

**JECRC UNIVERSITY
SCHOOL OF SCIENCES
SESSION 2015-16**

Details of B. Sc. Hons. Microbiology course with various papers and their credits with contact hours are given below:

Semester I

Subject Code	Subject	Lecture (Hrs.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total Credits	
					L	P		
BMI 001A	Core 1 Physicochemical Techniques	4		2	4	2	6	
BMI 003A	Core 2 Microbial Diversity	4		2	4	2	6	
BMI 005A	Core 3 Biochemistry	4		2	4	2	6	
BMC 051A	Environmental Science	2			2		2	
BMC 001A BMC 002A	Fundamentals of Computers Fundamentals of Computer Lab-I	4			2	2	4	
BMI 007A	Seminar I	3			3		3	
Total								27

Semester II

S. No.	Subject	Lecture (Hrs.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total credits	
					L	P		
BMI 008A	Core 1 Bacteriology	4		2	4	2	6	
BMI 010A	Core 2 Immunology	4		2	4	2	6	
BMI 012A	Core 3 Mycology	4		2	4	2	6	
BMC 102A	Communication Skills-I	3			3		3	
BMC 003A	Computers Application-II(Advanced MS Excel)	3				3	3	
BMI 014A	Seminar II	3			3		3	
Total								27

Semester III

S. No.	Subject	Lecture (Hrs.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total credits	
					L	P		
BMI 015A	Core 1 Phycology	4		2	4	2	6	
BMI 017A	Core 2 Virology	4		2	4	2	6	
BMI 019A	Core 3 Molecular biology	4		2	4	2	6	
BMC 105A	Communication Skills-II	3			3		3	
BMC 004A	Computer Applications- III(MS-Projects)	3					3	
BMI 021A	Seminar III	3			3		3	
Total								27

Semester IV

S. No.	Subject	Lecture (Hrs.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total credits	
					L	P		
BMI 022A	Core 1 Microbial Genetics	4		2	4	2	6	
BMI 024A	Core 2 Biostatistics	4		2	4	2	6	
BMI 026A	Core 3 Environmental microbiology	4		2	4	2	6	
BMC 111A	Communication Skills-III	3			3		3	
BMC 005A	Computer Applications- IV(Web Designing)	4			2	2	4	
BMC 006A	Computer Applications- IV(Web Designing Lab)							
BMI 028A	Seminar-IV	3			3		3	
Total								28

Semester V

S. No.	Subject	Lecture (Hrs.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total credits
					L	P	
BMI 029A	Core 1 Microbial Physiology	4		2	4	2	6
BMI 031A	Core 2 Food Microbiology	4		2	4	2	6
BMI033A	Core 3 Medical Microbiology	4		2	4	2	6
BMC 113A	Communication Skills-V	3			3		3
BMC 109A	Value Education	3			3		3
BMI 035A	Basic Techniques for Instrumentation	6			6		6
BMI 036A	Seminar- V	3			3		3
							33

Semester VI

S. No.	Subject	Lecture (Hrs.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits		Total credits
					L	P	
BMI 037A	Project	44			44		44
BMC 038A	Seminar	2			2		2
							46

Total Credits

Credits	I Sem	II Sem	III Sem	IV Sem	V Sem	VI Sem	Total
	27	27	27	28	33	46	188

B. Sc. Microbiology

Semester –I				
Course Code	Title	L	P	C
BMI 001A	Physicochemical Techniques	4		4
BMI 002A	Instrumentation Lab		2	2
BMI 003A	Microbial Diversity	4		4
BMI 004A	Microbial Diversity Lab		2	2
BMI 005A	Biochemistry	4		4
BMI 006A	Biochemistry Lab		2	2
BMI 007A	Seminar			3
	Total Credits	21		
Semester –II				
BMI 008A	Bacteriology	4		4
BMI 009A	Bacteriology Lab		2	2
BMI 010A	Immunology	4		4
BMI 011A	Immunology Lab		2	2
BMI 012A	Mycology	4		4
BMI 013A	Mycology Lab		2	2
BMI 014A	Seminar			3
	Total Credits	21		
Semester –III				
BMI 015A	Phycology	4		4
BMI 016A	Phycology Lab		2	2

BMI 017A	Virology	4		4
BMI 018A	Virology Lab		2	2
BMI 019A	Molecular biology	4		4
BMI 020A	Molecular biology Lab		2	2
BMI 021A	Seminar			3
	Total Credits		21	
Semester –IV				
BMI 022A	Microbial Genetics	4		4
BMI 023A	Microbial Genetics Lab		2	2
BMI 024A	Biostatistics	4		4
BMI 025A	Biostatistics Lab		2	2
BMI 026A	Environmental microbiology	4		4
BMI 027A	Environmental microbiology Lab		2	2
BMI 028A	Seminar			3
	Total Credits		21	
Semester –V				
BMI 029A	Microbial Physiology	4		4
BMI 030A	Microbial Physiology Lab		2	2
BMI 031A	Food Microbiology	4		4
BMI 032A	Food Microbiology Lab		2	2
BMI 033A	Medical Microbiology	4		4
BMI 034A	Medical Microbiology Lab		2	2
BMI 035A	Basic Techniques for Instrumentation			6
BMI 036A	Seminar			3

