

# Sample Paper

ive examination M.Sc. Biotechnology

Institute of Molecular Biology and Biotechnology (IMBB)

udent Name: \_\_\_\_\_

Signature \_\_\_\_\_

oll No.: \_\_\_\_\_ Time: 60 min

Total Marks: 60

*Cutting and over-writing is not allowed*

1) The unique properties of each amino acid are determined by its particular

- a) Number of bonds to other amino acids
- b) R group
- c) Kinds of peptide bonds
- d) Presence of hydrogen

2) The process of uptake of free DNA that is induced by subjecting bacteria to high voltage electric field in the presence of DNA is known as

- a) Conjugation
- b) Electroporation
- c) Recombination
- d) None of these

3) *Bacillus thuringiensis* is used to control

- a) Nematodes
- b) Fungal pathogens
- c) Bacterial pathogens
- d) Insect pests

4) The rate of migration of DNA within an agarose gel in the gel electrophoresis technique is primarily based on what factor?

- a) The negative charge of the DNA
- b) The number of DNA fragments
- c) The size of the wells of the gel
- d) The size of the DNA fragments

5) You are working in a government laboratory in charge of destroying bioterrorism materials. An envelope containing the spore-forming bacterium anthrax must be disposed of safely. What would be the best method for ensuring the anthrax is killed?

- a) Autoclave
- b) Dry Heat
- c) Disinfectant
- d) Sanitizing Spray
- e) Bleach Soaking

6) The technique that utilizes probes to detect specific DNA sequences is known as what?

- a) Western blot
- b) Northern blot
- c) Southern blot
- d) Eastern blot

7) Sterilization of tissue culture medium is done by

- a) Mixing the medium with antifungal agents
- b) Filtering the medium through fine sieve
- c) Autoclaving of medium at 120° for 15 min
- d) Keeping the medium at -20°C

8) A scientist has a processed mRNA transcript for a gene he/she wants to clone into a bacterial vector. What must he/she do as a first step in this process?

- a) Use PCR to create a cDNA molecule
- b) Generate primers to the processed mRNA
- c) Sequence the mRNA transcript
- d) Ligate the mRNA into the cloning vector

9) Viruses exhibit several different interactive strategies in the host cell. Which of the following does not describe one of those strategies?

- a) The virus takes over the host cell metabolism and destroys the cell
- b) The virus does not take over the cell's metabolism and leaves the cell without killing it
- c) The virus integrates its nucleic acid into that of the host cell and lives harmoniously with the cell for a long time
- d) The virus takes over the host cell metabolism but does not reproduce itself
- e) The virus integrates its nucleic acid into that of the host cell, but eventually lyses the host cell upon exiting from it

10) Biolistics (Gene-gun) is suitable for

- a) Constructing recombinant DNA by joining with vectors
- b) Transformation of plant cells
- c) Disarming pathogen vectors
- d) DNA finger printing

11) Many physicians prefer mother's milk over cow's milk for infants. This is because mother's milk has the following property not found in cow's milk

- a) Antibodies against human disease
- b) Proteins for growing human muscle
- c) More essential amino acids
- d) MHCs for maturing the infant's immune system
- e) B cells

12) Detection of GMOs accomplished by \_\_\_\_\_

- a) PCR
- b) ELISA
- c) Southern blot
- d) a and b
- e) a and c
- f) b and c

13) A researcher is maintaining a liquid culture of bacteria at exponential growth. The pump providing nutrients to the culture breaks down over the weekend, allowing culture to run out of nutrients. It is very likely that upon return to the lab the researcher will find the culture in which of the following stages of growth?

- a) Continuous
- b) Log
- c) Lag
- d) Stationary

14) The plant tissues have high rates of cell division and either concentration or production required growth regulating substances including \_\_\_\_\_

- a) Auxine
- b) Cytokinin
- c) Both Auxine and cytokinin
- d) Gibbralline

15) Differentiation of organs and tissues in a developing organism is associated with

- a) Differential expression of genes
- b) Differential expression of protein
- c) Both (a) and (b)
- d) None of the above



16) Which of the following terms is used to describe the component isolated from a plant, for in vitro culturing in the specific medium?

