

**KANNUR UNIVERSITY**  
(Abstract)

*MSc Biotechnology Programme - under Credit Based Semester System in Affiliated Colleges- Revised Scheme, Syllabus & Model Question Papers - implemented with effect from 2014 admission - Orders Issued.*

**ACADEMIC BRANCH**

No. Acad/C2/8365/2014

Dated, Civil Station P.O, 16-07-2014

- Read: 1.U.O No. Acad/C1/11460/2013 dated 12-03-2014  
2. Minutes of the meeting of the Board of Studies in Biotechnology (Cd) held on 05-11-2013  
3. Minutes of the meeting of the Faculty of Science held 25--03-2014  
4. Letter dated 03.07.2014 from the Chairman, BOS in Biotechnology (Cd)

**ORDER**

1. The Revised Regulations for PG Programmes under Credit Based Semester System (CBSS) were implemented in this University with effect from 2014 admission as per paper read (1) above.

2. As per paper read (2) above the Board of Studies in Biotechnology (Cd) finalized the Scheme , Syllabus & model Question Papers of MSc Biotechnology programme to be implemented with effect from 2014 admission..

3. As per read (3) above the Faculty of Science held on 01.04.2014 approved Scheme, syllabus & model question papers of MSc Biotechnology programme to be implemented with effect from 2014 admission.

4. The Chairman, Board of Studies in Biotechnology (Cd) vide paper read (4) above has submitted the finalized copy of Scheme, syllabus & Model question papers of MSc Biotechnology programme for implementation with effect from 2014 admission.

5. The Vice Chancellor, after examining the matter in detail, and in exercise of the powers of the Academic Council as per section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with, has accorded sanction to implement the revised scheme, syllabus & model question papers of MSc Biotechnology Programme with effect from 2014 admission.

6. Orders, are therefore issued implementing the revised scheme, syllabus & model question papers of MSc Biotechnology programme under Credit Based Semester System (CBSS) with effect from 2014 admission subject to report to Academic Council

7. Implemented revised Scheme, Syllabus & Model Question Papers are appended.

Sd/-  
DEPUTY REGISTRAR (ACADEMIC)  
FOR REGISTRAR

To:

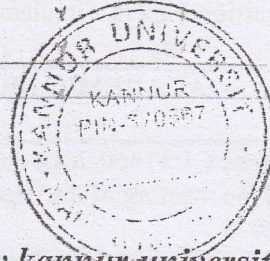
1. The Principals of Affiliated Colleges offering M.Sc Biotechnology Programme
2. The Examination Branch (through PA to CE)

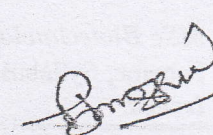


Copy To:

1. The Chairman, BOS Biotechnology (Cd)
2. PS to VC/PA to PVC/PA to Registrar
3. DR/AR I Academic
4. Central Library
5. PA to FO
6. SF/DF/FC.

Approved for Issue



  
Section Officer

❖ For more details log on to [www.kannur-university.ac.in](http://www.kannur-university.ac.in)

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**KANNUR UNIVERSITY**



**COURSE STRUCTURE & SYLLABUS FOR  
M.Sc. BIOTECHNOLOGY PROGRAMME  
Under Choice Based Credit Semester System**

**2014 Admission Onwards  
For Affiliated Colleges**

**Kerala - 670 002, INDIA**

**CREDIT AND MARK DISTRIBUTION FOR M.Sc. BIOTECHNOLOGY PROGRAMME  
(KUCBSS-PG-2014 ADMISSION ONWARDS)**

**SEMESTER I**

COURSE CODE	TITLE OF THE COURSE	MARKS			CREDIT	WEAKLY CONTACT HOURS
		Internal	External	Total		
BTG1C01	Biochemistry	10	40	50	4	5
BTG1C02	Biophysics	10	40	50	3	4
BTG1C03	Cell Biology	10	40	50	3	4
BTG1C04	General Microbiology	10	40	50	4	4
BTG1P01	Practical I (Practical of BTG1C01 and BTG1C02)					4
BTG1P02	Practical II (Practical of BTG1C03 and BTG1C04)					4
Total		40	160	200	14	25