	Total Credits	27		
Semester –VI				
BMI 037A	Project Training		44	44
BMI 038A	Seminar			2
	Total Credits	46		

Microbiology

Course Objective

- 1) To familiarize students with fundamental concept of basic techniques and their applications.
- 2) It is expected that the knowledge gained through this course will make student competent to meet the challenges of academic and professional courses.
- 3.) To train the student in various aspects related to applied microbiology and medical microbiology.

BMI 001A Physicochemical Techniques

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit-I

General lab Instruments: principle, working and applications of pH meter, Autoclave, laminar, calorimeter, spectrophotometer, centrifuge, waterbath, vortex mixer, oven, incubator and colony counter.

Microscopy: light microscopy and electron microscopy.

Unit -II

Centrifugation: types, working, principle and applications

Electrophoresis: types, working, principle and applications

Unit - III

Radioisotopic Techniques: Types of radioisotopes used in Biochemistry, units of radioactivity measurements, isotopes commonly used in biochemical studies – ^{32}P , ^{35}S , ^{14}C and ^3H).

Unit IV

Autoradiography. Biological hazards of radiation and safety measures in handling radioisotopes. Biological applications of radioisotopes.

Unit V

Chromatography: types, working, principle and applications
Spectroscopic Techniques: Beer-Lambert law, light absorption and its transmittance, determination and application of extinction coefficient, application of visible and UV spectroscopic techniques.

Suggested Readings:

1. Textbook of optics and atomic physics – P.P. Khandelwal (Himlaya Publishing House)
2. Nuclear physics an introduction – S.B. Patel (New Age International)
- Biophysics – Pattabhi and Gautham (Narosa Publishing House)
3. Instrumentation measurements and analysis – Nakara, Choudhari (Tata Mc Graw Hill)
4. Handbook of analytical instruments – R.S. Khandpur (Tata Mc Graw Hill)
5. Perspectives of modern physics – Arthur Beiser (Mc Graw Hill)
6. Introduction to atomic spectra – H.E. White (Mc Graw Hill)

7. Molecular cell biology – Ladish, Berk, Matsudara, Kaiser, Krieger, Zipursky, Darnell (W.H. Freeman and Co.)

BMI 002A Laboratory exercise

- 1) Demonstration of laboratory rules, basic requirements in a microbiological laboratory and safety measures.
- 2) Explanation of principles and various methods of sterilization.
- 3) Demonstration of the components, use and care of bright field microscope.
- 4) Determination of size of a given microorganism using micrometry.
- 5) Demonstration of the pH meter and determination of pH of a given sample.
- 6) Demonstration of centrifuge and separation of serum and cells from blood sample.
- 7) Demonstration of electrophoresis.
- 8) Separation of chlorophyll a and b using paper chromatography.
- 9) Separation of amino acids using TLC.
- 10) Explanation of Beer – Lamberts' Law.
- 11) Demonstration of colorimeter.
- 12) Explanation of biohazards of radiations.

BMI 003A Microbial Diversity

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit-I

Overview of history of Microbiology - Biogenesis and abiogenesis Contributions of Redi, Spallanzani, Needham, Pasteur, Tyndal, Joseph Lister, Koch [Germ Theory], Edward Jenner and Flemming, Scope of Microbiology. Classification of Microbes – Systems of classification, Identifying characters for Classification, General properties and principles of classification of microorganisms Systematics of bacteria and Nutritional types. Classification on the basis of oxygen requirement.

Unit -II

Bacterial Morphology and subcellular structures: Morphology of bacteria, Slime layer, Capsule, Cell wall, Ribosome, Cytoplasmic membrane, Cytoplasmic inclusion bodies - inorganic, organic; Exospores & Cysts: types & structure.

Unit -III

Endospore, Flagella, Pilus, Fimbriae (structure, composition and functions). Plasmids and episomes. Nuclear material, Bacterial Chromosome (Fundamental differences with eukaryotic chromosome). Bacterial cell wall biosynthesis and structure.

Unit -IV

Brief description of eukaryotic Algae , Fungi and protozoa : General characteristics, vegetative and reproductive structure of Protozoa: *Giardia*, *Entamoeba* and *Plasmodium*

Unit -V

General Properties of other viruses, viroids and prions : Viroids, prions, Filamentous DNA phages, Single stranded RNA phages, Virus of Plants, Vaccinia and Simian virus of animals.