- a) Synthetic seeds
- b) Embryoid
- c) Callus
- d) Explant

17) Two microbes ..... and ..... found to be very useful in genetic engineering.

- a) *E. coli* and *Agrobacterium tumefaciens*
- b) Plasmid and *Agrobacterium tumefaciens*
- c) *E. coli* and *Aspergillus* sp.
- d) Algae and *E. coli*

18) CryI endotoxins obtained from *Bacillus Thuringiensis* are effective against:

- a) Flies
- b) Mosquitoes
- c) Boll worms
- d) Nematodes

19) The structure of a protein can be denatured by

- a) Presence of oxygen
- b) Heat
- c) Presence of carbon dioxide gas
- d) The polar bonds of water molecules

20) A method that counts only live microbes is the

- a) Pure culture method
- b) plate count method
- c) Turbidity method
- d) cell counting method

21) Meristem culture is practiced in horticulture to get

- a) Slow-growing callus
- b) Somaclonal variation
- c) Haploids
- d) Virus-free plants

22) Micropropagation is a technique for production of ---

- a) True to type plants
- b) Haploid plant
- c) Somatic hybrids
- d) Somaclonal plants

23) The protein products of the following Bt toxin genes cry IA c and cry II Ab are responsible for controlling

- a) Moth
- b) Fruit fly
- c) Bollworm
- d) Roundworm

24) A mixture of organisms is in a pool of seawater. Which organism will have a growth advantage as the water evaporates?

- a) neurophiles
- b) aerotolerant anaerobes
- c) mesophiles
- d) osmotolerant prokaryotes

25) In genetic engineering, a chimera is

- a) An enzyme that links DNA molecules
- b) A plasmid that contains foreign DNA
- c) Virus that infects bacteria
- d) A fungi

26) Problems in obtaining large amounts of proteins encoded by recombinant genes can often be overcome by using

- a) BACS
- b) Expression vectors
- c) YACS
- d) all of these

27) In plant biotechnology, Polyethylene glycol method is used for

- a) Energy production from sewage
- b) Gene transfer without a vector
- c) Biodiesel production
- d) Seedless fruit production

28) RNA primer attracts DNA-----

- a) Ligase
- b) Polymerase
- c) Helicase
- d) all

29) Polymerase chain reaction was invented in 1983 by

- a) Kary Mullis
- b) Griffith
- c) Miescher
- d) Avery

30) A dividing and undifferentiated mass of cells is called

- a) Callus
- b) Embryo
- c) Explant
- d) Zygote

31) In plants, DNA is found in-----

- a) Nucleus
- b) Plastids
- c) Mitochondria
- d) All of the above

32) Genetic information are stored in

- a) DNA
- b) protein
- c) Chromosome
- d) RNA

33) Somatic hybridization is achieved through

- a) Grafting
- b) Protoplast fusion
- c) Conjugation
- d) Recombinant DNA technology

34) The enzymes required to obtain wall-free/naked protoplasts are

- a) Cellulase and proteinase
- b) Cellulase and pectinase
- c) Cellulase and amylase
- d) Amylase and pectinase

35) Why does the Environmental Protection Agency closely monitor the release of transgenic bacteria used for agricultural purposes?

- a) They want to monitor the destruction of crops by GMOs.
- b) They want to observe the effect the GMOs have on crops.
- c) They want to ensure the GMOs do not proliferate in the environment and pose a threat to humans.
- d) They want to ensure that people are aware that GMOs may have played a role in the production of a particular food product.

36) The first transgenic crop was

- a) Pea
- b) Tobacco
- c) Flax
- d) Cotton

37) All methods of DNA fingerprinting depend on some variation of what strategy?

- a) RFLP
- b) GMOs
- c) Gene therapy
- d) Microarray analysis

38) A tripeptide contains glycine, alanine, and serine. How many different sequences are possible?