**SEMESTER II**

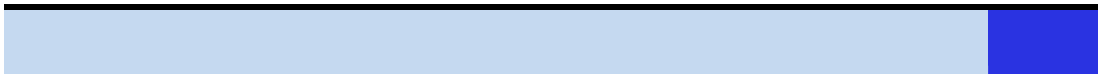
COURSE CODE	TITLE OF THE COURSE	MARKS			CREDIT	WEAKLY CONTACT HOURS
		Internal	External	Total		
BTG2C05	Immunology	10	40	50	3	3
BTG2C06	Molecular Biology	10	40	50	3	3
BTG2C07	Genetics	10	40	50	3	3
BTG2E01	Enzymology					
BTG2E02	Bioinstrumentation	10	40	50	4	4
BTG2E03	Intermediary Metabolism					
BTG1P01	Practical I (Practical of BTG1C01 and BTG1C02)	10	40	50	2	
BTG1P02	Practical II (Practical of BTG1C03 and BTG1C04)	10	40	50	2	
BTG2P03	Practical III (Practical of BTG2C05)	10	40	50	2	4
BTG2P04	Practical IV (Practical of BTG2C06)	10	40	50	2	4
BTG2P05	Practical V (Practical of BTG2C07)	10	40	50	2	4
Total		90	360	450	23	25

### SEMESTER III

COURSE CODE	TITLE OF THE COURSE	MARKS			CREDIT	WEAKLY CONTACT HOURS
		Internal	External	Total		
BTG3C08	Biostatistics and Bioinformatics	10	40	50	3	3
BTG3C09	Recombinant DNA Technology	10	40	50	3	4
BTG3C10	Plant Biotechnology	10	40	50	3	3
BTG3C11	Animal cell Biotechnology	10	40	50	3	3
BTG3E04	Bio-safety, Bioethics and Intellectual Property Rights	10	40	50	4	4
BTG3E05	Food Biotechnology					
BTG3E06	Medicinal Chemistry					
BTG3P06	Practical VI (Practical of BTG3C09)					4
BTG3P07	Practical VII (Practical of BTG3C10 and BTG3C11)					4
Total		50	200	250	16	25

### SEMESTER IV

COURSE CODE	TITLE OF THE COURSE	MARKS			CREDIT	WEAKLY CONTACT HOURS
		Internal	External	Total		
BTG4C12	Medical Biotechnology	10	40	50	2	3
BTG4C13	Environmental and Agricultural Biotechnology	10	40	50	3	3
BTG4C14	Microbial Technology	10	40	50	2	3
BTG4E07	Bimolecular Modeling and Drug Design	10	40	50	4	4
BTG4E08	Nanobiotechnology					
BTG4E09	Diagnostic Techniques in Microbiology					
BTG3P06	Practical VI (Practical of BTG3C09)	10	40	50	2	
BTG3P07	Practical VII (Practical of BTG3C10 and BTG3C11)	10	40	50	2	
BTG4P08	Practical VIII (Practical of BTG4C12 and BTG4C13)	10	40	50	2	4
BTG4P09	Practical IX (Practical of BTG4C14)	10	40	50	2	4
BTG4Pr	Project	30	120	150	6	4
BTG4C15	General Viva-Voce	10	40	50	2	
Total		120	480	600	27	25
Grand Total		300	1200	1500	80	



*M.Sc. Biotechnology Syllabus - KUCBSS-2014 - Kannur University*



# SYLLABUS



### **UNIT I**

Molecular logic of living system - Characteristics of living matter at molecular level. Origin of life and cells.

### **UNIT II**

Carbohydrates: Definition and classification and structure of monosaccharides, disaccharides, polysaccharides, glycosaminoglycans.

### **UNIT III**

Proteins: Amino acids- classification based on structures, properties of amino acids. Isoelectric pH, buffering actions of amino acids and proteins. Structural organization of proteins: primary, secondary, tertiary and quaternary structure, motifs and domains. Denaturation, isoelectric precipitation of proteins.