Suggested Readings:

1. Stanier, RY., et al., General Microbiology, 5th ed.,2000, Tata-McGraw Hill
2. Atlas, RM., Principles of Microbiology, 2nd ed.,1997, McGraw-Hill

BMI 004A Laboratory exercise

- 1) Preparation of microscopic slides using various microbial samples.
- 2) Preparation of bacterial smear.
- 3) Simple staining of bacteria and fungi.
- 4) Identification of common morphological forms of bacteria.
- 5) Identification of Cyanobacteria (blue-green algae).
- 6) Identification of some common fungi (*Aspergillus*, *Penicillium*, *Mucor* and *Rhizopus*).
- 7) Identification of common algae.
- 8) Demonstration and explanation of different types of viruses.
- 9) Gram staining.
- 10) Temporary wet mount (TWM) technique for microscopic observation of living microorganism.
- 11) Microscopic examination of free-living protozoa of a pond.
- 12) Hanging drop technique demonstrating motility of Bacteria.

BMI 005A BIOCHEMISTRY

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit I

Introduction to biochemistry, scope and importance Molecular interactions, The concept of pH, dissociation and ionization of acids and bases.

Classification and biological importance of Carbohydrates; Glycolysis, Citric acid cycle.

Unit II

Classification, structure, properties and biological importance of Amino acids and Proteins; biologically active peptides, structure of proteins-primary, secondary, tertiary and quaternary; Transamination, Deamination, Urea cycle

Unit III

Classification and biological importance of lipids; Biosynthesis and β -oxidation of palmitic acid.

Chemical properties and characterization of Fats, Waxes, cerebrosides, gangliosides, phospholipids and proteolipids.

Unit IV

Definition and classification of enzymes. Enzymes: as biocatalyst, classification, specificity, active site, isozymes.

Unit V

Definition and classification of vitamins. Inborn error of metabolism, vitamin deficiency diseases. Vitamins: Structure and biochemical properties of water soluble and fat soluble vitamins and their coenzyme activity.

Suggested Readings:

- Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IVEdition. W.H Freeman and Co.
- Biochemistry. XXVIII Edition. Lange Medical Books/McGraw-Hill.
- Biochemistry, Berry, A.K. Emkey Pub. New Delhi.

- Donald Voet and Judith G. Voet Biochemistry, John Wiley and Sons., New York.
- Lubert Stryer, Biochemistry International Student edition W.H. Freeman and Company, New York.
- H.S. Srivastava, Element of Biochemistry, Rastogi Publications Meerut.
- Leninger, A.D. Principles of Biochemistry, CBS Publishers and Distributors, Shahdra, Delhi.
- Jain,J.L.Fundamentals of Biochemistry ,S.Chand publishers New Delhi.
- Murray, R.K.,Harper’s Biochemistry;Appleton and Lange , Norwalk,Connecticut

BMI 006A Laboratory exercise

- 1) Qualitative test (Molisch’s test) for presence of the carbohydrates in a given sample.
- 2) Iodine test for presence of Starch in a given sample.
- 3) Benedict’s test for presence of reducing sugars in a given sample.
- 4) Fehling’s test for presence of reducing sugars in a given sample.
- 5) Ninhydrin test for the presence of amino acids in a given sample.
- 6) Xanthoproteic test for the presence of aromatic amino acids in a given sample.
- 7) Biuret test for the presence of peptides or proteins in a given sample.
- 8) Solubility test for lipids.
- 9) Qualitative test for the presence of fatty acids by titrimetric method.
- 10) Determination of acid value of fats and oil.
- 11) Determination of iodine number of a fat sample.
- 12) Measurement of Riboflavin (Vitamin B2) in a given sample.

II semester

BMI 008A Bacteriology

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit I

Form and function of bacteria : Internal structure, Bacterial shapes and arrangement, cell membrane, cell wall of bacteria, inclusion bodies, flagella, capsule, slime, fimbriae and pilli. Bacterial endospores – structure, formation and germination.

The world of bacteria- A brief outline of salient features of major bacterial groups according to Bergey’s manual of systematic Bacteriology Volume I and II.

Unit II

Gram negative Eubacteria: The Spirochetes ,Aerobic/microaerophilic, motile, helical/vibroid, Gram negative Bacteria.Non motile , Gram negative curved bacteria. Aerobic Gram negative

rods and Cocci .Facultative anaerobic Gram negative rods, Anaerobic Gram negative straight, curved and helical rods.

Unit III

Dissimilatory sulphate or sulphur reducing bacteria. Anaerobic Gram negative Cocci. Rickettsia, Chlamydia , Mycoplasmas.

Unit IV

Gram positive Eubacteria: Gram positive Cocci ,endospore forming Gram positive bacteria, Nonspore forming Gram positive Rods of regular shape ,Nonspore forming Gram positive Rods of irregular shape, Mycobacterium .

Unit V

Archaeobacteria: Methanotrophs and Halophils, Cultivation of Bacteria: growth of bacteria, growth curve, environmental factors affecting growth.