- a) 3
- b) 4
- c) 5
- d) 6

39) Transgenic plants are developed by

- a) Introducing foreign genes
- b) Introducing gene mutations
- c) Deleting certain chromosomes parts
- d) Stopping spindle formation

40) Repressor molecules bind to the:

- a) Promoter
- b) Enhancer
- c) Operator
- d) Hormone response element



- 41) Somatic gene therapy could potentially correct a genetic defect in  
a) Affected individual and his or her offspring only  
b) Affected individual and all his or her descent  
c) Parents of affected child  
d) Affected individual only
- 42) Agriculture by using only biofertilizers is called  
a) Manuring                      b) Composting  
c) Inorganic farming          d) Organic farming
- 43) Nucleotide arrangement in DNA can be seen by  
a) Light microscope              b) Electron microscope  
c) X-Ray crystallography        d) Ultracentrifuge
- 44) *Agrobacterium tumefaciens* is -----  
a) A disease in humans that causes loss of sight  
b) A bacterium that can be used to introduce DNA into plants  
c) A fungi that is used to produce antibiotics in large amounts  
d) Disease in humans that causes loss of weight
- 45) Good cloning vectors must possess all but which of the following qualities?  
a) They should possess their own origin of replication  
b) They should be readily accepted by the cloning host  
c) They should be easily manipulated  
d) They should be capable of carrying a significant piece of donor DNA  
e) They should be resistant to restriction endonucleases
- 46) A molecular marker which is amplified by PCR and is polymorphic by length is a(n):  
a) Restriction fragment length polymorphism.  
b) Variable number of tandem repeats site.  
c) Amplified fragment length polymorphism.  
d) Single nucleotide polymorphism.
- 47) A nucleoside is a combination of  
a) Nitrogen base+sugar    b) Nitrogen base+phosphate  
c) sugar+phosphate        d) none
- 48) Restriction endonucleases are most widely used in recombinant DNA technology. They are obtained from  
a) Bacteriophages              b) Bacterial cells  
c) Plasmids                      d) All prokaryotic cells
- 49) PCR proceeds in three distinct steps governed by temperature, they are in order of  
a) Annealing, Synthesis, Denaturation  
b) Synthesis, Annealing, Denaturation  
c) Denaturation, Annealing, Synthesis  
d) Denaturation, Synthesis, Annealing
- 50) Nucleic acid segment tagged with a radioactive molecule is called  
a) Plasmid                      b) Probe  
c) Clone                        d) Vector
- 51) Which of these genetic markers is most likely to be highly polymorphic (have many different alleles)?  
a) An RFLP                      b) A microsatellite  
c) An SNP                        d) All of these
- 52) Plasmid has almost 20 different reorganization sites for-----  
a) Restriction endonucleases      b) restriction exonucleases  
c) a and b                        d) None of these
- 53) Which vehicles are often used for gene therapy to carry a healthy gene?  
a) BAC                              b) YAC  
c) Bacterial Vectors              d) Viral Vectors
- 54) Why might use of microsatellites in genetic mapping studies be an advantage over RFLPs?  
a) Microsatellites are easier to detect.  
b) Microsatellites are more abundant than RFLPs.  
c) Microsatellites have more potential alleles than RFLPs.  
d) All of these.
- 55) The addition of a phosphoryl group to a OH group of a sugar by a kinase is a form of:  
a) Dehydrogenation              b) Reduction  
c) Oxidation                        d) Esterification
- 56) In gene therapy, in order to be successful, the healthy gene inserted into a target cell must  
a) Take over and kill the defective gene  
b) Be inserted manually into the cell's mitochondria  
c) Become attached to the cell's mRNA molecules  
d) Be able to make the correct amount of the protein needed
- 57) Plasmids are suitable vectors for gene cloning because  
a) These can shuttle between prokaryotic and eukaryotic cells  
b) These are small circular DNA molecules with their own replication origin site  
c) These are small circular DNA molecules, which can integrate with host chromosomal DNA  
d) These often carry antibiotic resistance genes
- 58) Linkage mapping can determine the distance between which of the following pairs of DNA sequences?  
a) AFLPs and RFLPs              b) Two AFLPs  
c) Two known genes              d) All of these
- 59) Which one is a true statement regarding DNA polymerase used in PCR?  
a) It is isolated from a virus  
b) It remains active at high temperature  
c) It is used to ligate introduced DNA in recipient cells  
d) It serves as a selectable marker
- 60) For transformation, micro-particles coated with DNA to be bombarded with gene gun are made up of  
a) Silicon or Platinum              b) Gold or Tungsten  
c) Silver or Platinum              d) Platinum or Zinc



