board RG. (1996). Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.
5. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
6. Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.
7. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.
8. Lund BM, Baird Parker AC, and Gould GW. (2000). The Microbiological Safety and Quality of Foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
9. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education

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M. Sc. BIOTECHNOLOGY SEMESTER –IV (2016-17)

DSE 3: b. ADVANCED BIOTECHNOLOGY (THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit I

Credit hours: 10

Genomics: DNA micro Arrays, strategies of whole genome sequencing and shot gun approach, contigs and genome assembly. Metagenomics- Introduction and applications. Proteomics technologies: Protein Arrays, Protein chips and their application, 2D Gel electrophoresis and its application, Mass spectrometry and protein identification.

Unit II

Credit hours: 10

Stem cell basics: properties and types. Stem cell therapy. *In vitro* fertilization: Principle, methods and applications. Transplantation: Types of grafts, immunologic basis of graft rejection, mechanism and types of rejection, clinical manifestation of graft rejection, immuno suppressive therapy, immuno tolerance to allograft, clinical transplantation.

Unit III

Credit hours: 15

Gene therapy: introduction, types, strategies and gene delivery system. Therapeutic applications of gene therapy in genetical and neurological disorders. Tissue engineering: design, scaffolds, biomaterials; production of complete organs like skin, cartilage, kidney, heart and eyes.

Unit IV

Credit hours: 10

Cancer biology: introduction, types, development and causes, carcinogens, tumor suppressor genes, oncogenes; mechanism of activation, cancer prevention and treatment with special reference to nano biotechnological approach.

Unit V

Credit hours: 15

Introduction to Nano biotechnology, Biomaterials and biological materials-examples and uses. DNA nanotechnology, Nanopore and Nanoparticles-biological arrays- nanoprobes for analytical applications. Nano biosensors-nanoscale organization-characterization-quantum size effects-sensors of the future.

Suggested Readings

1. Kuby *et al.* Immunology. W.H. Freeman and Company.
2. Weinberg R A . the biology of cancer. John wiley and sons.
3. Poole and owens, introduction to nanotechnology. Wiley student edition .
4. Lesk A. introduction to protein sciences, oxford university press, second edition.
5. Jonathan Pevsner. Bioinformatics and Functional Genomics. Wiley India pvt. Ltd.

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DSE 4: a. MEDICAL AND PHARMACEUTICAL BIOTECHNOLOGY (THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit I

Credit hours: 10

Disease diagnosis: probes, detection of genetic diseases. Uses of products of non recombinant and recombinant organisms for disease treatment. Drug manufacturing process. Drug design: ligand based, structure based, active site identification, ligand fragment link, scoring method. computer aided drug design.

Unit II**Credit hours: 15**

Drug metabolism: Non Synthetic-oxidation, reduction, hydrolysis etc., conjugation reactions- methylation, sulphation etc. Factors affecting drug metabolism, Drug development process: pharmacological microbial, recombinant, biochemical and molecular level screening system and their construction strategies.

Unit III**Credit hours: 15**

Drug delivery-theory of controlled release drug delivery systems: zero order kinetics, theory of diffusion: release and diffusion of drug polymers. Types of drug delivery- Targeted, Thin film, self microemulsifying, acoustic, neural, drug carrier, liposomes, microspheres, nanofibers etc.

Unit IV**Credit hours: 10**

Antibiotics- mechanism, side effects, metabolisms, bioavailability, representative member, resistance, uses of β lactam (penicillin), aminoglycosides (Streptomycin), tetracycline, metronidazole, rifampicin, daptomycin, sulphonamides, multiple drug resistance.

Unit V**Credit hours: 10**

Production of Biopharmaceuticals- Insulin, Inerferon. Vaccines-Live vaccines, killed vaccines- Subunit vaccines-Recombinant vaccines-DNA vaccines, Applications of biotechnology in forensics. Microencapsulation in medicine, Biosensors and their applicaiton in medicine. Detection of genetic diseases: amniocentesis, carrier detection.

Suggested Readings:

- 1 Christopher, H. Gene cloning and Manipulation. Cambridge University, Press.
- 2 Nicholl, D.S.T. An introduction to genetic engineering. Cambridge University Press.
- 3 Sambrook, Russell and Maniatis. Molecular Cloning : A Laboratory Manual (Vol. I, II and III).Cold Spring Harber Laboratory.
- 4 Glover, D.M. and Hames, B.D. DNA Cloning : A (Practical) approach. IRL Press. Oxford.

- 5 Brown, T.A. Gene cloning. Blackwell Publisher.
- 6 Kreuzar, H. and Massey, A. Recombinant DNA technology. A.S.M. Press, Washington.
- 7 Primrose, S.B. Molecular Biotechnology. Panima.
- 8 Watson and Zoller. Recombinant DNA. Panima.
- 9 Boylan, M. Genetic engineering – science and ethics on new frontier. Pearson Edu.
- 10 Old and Primrose. Principles of Gene Manipulation.
- 11 Glick and Pasternak. Molecular Biotechnology. ASM Press Washington, USA.