Suggested Readings:

1. General Microbiology, 7th edition, H S Schlegel, Cambridge University Press, 1995
2. Microbiology ,5th edition M J Pelczar, E C S Chan, N R Kreig, Tata Mc Graw Publication, 2006
3. Microbiology-a Laboratory Manual, 6th edition, J G Cappuccino and N Sherman, Addison Wesley, Pearson Education, Inc., 2006
4. Microbiology-an introduction, 9th edition G.J. Tortora, B.R. Funke, C.L. Case Pearson Education, Inc., 2007

BMI 009A Laboratory exercise

- 1) Gram staining
- 2) Negative staining for capsule
- 3) Flagella staining
- 4) Endospore staining
- 5) Acid fast staining
- 6) Explanation of Culture media and their types.
- 7) Demonstration of sterilization by moist heat using autoclave.
- 8) Preparation of culture media – liquid and solid media.
- 9) Demonstration of selective and differential media.
- 10) Demonstration of culture inoculation techniques – spread plate, streak plate and pour plate methods
- 11) Demonstrations of pure culture techniques – streak plate, pour plate and serial dilution method.
- 12) Demonstration of cultivation of Anaerobic bacteria.

BMI 010A Immunology

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit I

Overview of immune system; innate immunity and adaptive immunity

Cells and Organs of immune system: lymphocytes, mononuclear phagocytes, granulocytic cells, primary and secondary lymphoid organs

Unit II

Antigens: Properties of antigens, Adjuvants, Haptens.

Antibodies: Basic structure, classes and function, Polyclonal sera, Monoclonal antibodies

Unit III

Antigen- Antibody interaction: precipitation reaction, agglutination reaction, neutralization reaction, lytic reaction and phagocytic reaction.

Unit IV

Complement pathway (Classical and Alternative pathway), Major histocompatibility complex: Structure and functions.

Unit V

Immune System in Health and Disease: Brief introduction to Vaccines, Immunodeficiency and autoimmunity.

Suggested Readings

Kindt, T. J., Goldsby, R. A., Osborne, B. A., Kuby, J. (2006). VI Edition. Immunology. W.H. Freeman and Company.

Delves, P. J., Martin, S. J., Burton, D. R., Roitt, I.M. (2006). XI edition. Roitt's Essential Immunology, Blackwell Publishing

BMI 011A Laboratory exercise

- 1) Demonstration of the bacterial flora of the skin.
- 2) Demonstration of dermatophytes.

- 3) Isolation of microbial flora of mouth (from saliva).
- 4) Isolation of microbes from upper respiratory tract (from Throat).
- 5) Isolation of enteric pathogens (Coli form bacteria).
- 6) Determination of human blood group.
- 7) Determination of Rh factor of human blood.
- 8) Demonstration of the Widal test.
- 9) Estimation of RBCs in a given blood sample.
- 10) Estimation of WBCs in a given sample.
- 11) Determination of differential blood count of WBCs in given blood sample.
- 12) Estimation of hemoglobin in a given sample.

BMI 012A MYCOLOGY

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit I

Introduction to fungi. History, General features, thallus organization, asexual and sexual reproduction, life cycle biological and economic importance of fungi.

Unit II

What is Diseases. Important symptoms of plant disease caused by fungi and control measures.

Unit III

Classification of fungi (Saccardo, Alexopolus and Mims and Ainsworth). Brief general account, structure, importance and life cycle of some important classes of fungi viz. (Myxomycetes, Phycomycetes, Oomycetes and Zygomycetes).

Unit IV

Brief general account, structure, importance and life cycle of some important classes of fungi (Ascomycetes, Basidiomycetes and Deuteromycetes).

Unit V

Culture of Fungi (media types). Identification and Description of some commonly occurring fungi of Rhizosphere.

Suggested Readings:

1. Vashishtha, B.R Botany for Degree students (Fungi). S.Chand and Company. New Delhi.
2. Dube H.C Fungi Rastogi Publication. Merrut
3. Sarabhai and Saxena A Text Book of Botany. Rastogi Publication. Merrut.
4. Sharma. O.P. Fungi, Today and Tomorrow Publication. 2000
5. Alexopolus and Mims. Introductory Mycology. John Wiley and Sons. New York. 2000.
6. Mehrotra and Aneja. An Introduction to Mycology.

BMI 013A Laboratory Exercises

- 1) Demonstration of culture techniques for fungi.
- 2) Demonstration of the dimorphic fungi and the difference between yeast and molds.
- 3) Isolation and identification of fungi from soil.
- 4) Isolation and identification of fungi from air.
- 5) Isolation and identification of fungi from spoiled food (bread).
- 6) Isolation and identification of fungal plant pathogen from leaves, stems and other aerial parts of the plants.
- 7) Study of the symptoms and life cycle of important plant disease caused by fungi of classes – Myxomycetes, Oomycetes, Phycomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes.
- 8) Isolation and identification of fungal human pathogens (dermatophytes) from skin.
- 9) Study of the human diseases caused by fungi – superficial mycosis, subcutaneous mycosis and systemic mycosis.
- 10) Demonstration of bread production using baker's yeast.
- 11) Demonstration of alcohol production using brewer's yeast.
- 12) Identification of edible and poisonous mushrooms.