Sample Paper  
**Comprehensive examination M.Sc. Biotechnology**  
**Institute of Molecular Biology and Biotechnology (IMBB)**

Student Name: \_\_\_\_\_ Signature \_\_\_\_\_

Roll No.: \_\_\_\_\_ Time: 60 min Total Marks: 40

- Q No:1 What is tissue culture? Discuss the types of cultures and their importance used in tissue culture?
- Q No: 2 Define Genetic Engineering. Discuss steps of genetic engineering to design genetic constructs?
- Q No:3 Write a note on:  
a) Food preservation b) Advantages of GM foods
- Q No:4 Describe the essential biosafety equipment's for BSL-2?
- Q No:5 Define replication? What are the basic differences in prokaryotic and eukaryotic replication?
- Q No:6 What are the composting organism? What are the requirements for their proper functioning?



# Institute of Bio Technology

Bahauddin Zakariya University Multan

## Programme Details

### M.Sc. Molecular Biology & Biotechnology (Morning)

#### Core Courses for Comprehensive Exam Sessions 2014-16

S/No	Course No.	CourseTitle	Cr.Hrs
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#### Semester 01

1	Biotech-3	Mol.Biology II (F)	3
2	Biotech-5	Cell and Tissue Culture. (M)	3
3	Biotech-6	Elements of Biotechnology (M)	2

#### Semester 02

4	Biotech-9	Agriculture Biotechnology (M)	3
5	Biotech-10	Food Biotechnology (M)	3

#### Semester 03

6	Biotech-13	Recombinant DNA Technology (M)	3
7	Biotech-15	Metabolomics, Proteomics and Genomics (M)	2

#### Semester 04

8	Biotech-20	Environment Biotechnology (M)	3
9	Biotech-22	Bio-safety & Bioethics (M)	1





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## MOLECULAR BIOLOGY-II

(2 +1)

### COURSE OBJECTIVES:

To acquaint the student with the chemistry and biology of macromolecules.

### COURSE CONTENTS:

Mutations, Types of Mutations, Biochemical basis of Mutagenesis, Base- Analogue Mutagens, chemical Mutagens, Intercalating Agents, Reversion, Transcription, Basic Features of RNA synthesis, Enzymology of RNA synthesis, RNA chain synthesis Initiation, elongation and Termination, Transcription in Eukaryotes, Post-transcriptional Modifications, Translation, Genetic code, codons, Decoding system, Role of mRNA, Role of tRNA, chemical composition of Ribosomes, initiation of protein synthesis, Elongation of polypeptide chain, Termination of polypeptide chain, Difference between protein synthesis in prokaryotes and Eukaryotes, Post-translational Modifications, Regulation of Genes and gene products in prokaryotes, Regulation in Eukaryotes, Protein sorting and transport. DNA repair mechanisms.

### Practicals:

Restriction digestion of DNA and preparation of restriction maps, Gel Electrophoresis, PCR, Blotting Techniques, RNA isolation and RT-PCR.

### RECOMMENDED TEXT BOOKS:

1. Molecular Biology by Daved Freifelder. Jones & Barlet Publisher, Boston
2. Molecular Biology of the cell by B. Alberts. D. Brag, J. Lewis. M. Raff, K. Roberts and J. D. Watson, Garland Publishers. Jones & Barlet Publisher, Boston



2

## CELL AND TISSUE CULTURE

(2+1)

### COURSE OBJECTIVES:

To acquaint the student with the techniques to produce disease free plant material.