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DSE 4: b. HOST-PARASITE INTERACTIONS(THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit I

Credit hours: 12

Microbial parasites: Historical account; Bacteria, Fungi, Viruses, Protozoas, Helminthes and Arthropods, Prions; Host-parasite relationship; Infection-mode of transmission in infection, factors predisposing to microbial pathogenecity, types of infectious diseases

Unit II

Credit hours: 12

Invasion of Microbes: Adsorption to the potential sites, membrane trafficking in eukaryotic cells, routes of invasion and selection of intracellular niche, bacterial manipulation of host cell cytoskeleton, nosocomial infection; Normal microflora of human body; Bacterial toxins and virulence genes; Strategies of host defense.

Unit III

Credit hours: 12

Methods of Disease Diagnosis: Sampling site-normally sterile and with normal microflora; Sample collection-method of collection, transport and processing of samples, interpretation of results; Diagnostic methods- cultured: microscopy, microbial antigen; non-cultured: PCR based microbial typing: Eubacterial identification based on 16s rRNA sequences.

Unit IV

Credit hours: 12

Diagnosis of Infections : Bacteria- *Streptococcus*, Coliforms, *Salmonella*, *Shigella*, *Vibrio* and

Mycobacterium; Fungi-Major fungal diseases, Dermatophytoses, Candidiosis and Aspergillosis
DNA and RNA Viruses- POX virus, Rhabdo Virus, Hepatitis Virus and Retro Virus.

UNIT V

Credit hours: 12

Diagnosis of Infections Viruses-AIDS Virus; Protozoan diseases-Amoebiosis, Malaria, Trypanosomiasis, Leishmaniasis; Helminthiasis diseases- *Fasciola hepatica* and *Ascaris lumbricoides*; Filariasis and Schistosomiasis.

Suggested Readings

1. Bailey and Scott's Diagnostic Microbiology (2002). Betty A. Forbes, Daniel F. Sahn, Alice S. Weisfeld, Ernest A Trevino. Published by C.V. Mosby
2. Medical Microbiology (1997). Edited by Greenwood. D, Slack. R and Peutherer. J, ELST Publishers.
3. Fundamental of Molecular Diagnostics (2007). David E. Bruns, Edward R. Ashwood, Carl A. Burtis. Saunders group.
4. Henry's Clinical Diagnosis and Management by Laboratory Methods (2007). Mepherson.
5. Molecular Diagnostics for the Clinical Laboratorian 2nd ed. (2006). W.B.Coleman. Humana Press.

SKILL DEVELOPMENT COURSES

BT SEC1 (M2BT07SEC01): TECHNIQUES OF MOLECULAR BIOLOGY

TOTAL HOURS: 30

CREDITS: 2

Duration- 6 Months

Overview- This short-term training course is intended to offer students a platform to learn various modern tools of molecular biology that are now regularly used in advanced research laboratories. It has been designed to sensitize the participants about the enormous potential of several advanced techniques to enable them to utilize these techniques in their fields of research.

Eligibility: Higher secondary /U.G. /P.G. in Science

Goal

Our intentions are to provide these candidates with an exposure to an international quality biotechnology research environment. Through this experience, the student will become skilled in various molecular biology techniques and become efficient in solving major biotechnological queries.

Fee – 15,000/- per student

Student intake - 20

Course details-

UNIT I**Credit hours: 6**

Instrumentation in Molecular Biology.

UNIT II**Credit hours: 6**

Isolation and purification of Genomic DNA, Quantitative and Qualitative Analysis of Nucleic acids, Isolation and purification of Plasmid DNA

UNIT III**Credit hours: 6**Agarose Gel Electrophoresis, SDS Poly Acrylamide Gel Electrophoresis for Protein
Native Poly Acrylamide Gel Electrophoresis**UNIT IV****Credit hours: 6**

Restriction Digestion, PCR Techniques

UNIT V**Credit hours: 6**

Isozyme analysis

BT SEC2: (M3BT07SEC02): TECHNIQUES OF PLANT BIOTECHNOLOGY**TOTAL HOURS: 30****CREDITS: 2****Duration - 6 Months**

Overview- The objective of the training program is to prepare young tissue culturist to work on important problems in plant tissue culture. This involves not only collaborations, but also exchange of ideas among the larger group of trainees and training faculty in the fields of Biotechnology. These interactions range from informal conversations in the laboratory and shared equipment facilities, but also in organized seminars, joint group meetings, journal clubs and graduate classes.

Eligibility: Higher secondary /U.G. /P.G. in Science

Goal

Our goal is to produce intellectually critical and skilled technologists with the skills necessary for a productive career in the Biotechnology. Through this experience, the trainee becomes skilled at posing questions about fundamental biological processes and designing experiments to answer those questions. The training is augmented by formal courses offered by the Biology by seminar programs that highlight current research in Plant tissue culture and related disciplines, by the close involvement of a Thesis Advisory Committee, and by research seminar and journal club presentations by trainees.

Fee – 15,000/- per student

Student intake – 20

Course Details-

UNIT I

Instrumentation in Plant tissue culture

Credit hours: 6

UNIT II

Preparation of Stock solution, Preparation of media, Preparation of Hormone stock solution

Credit hours: 6

UNIT III

Sterilization techniques

Credit hours: 6

UNIT IV

Callus culture, Embryo culture, Anther culture, Meristem culture, Root culture

Credit hours: 6

UNIT V

Synthetic seed, Somatic embryogenesis

Credit hours: 6