Semester-III

BMI 015A Phycology

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit I

Algae - General characteristics; Ecology and distribution, Range of thallus organization and reproduction; Basic criteria used in classification (Fritsch, and Smith)

Unit II

Important classes in relation to applied Phycology listed below (one member in each class)

Cyanophyceae, Chlorophyceae, Xanthophyceae and Phaeophyceae. *Nostoc*, *Volvox*, *Chlamydomonas*, *Vaucheria*, *Ectocarpus* and *Polysiphonia*.

Unit III

Economic importance of algae,
algal ecology, role in biotechnology.

Unit IV

Lichen- ascolichen, basidiolichen, deuterolichen.

Economic Importance of lichen.

Suggested Reading

1. Gilbert, M. Smith, Cryptogamic Botany Vol I and II, IInd Ed. Tata McGraw Hill Publishing Company Ltd. N.D. 1985.
2. Glemawat M.S., Kapoor, J.N. and Narayan H.S. : A text book of Algae. Ramesh Book Depot. Jaipur 1976.
3. Kumar. H.D. Introductory Phycology. Affiliated East-West Press Ltd., Newyork 1988.
4. Singh V., Pande P.C. and Jain D.K. A Text Book of Botany Rastogi and Co. Merrut, 2001.

BMI 016A Laboratory Exercises

- 1) Isolation and identification of blue-green algae from pond water.
- 2) Isolation and identification of algae from soil.
- 3) Determination of algal growth.
- 4) Study of class work material by making suitable temporary slides of *Nostoc*, *Volvox*, *Chlamydomonas*, *Chlorella*, *Vaucheria*, *Ectocarpus*, *Polysiphonia*.
- 5) Demonstration of photosynthesis by algae.

BMI 017A Virology

L	T	P	C
4	-	2	6

Contact Hours: 60
Credits: 04

Unit I

Brief history on discovery of virus. Nomenclature and classification(LHT and as per VII report of the international committee on taxonomy of viruses)Distinctive properties of virus.

Unit II

Morphology and ultrastructure (capsid, envelop and viral genome, their types and structure).

Unit III

Virus related agents (viroids,Prions)Bacteriophage,(structural organization life cycle.) Plant Virus: Classification and nomenclature,general symptom and effect of virus on plant(paddy, tomato and sugarcane).

Unit IV

Animal viruses: Classification and nomenclature. Epidemiology, replication, pathogenicity prevention and treatment of RNA virus, Picorna virus, Rhabdovirus, HIV virus and DNA virus, Pox virus, Herpes virus and Hepatitis virus.

Unit V

Transmission of plant virus.Virus of cyanobacteria and fungi. Cultivation of virus on embryonated eggs, experimental animals and cell cultures.

Suggested Readings:-

Dimmock Nj PrimroseS B.(1994) Intro. to Modern Virology IV Ed. Blackwell Scientific Publications, Oxford.

Morag C. and Timbury M. (1994) Medical Microbiology Xth Ed Churchill Living stone,London.

Conrat HF Kimball PC and Levy JA (1994) Virology III Ed. Prentice Hall, Englewood Cliff, New Jersey.

Ronald M Atlas (1995) Principles of Microbiology. Moseby Year book Inc. Missouri.

Kenneth M Smith Plant Viruses Universal Book Stall, New Delhi.

Powar and Daginawala General Microbiology Vol II Himalaya Publishing House

Biswas and Biswas An Itrouction to Virus. Vikas Publishing House.

BMI 018A Laboratory Exercises

- 1) Demonstration of the diseases of plants caused by viruses viz. Tobacco Mosaic Disease and Cucumber Mosaic disease.
- 2) Demonstration of the human diseases caused by viruses viz. AIDS, Mumps, Small pox and Chicken pox etc.
- 3) Demonstration of different types of plant viruses.
- 4) Demonstration of different types of animal viruses.
- 5) Cultivation of animal viruses in embryonated eggs.
- 6) Demonstration of Plaque test for the bacteriophages.

BMI 019A Molecular biology

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit -I

DNA Structure: Miescher to Watson and Crick model, Salient features of double helix, Types of DNA, denaturation and renaturation, DNA topology - linking number, topoisomerases; Organization of DNA in Eukaryotes. RNA Structure, Organelle DNA -- mitochondria and chloroplast DNA. Genome Structure, Chromatin and the Nucleosome Chromatin structure- Euchromatin, Heterochromatin in Eukaryotes.

Unit -II

Chemistry of DNA synthesis, general principles - bidirectional replication, Semiconservative, Semi discontinuous, RNA priming, Various models of DNA replication including rolling circle, replication of linear ds-DNA, replicating the 5' end of linear chromosome. Enzyme involved in DNA replication – DNA polymerases, DNA ligase, Primase, Telomerase and other accessory proteins.
The Replication of DNA (In Eukaryotes)

Unit -III

Mechanism of Transcription: RNA Polymerase and the transcription unit. RNA Modifications; Split genes, concept of introns and exons, removal of Introns, spliceosome, splicing pathways, alternative splicing, exon shuffling, RNA editing, and mRNA transport.