### COURSE CONTENTS:

Cell and Plant Tissue culture, Introduction, history and importance, Methods of cell and tissue culture, callus culture, organogenesis, somatic embryogenesis, protoplast isolation and fusion, anther and pollen culture Micropropagation, improvement of Plants via Plant cell culture, production of variant plants from selected cells, selection for stress tolerance, production of disease resistant plant material.

### Practicals:

Preparation of stock and working solutions, preparation of culture media (liquid) semi-liquid and semi-solid) Explants preparation, callus culture and organogenesis. Preparation and fusion of protoplasts.

### RECOMMENDED TEXT BOOKS:

1. Plant Tissue culture manual. K. Lindeseg Kluwer. Academic Publisher, The Netherlands
2. Principles of Tissue Engineering, R.P. Lanza, R. Langer and J. Vacantuy. Academic Press, California, USA.



**COURSE OBJECTIVES:**

To acquaint the student with the importance and basic concepts of biotechnology.

**COURSE CONTENTS:**

The cell its organelles and their functions, growth requirements, Characteristics and Industrial importance of algae, fungi and bacteria, Glycolytic pathway and enzymes, fermentative ethanol production, High- energy compounds and coenzymes, TCA cycle and its metabolic and industrial importance, Protein structure, synthesis and function, Nucleic acids and microbial strain selection techniques, Cell growth parameters, fermentor assembly and systems, cultivation conditions, sterilization and inoculation procedures, Biomass and Single-Cell Protein production. Aerobic and anaerobic yeast fermentations: products & processes.

**RECOMMENDED TEXT BOOKS:**

1. Principles of Plant Biotechnology an introduction to Genetic Engineering in plants. S. H. Mantel, J. A. Mathews, R. A. Mecee, Blackwell Scientific Publication Oxford, London, Boston.
2. Biotechnology in 21<sup>st</sup> century, Ayyana, C. McGraw Hill.
3. Shuler, M.L. and F. Kargi. 1992. Bioprocess Engineering, Prentice-Hall, Englewood Cliffs, NJ.
4. Bailey, J.E. and D.F. Ollis. 1986. Biochemical Engineering Fundamentals, 2nd ed. McGraw - Hill, New York.
5. Parashar, R.L.M. Parsh, 1993. Plant Biotechnology: Commercial Prospects and Problems, Intergraph
6. Peter M. Gresshoff, 1992. Plant Biotechnology and Development, CRC Press
7. Adrian Slater, Nigel W. Scott, Mark R. Fowler, 2008. Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.
8. Sheela Srivastava, Alla Narula, S. S. Shrivastava, Inc NetLibrary, 2004. "Plant
9. Biotechnology and Molecular Markers" publishers Springer link
10. H.S. Chawla, 2002 "Introduction to Plant Biotechnology" Second Edition, ISBN 978-1-57808-228-5, 562 Pages, Science publishers, USA
11. S. Harding, 2007. Biotechnology and Genetic Engineering Reviews, V. 24, Nottingham University Press
12. Jane K Setlow, 2003. Genetic Engineering: Principles and Methods, Springer
13. National Biosafety Guidelines Biosafety rules 2005
14. Clarence Swisher, Carol Wekesser, 1996, Genetic Engineering, Lucent Books



**COURSE OBJECTIVES:**

To acquaint the students with the techniques to develop skills to produce Transgenic Crops.

**COURSE CONTENTS:**

The concepts of Plant Molecular Markers, Historical Back ground of Tissue Culture, Requirements for in-vitro cultures, Role of Phyto- hormones in somatic embryogenesis, Types of Cultures: Tissue culture and regeneration, Cell culture, Haploid Culture, Protoplast culture. Somaclonal variations as breeding tool, Somatic Hybridization, Commercial application and Issues related to tissue culture, Plant Transformation; Gene Gun Method of Transformation, *Agrobacterium*- Mediated transformation, Chloroplast Transformation, PEG mediated transformation etc, Field Evaluation and Commercialization, Transgenic crops for Herbicide, Biotic and Abiotic stress resistance, Introduction to Biofertilizers. Biosafety Concerns and Bioethics on GM crops.