Unit -IV

Translation (In Eukaryotes) Assembly line of polypeptide synthesis - ribosome structure and assembly, various steps in protein synthesis. Structure of tRNA, aminoacyl tRNA synthetases. Proteins involved in initiation, elongation and termination of polypeptides. Inhibitors of protein synthesis. Regulation of translation. Translation-dependent regulation of mRNA and Protein Stability.

Unit V

Transcription Regulation in Eukaryotes, Conserved mechanism of regulation, Signal integration, combinatorial control, transcriptional repressors, signal transduction and control of transcriptional regulator, Gene Silencing.

Suggested Readings

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008) Molecular Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.

BMI 020A Laboratory Exercises

- 1) Preparation of Polytene chromosome from *Chironomous* larva/*Drosophila* larva.
- 2) Demonstration of Mammalian Sex chromatin.
- 3) Preparation of culture medium (LB) for *E. coli* (both solid and liquid) and raise culture of *E. coli*.
- 4) Isolation of DNA from *E. coli* cells.
- 5) Isolation of total RNA from yeast.
- 6) Estimation of DNA by diphenylamine.
- 7) Determination of RNA by orcinol method.
- 8) Determination of melting temperature (T_m) and base composition of DNA from thermal denaturation characteristics.
- 9) Preparation of restriction enzyme digests of DNA samples and southern blotting of DNA fragments from agrose gel.
- 10) Demonstration of semiconservative replication of DNA.

IVsemester

BMI 022A Microbial Genetics

L	T	P	C
4	-	2	6

Contact Hours: 60
Credits: 04

Unit I

DNA structure and replication in microorganisms:
DNA as a genetic material, structure of DNA and RNA, DNA replication (conservative and semi-conservative replication, conformational flexibility of DNA), Replication in prokaryotes and eukaryotes.

Unit II

Transcription in microorganisms:
Mechanism of transcription in prokaryotes, Enzymes and transcription factors, post transcriptional modifications.

Unit III

Translation and regulation of gene expression in microorganisms:
The genetic code, central dogma. Translational machinery in eukaryotes and prokaryotes. Mechanism of initiation, elongation and termination. Inhibitors of protein synthesis. Regulation of gene expression in prokaryotes-operon concept, positive and negative regulation of *lac* operon.

Unit IV

Mutations and mutant selection

Molecular mechanism of mutation, forward and reverse mutation, transition, transversion, spontaneous and induced mutations, mutation frequency, applications of mutation, Methods of mutant selection – direct selection, antibiotic selection, replica plating, conditional lethality and its use in mutant selection.

Mechanism of DNA repair – photo reactivation, excision repair, mismatch repair, SOS repair.

Unit V

Recombination in bacteria

Transformation, transduction and conjugation, Use of transformation, transduction and conjugation in gene mapping, a brief idea of cloning vectors (plasmids, cosmids, bacteriophages)

Essential Readings:

1. Principles of Genetics, 8th edition, Gardener E J, John Wiley and Sons Publications, 2005.
2. Gene VI, Lewin, B, New York, Oxford University Press, 2000.
3. Cell and Molecular Biology, 4th edition, Gerald Karp, John Wiley and Sons. 2005.
4. Biochemistry and Molecular Biology, 3rd edition, Elliott W H and Elliot D C, Oxford University Press, 2005.
5. Essentials of Molecular Biology, 3rd edition, Malacinski G M and Freifelder D Jones and Bartlett Publishers, 1998.
6. Cell and Molecular Biology, 3rd edition, Philip Scheeler and Donald E Bianchi, John Wiley and Sons. 1987.
7. Microbial Genetics, 2nd edition, Stanley R Maloy, John E Cronnan, David Freifelder. Jones and Barlett Publishers, 1994.

BMI 023A Laboratory Exercises

- 1) Isolation of antibiotic resistant bacterial population by gradient plate method.
- 2) Isolation of antibiotic resistant mutants by Replica plating technique.
- 3) Demonstration of genetic recombination in bacteria by conjugation.
- 4) UV-induced auxotrophic mutants production and isolation of the mutants by replica plating.
- 5) Demonstration of genetic recombination in bacteria by transduction.
- 6) Demonstration of genetic recombination in bacteria by transformation.
- 7) Detection of carcinogens/mutagens by the Ames test.

BMI 024A Biostatistics

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit -I

Introduction, Definition, Functions, scope and application of biostatistics. Understanding the concepts of descriptive and inferential statistics.

Frequency distribution, Collection of data : Primary and secondary data, tabulation of data, discrete and continuous series. Graphical presented : Types of diagrams, Graphs of frequency distribution- Bar diagrams, Histogram, frequency Polygon, smooth frequency curve, Ogives.

Unit -II

Measures of Central Value, Introduction, Definition and Limitation of Average; Arithmetic Average–Mean; Arithmetic, Geometric, Harmonic and Positional Average- Mode, Median.

Unit –III

Measures of Dispersion, Introduction, Definition, various measures of variation; Range, Quartile deviation, Mean Deviation, Standard Deviation, Variance.

Statistical Inference, Testing of Hypothesis ; Procedure, test of significance of mean; Standard error of mean and standard deviation ; student's 't' test , chi-square test.

Unit -IV

Correlation, Introduction, definition, kinds- negative, positive and zero correlation, coefficient of correlation, methods of studying correlation-scatter diagram, Graphical method, Karl pearson's coefficient of correlation.

Unit -V

Probability, Introduction, definition, types and theorems of probability, theoretical distribution and calculations of probability.

Regression Analysis, Introduction, definition, regression equation, regression lines and regression coefficients.

Suggested Readings

1. Edmondson and D. Druce : *Advanced Biology Statistics*, Oxford University Press; 1996.
2. W. Danial : *Biostatistics : A foundation for Analysis in Health Sciences*, John Wiley and Sons Inc; 2004.
3. Goon, A.K.M and Gupta, B.D., *Fundamental of Statistics*.

BMI 025A Laboratory Exercises

- 1) Construction of frequency tables.
- 2) Demonstration and exercises on data interpretation using histograms, polygons and pie-charts.
- 3) Demonstration and exercises on mean, median and mode.
- 4) Demonstration and exercises on permutation and combination.
- 5) Demonstration and exercises on probability.
- 6) Demonstration and exercises on the testing of hypothesis using student t test.
- 7) Demonstration and exercises on the testing of hypothesis using Chi-square test.

BMI 026A Environmental Microbiology

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit I

Introduction to environmental microbiology, scope and importance. Microorganisms in environment: viruses, bacteria, fungi, algae and protozoa.

Unit II

Terrestrial environment: soil and soil subsurface environment, microorganisms in surface soil, shallow and deep subsurface environment.

Unit III

Aeromicrobiology : atmosphere, aeromicrobiological pathway, microbial survival in air, extramural and intramural aeromicrobiology.

Unit IV

Microbial transport: factors affecting microbial transport, factors affecting transport of DNA.
Biogeochemical cycling: carbon cycle, nitrogen cycle, sulfur cycle.

Unit -V

Aquatic and extreme environments: microbial habitat in aquatic environment, environment determinants that govern extreme environments

Suggested readings:

Raina M.Maier, Ian L Pepper, Charles P Gerba. (2000) Environment Microbiology . Academic press an imprint of Elsevier(san diego, san Francisco,)

Atlas and Bartha (1998) MICROBIAL ECOLOGY: fundamentals and applications. Fourth edition. Pearson education (Singapore)

BMI 027A Laboratory exercise

- 1) Isolation of microbes from soil samples.

- 2) Isolation of microbes from water samples.
- 3) Isolation of microbes from air.
- 4) Determination of dissolved oxygen (DO) of water samples.
- 5) Determination of biological oxygen demand (BOD) of water samples.
- 6) Determination of chemical oxygen demand (COD) of water samples.
- 7) Bacteriological examination of water by multiple tube fermentation test (multiple tube test) – (a) Presumptive coli form test, (b) Confirmed coli form test, and (c) Completed coli form test.
- 8) Isolation of *Rhizobium* from root nodule.
- 9) Demonstration of ammonification.
- 10) Demonstration of nitrification.

Semester V

BMI 029A Microbial Physiology

L	T	P	C
4	-	2	6

Contact Hours: 60
Credits: 04

Unit I

Introduction to microbial Diversity. Nutritional classification of microorganism. Chemoautotroph, chemoheterotroph and photosynthesis in microorganism.

Unit II

Role of chlorophyll, carotenoid and phycobilins. Light and Dark reaction.

Unit III

Chemolithotrophy. Hydrogen, Iron, Nitrate, Sulphur and oxidizing bacteria. Nitrogen metabolism and N₂ Fixation. Nitrate and Sulphate reduction. Methanogenesis.

Unit IV

Respiratory metabolism especially in reference to microbes. EMP and EnterDoudroff Pathway. Glyoxalate pathway Krebs cycle, reverse TCA cycle, Phosphorylation.

Unit V

Prokaryotic life cycle, the growth curve, measurement of microbial growth, influence of environmental factors on growth.

Suggested Reading:

Caldwell.D.R(1995) Microbial Physiology and Metabolism Brown Publishers.

Stainer R.Y, Ingraham J.L, Whelis M.L and Painter P.R General Microbiology. The Macmillan Press Ltd.

Madigan M.T Martinko J.M and Parker J Brock Biology Microorganism Prentice Hall.

Powar and Dagainawala General Microbiology Vol II Himalaya Publishing House.