**Practical:**

Selection of ex-plant, Medium Preparation and Callus Induction, Culturing *Agrobacterium* and Infection to plant callus, Selection of Transformants, Regeneration of Plantlets and acclimatization, Plant DNA extraction and PCR for Trans gene.

**RECOMMENDED TEXT BOOKS:**

1. Jitendra Prakash, R.L.M. Pierik, 1993. Plant Biotechnology: Commercial Prospects and Problems, Intercept
2. Peter M. Gresshoff, 1992. Plant Biotechnology and Development, CRC Press
3. Adrian Slater, Nigel W. Scott, Mark R. Fowler, 2008. Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.
4. Sheela Srivastava, Alka Narula, S. S. Bhojwani, Inc NetLibrary, 2004 "Plant
5. Biotechnology and Molecular Markers" publishers Springer link
6. H.S. Chawla, 2002 "Introduction to Plant Biotechnology" Second Edition, ISBN 978-1-57808-228-5; 562 Pages, Science publishers, USA
7. S Harding, 2007. Biotechnology and Genetic Engineering Reviews: V. 24, Nottingham University Press
8. Jane K Setlow, 2003. Genetic Engineering: Principles and Methods, Springer
9. National Biosafety Guidelines Biosafety rules 2005
10. Clarice Swisher, Carol Wekesser, 1996. Genetic Engineering, Lucent Books



## **FOOD BIOTECHNOLOGY (2+1)**

### **COURSE OBJECTIVES:**

To acquaint the student with the role of microorganisms in food and food industry, and also with the principles of enzymology, and food engineering.

### **COURSE CONTENTS:**

Food composition, proximate analysis. Probiotics. Fermented foods, Food enzymes, colors and additives, Microbial Food spoilage and food born disease, Food preservation methods, Food engineering principles, Modified atmospheric packaging, Food marketing principles. Mathematical Modeling in food technology. Microbial biotechnology of food flavors production, oil and fats, dairy products, meat and cereal foods, Food Safety and quality control.

#### **Practical:**

Estimation of moisture, ash, carbohydrates, protein, fat, crude fiber in food, Detection of proteases, amylases in milk. Determination of iodine number of fats. Determination of specific gravity of sugar. Separation of gluten from wheat flour. Detection of E.coli in drinking water. Detection of yeast and mould in dairy and bakery products. Production of cheese.

### **RECOMMENDED TEXT BOOKS:**

1. Food Biotechnology by Ulf Stahl, Ute E.B. Donalies and Elke Nevogit, 2008.
2. Food colors, flavors and additives technology by NIIR, National Institute of industrial research, Dehli, India 2007.
3. Biotechnology and food processing by Meenakshi Paul, 2007
4. Food Biotechnology, edited by K. Shetty et al, 2<sup>nd</sup> edition, 2006.
5. Fundamentals of food Biotechnology, Dyong H.Lee, 1996 Food Chemistry, lab. Manual by Dennis D. Miller, Willey Inter science. , 1998
6. Food analysis Manual by Javid Aziz Awan.2000.
7. Biotechnology and our Food by Joan Nordquist, Mass Market paper back, 2000



## **RECOMBINANT DNA TECHNIQUES (2+1)**

### **COURSE OBJECTIVES:**

To acquaint the students with Basic techniques and tools used in gene manipulation and its practical uses.

### **COURSE CONTENTS:**

Introduction and History of Recombinant DNA technology, Basic techniques, gel electrophoresis, Blotting techniques, restriction endonucleases, restriction mapping, vectors and their types, cloning vectors, transformations, Polymerase Chain reaction, Cloning strategies, Site-directed mutagenesis. Sequencing strategies, Application of recombinant DNA Technology (agriculture, health, industry, environment and basic research).

### **Practicals:**

DNA and plasmid isolation and agarose gel electrophoresis, conjugation, transformation, role of mutagenic agents in mutation, Blotting techniques.

### **RECOMMENDED TEXT BOOKS:**

1. Robert F.W., 2005. Molecular Biology. McGraw-Hill.
2. Dale, J.W. and von Schantz, M. 2002. From Genes to Genomes: Concepts and Applications of DNA Technology. John-Wiley and Son Limited.
3. Meyers, R.A., 2006. Genomics and Genetics. John-Wiley and Son Limited.
4. Primrose, S.B., and Twyman, R.M. 2006. Gene Manipulation and Genomics 6<sup>th</sup> edition. Blackwell Publishing.
5. Watson, J.M., Caudy, A.A., Meyers, R.A., and Witkowski, J.A., 2007. Recombinant DNA. Gene and genomes. 3<sup>rd</sup> Edition. W.h. Freeman and Company, New York.



## **METABOLOMICS, PROTEOMICS AND GENOMICS (2+0)**

### **COURSE OBJECTIVES:**

To acquaint the students with structural and functional genomics, proteomics and metabolomics

### **COURSE CONTENTS:**

Structural genomics, Organization and Structure of the Genomes, Genetic Mapping, Transcript Mapping, Structural Variation in the Genomes, Genomics and proteomics, Molecular Biology of Proteins, Posttranslational modifications, Molecular mechanisms of cellular communication/signaling pathways, Protein-Protein Interactions, receptor identification and characterization, Integral Membrane Proteins and Ion Channels, Advance techniques used in proteomics (MS, LCMS/MS, ICAT, iTRAQ). Introduction to Metabolomics, detection, profiling, analysis and engineering. Microarray and RNA interference.

### **RECOMMENDED TEXT BOOKS:**

1. "Handbook of comparative genomics: principles and methodology" by Cecilia Saccone, Graziano Pesole (2003). Published by Wiley-Liss,
2. Functional genomics by Chris Town (2002). Published by Springer.
3. Human Molecular Genetics-3 by T. Strachan, Andrew P. Read Published by Garland Science, 2004
4. Genes IX by Benjamin Lewin . Published by Jones and Bartlett Publishers, 2007
- 5 Systems Biology by Mohamed Al-Rubeai (2006), Martin Fussenegger Published by Springer
6. Environmental Microbiology: Principles and Applications, 2nd Edition, by David R. Boone and David M. Brock, ASM Press
7. Environmental Microbiology: Principles and Applications, 2nd Edition, by David R. Boone and David M. Brock, ASM Press
8. Environmental Microbiology: Principles and Applications, 2nd Edition, by David R. Boone and David M. Brock, ASM Press
9. Environmental Microbiology: Principles and Applications, 2nd Edition, by David R. Boone and David M. Brock, ASM Press
10. Environmental Microbiology: Principles and Applications, 2nd Edition, by David R. Boone and David M. Brock, ASM Press
11. Environmental Microbiology: Principles and Applications, 2nd Edition, by David R. Boone and David M. Brock, ASM Press
12. Environmental Microbiology: Principles and Applications, 2nd Edition, by David R. Boone and David M. Brock, ASM Press
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19. Environmental Microbiology: Principles and Applications, 2nd Edition, by David R. Boone and David M. Brock, ASM Press
20. Environmental Microbiology: Principles and Applications, 2nd Edition, by David R. Boone and David M. Brock, ASM Press



## ENVIRONMENTAL BIOTECHNOLOGY

(2+1)

### COURSE OBJECTIVES:

To acquaint the students with conservation and reclamation of environment through biotechnology.