J.L Jain- Biochemistry.

Keshav Trehan Biochemistry

Stryer 5th Ed 2001 Biochemistry Freeman W.H

Lehninger 3rd Ed. Principles of Biochemistry. McMillan.

BMI 030A Laboratory exercise

- 1) Demonstration of effect of temperature on bacterial growth.
- 2) Demonstration of effect of pH on bacterial growth.
- 3) Demonstration of effect of salt/sugar concentration on bacterial growth.
- 4) Demonstration of metals on bacterial growth.
- 5) Amylase production test.
- 6) Cellulose production test.
- 7) IMViC tests.
- 8) Measurement of fungal growth by dry weight method.
- 9) Measurement of bacterial growth by turbidity measurements.
- 10) Preparation of growth curve for bacterial growth in a batch culture and calculate the mean generation time (doubling time).

BMI 031A Food Microbiology

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit I

Food as a substrate for micro organisms - Micro organisms important in food microbiology; Molds, yeasts and bacteria - General Characteristics - Classification and importance.

Unit II

Principles of food preservation - Asepsis - Removal of micro organisms, anaerobic conditions - High temperature - Low temperature - Drying - Food additives.

Unit III

Contamination and spoilage - Cereals, sugar products, vegetables and fruits, meat and meat products, milk and milk products - Fish and sea food - Poultry, Spoilage of canned foods. Spoilage and defects of fermented daily products - oriental fermented foods.

Unit IV

Food borne infections and intoxications - bacterial, non -bacterial - Food borne disease outbreaks - Laboratory testing - preventing measures - Food sanitation - plant sanitation

Unit V

Employees' health standards - waste treatment and disposal - quality control. Food fermentations : Bread cheese, vinegar, fermented vegetables, fermented dairy products.

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.

BMI 032A Suggested Practicals

- 1) Determination of quality of milk sample by methylene blue reductase test.
- 2) Detection of number of bacteria in milk by standard plate count (SPC).
- 3) Alkaline phosphate test to check the efficiency of pasteurization of milk.
- 4) Production of yogurt/curd.
- 5) Isolation of spoilage microorganisms from spoiled milk.

- 6) Isolation of spoilage microorganisms from spoiled fruits and vegetables.
- 7) Isolation of spoilage microorganisms from spoiled bread.
- 8) Production of bread.

BMI 033A Medical Microbiology

L	T	P	C
4	-	2	6

Contact Hours: 60

Credits: 04

Unit I

Discovery and History of pathogenic microorganism. Contribution made by eminent scientists. Classification of medicinally important microorganism. Normal flora of human body.

Unit II

Characteristic of infectious disease. Disease cycle (source of disease, reservoir, carriers). Bacterial diseases, epidemiology, pathogenicity, laboratory, diagnosis, prevention and control of Anthrax, Tuberculosis, Typhoid, Tetanus and Leprosy.

Unit III

General account of viral and protozoan diseases. Pneumonia, Influenza, Mumps, Measles, Polio, Hepatitis B, Malaria and Leishmaniasis.

Unit IV

Brief account of STD diseases. Antibiotic Ist, IInd, IIIrd and IVth generation antibiotics. Mode of action of antibiotic on microorganism (in brief).

Unit V

General account of fungal diseases mycoses, subcutaneous. Transmission of pathogens (Air borne, contact transmission and vector transmission). control measures.

Suggested Readings:

Ananthanarayan R. and Panikar. J (1997) Text Book of Microbiology Orient Longman.

Mackie and Mc Cartney Medical Microbiology Vol I Microbial Infection. Churchil livingstone 1996.

Baron E.J, Peterson LR and Finegold S.M Mosby 1990. Bailey and Scott's Diagnostic Microbiology.

Greenwood, Slack R.C B and Peutherer J.F Medical Microbioloby Churchill Livingstone(Elsevier).

BMI 034A Laboratory exercise

- 1) Direct examination of infected tissues (skin) for dermatophytes.
- 2) Isolation of microorganisms from wound infection.
- 3) Isolation of microorganisms from teeth crevices.
- 4) Examination of microorganisms of sputum.
- 5) Isolation of enteric pathogens (*Salmonella* and *Shigella*).
- 6) Estimation of urine bacteria by pour plate method.
- 7) Demonstration of life cycle of Malaria parasite.
- 8) Demonstration of sexual transmitted diseases.
- 9) Determination of antibiotic susceptibility of a given microorganism against various antibiotics.
- 10) Demonstration of various routes for drug delivery to humans.

BMI 035A BMI Basic Techniques for Instrumentation/ Industrial Visit

Credits: 06

The Student will submit one Industrial Visit Report and Viva-voce will held at the end of semester for Instrumentation Techniques.

Semester- VI BMI 037A In-House Project

Credits: 25

Project Training

The dissertation work will involve practical work on a problem suggested by the supervisor of the candidate. The student will submit the dissertation report at the end of VI semester.



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