### COURSE CONTENTS:

Introduction to Environmental biotechnology, Fundamentals of Biological Intervention, Genetic manipulation strategies in environmental biotechnology, Pollution indicators, Pollution control strategies, Biology of Waste water and its treatment, Sludge treatment, Contaminated land and bioremediation, Aerobes and Effluents, Phytotechnology (Terrestrial Phyto-systems, Metal Phytoremediation, Rhizofiltration etc) Hyper accumulation, Solid Waste treatments, Concept of integrated Environmental biotechnology, Detoxification of hazardous chemicals: biodegradation, Biotransformation, Products of environmental biotechnology.

### Practical:

Biodegradation of environmental pollutants by microorganisms, Bacteriology of Drinking water, Microscopic studies of water specimens collected from various locations, Field survey of polluted areas, Field study for pollution indicators (Plants, Microorganisms).

### RECOMMENDED TEXT BOOKS:

1. Christon Hurst, Ronald Crawford, Jay Garland, David Lipson, Aaron Mills and Linda Stetzenbach (2007) Manual of Environmental Microbiology. 3<sup>rd</sup> Ed. Blackwell Publishers
2. Christopher F. Faster and D. A John Wase, John Wase (2004) Environmental Biotechnology. John Willey & Sons.
3. Derek R. Lovley (2000) Environmental Microb-Metal Interactions. ASM Press.
4. Environmental Biotechnology by Bhattacharyya and Rintu Banerjee (Paperback - Mar 1, 2007) OUP India.
5. Environmental Biotechnology by Bruce E. Rittmann and Perry L. McCarty (Paperback - Jan 1, 2001). McGraw-Hill Publishing Co.
6. Environmental Biotechnology Theory and application, 2003. Gareth M Evans and Judith C. Furlong. Wiley Publishers.
7. Environmental Biotechnology, 2008. T. Srinivas New Age international Publishers.
8. Environmental Microbiology: Methods and Protocols (Methods in Biotechnology) by John F. T. Spencer and Alicia L. Ragout de Spencer (Hardcover - Jul 15, 2004) Humana Press; 1 edition.
9. Laqrence P. Wackett (2001) Biocatalysis and Biodegradations: Microbial Transformation of Organic Compounds. ASM Press



## BIOSAFETY AND BIOETHICS

(1+0)

### COURSE OBJECTIVES:

To acquaint students with principles of biosafety and ethical perspectives of Biotechnological systems.

### COURSE CONTENTS:

Introduction to Biosafety (Definition, Concept, Uses and abuses of genetic information, Biohazards), Good Laboratory Practices, Risks Related to GMOs, International Rules & regulations for Biosafety & GMOs. Introduction to Bioethics, Ethical issues regarding GMOs, Euthanasia, Issues related to Reproductive & Cloning technologies, Issues to transplants and Eugenics, Patenting, Commercialization and Benefits Sharing, role of National Bioethic committees.

### RECOMMENDED TEXT BOOKS:

1. WHO. -2006. Laboratory Biosafety manual third edition. AITBS publishers and distributors, India. (Available online free of cost).
2. Lewis RJ. Sax dangerous properties of Industrial materials, 10th edition. Toronto, John Wiley and sons, 1999.
3. Lenga RE. 1988. The Sigma-Aldrich Library of chemical safety data, 2<sup>nd</sup> ed. Milwaukee, WI, Aldrich chemical company.
4. Furr AK. 2000. CRC handbook of laboratory safety 5<sup>th</sup> edition. Boca Raton, FL, CRC press.
5. United states Department Health and Human services. 1999. Biosafety in Microbiological and biomedical laboratories. 4<sup>th</sup> edition. Centers for disease control and prevention/National institutes of Health, Washington DC.
6. Biosafety in the Laboratory: Prudent Practices for Handling and Disposal of Infectious Materials Committee on Hazardous Biological Substances in the Laboratory, National Research Council ISBN: 0309-55920-0, (1989) available from the National Academies Press at: <http://www.nap.edu/catalog/1197.html>
7. Genes Technology and Policy. Jose Maria A. Ochave 2003 <http://www.apdip.net/publications/iespprimers/eprimer-genes.pdf>
8. Bioethics & Biosafety in Biotechnology by V Sree Krishna.