### **UNIT IV**

Lipids: Definition and classification, structure, function, physical and chemical properties - cholesterol, ergosterol, phosphatidic acid, lecithin, cephalin, phosphatidyl serine, sphingo lipids, eicosanoids. Saponification number, acid number and iodine number of fats.

### **UNIT V**

Nucleic acids: Purines and pyrimidines, double helical structure, Watson - Crick Model of DNA, base-pairing and base stacking, Hoogsteen base-pairing, DNA polymorphism Classification of nucleic acids.

### **UNIT VI**

Vitamins and minerals: chemistry, source and functions of water soluble and fat soluble vitamins. Source and functions of macro elements and trace elements (Na, K, Cl, Ca, Fe, Cu, Se, Zn).

### **UNIT VII**

Chemistry and function of peptide and steroid hormones. Examples and functions of plant and animal pigments, pheromones. Neurotransmitters.

### **References:**

1. Lehninger's Principle of Biochemistry. Nelson LD & MM Cox. Macmillan-Worth Pub.
2. Biochemistry. Jeremy M. Berg John and Tymoczko Lubert Stryer. W H Freeman & Co.
3. Biochemistry with Clinical Correlation. Thomas M Devlin. Wiley- Liss Publication.
4. Biochemistry. Donald Voet, Judith G Voet, Charlottew Pratt. John Wiley and Sons.
5. Biochemistry. Jeffery Zubay. Wm C Brown Pub.
6. Biochemistry. Mathews C K and KE van Holde. Benjamin Cumming Pub. Co.
7. Biophysical chemistry. Cantor and Schimmel. W H Freeman & Co. NY.



### **UNIT I**

Thermodynamics: open, closed and isolated systems, laws of thermodynamics, thermodynamic equilibrium, concept of enthalpy, entropy and free energy, free energy of ATP hydrolysis. Negative entropy changes in living systems, interpretation of life in terms of non equilibrium thermodynamics. Chemical kinetics: rate, order and molecularity of a reaction, energy of activation.

### **UNIT II**

Concepts and importance of following in biology: pH, hydrogen bond, water structure, surface tension, adsorption, osmosis, dialysis, colloids, detergents, redox potential.

### **UNIT III**

Basic principles of protein structure: Asymmetric carbon, amino acids and peptides, main chain and side chain torsion angles, cis and trans peptides. Principle and patterns of protein conformation. Ramachandran map. Structure of Lysozyme and rubisco. Protein - protein interaction.

### **UNIT IV**

Basic principles of nucleic acid structure: conformation of nucleotides, oligonucleotides, DNA supercoiling and t-RNA structure. Protein-Nucleic acid interactions, H-L-H, Zn-finger and Leucine zipper motifs.

### **UNIT V**

Configuration and conformation of monosaccharides, Haworth projection formula, boat and chair conformation, types of linkages. Conformation of polysaccharides.

### **UNIT VI**

Membrane structure and transport: lipid bilayer model, membrane potential, Donnan equilibrium. Membrane transport, diffusion, facilitated diffusion, carrier mediated transport and channel mediated transport.

### **References:**

1. Biological thermodynamics. Donald T Haynie, Cambridge University Press
2. Biophysics. M. V. Volkenstein, Mir publishers.
3. Biopolymers. A G Walson and J Blackwell Associated Press.
4. Essentials of Biophysics. P Narayanan, New Age International publishers.
5. Introduction to Protein Structure. C Branden and I Tooze, Garland Press, NY
6. Principles of Protein Structure. GE Schulz & RH Schirmer, Springer Verlag, Berlin.
7. Biochemical Calculations. Segel Irvin H. John Wiley and Sons, New York.
8. Biochemistry: Chemical Reactions of Living Cells. Metzler DE. Vol.1&2, Acad Press
9. Biophysical chemistry. Cantor and Schimmel. WH Freeman and Company, NY

### UNIT I

Cell as a UNIT of life. Properties of life, scientific hypothesis for origin of life. Development of chemosynthesis and photosynthesis. General organization of cell.

### UNIT II

The structural and functional organisations of cell membrane, ionic transport (passive and active transport) the extracellular matrix of eukaryotes, cell wall. Structure and functions of endoplasmic reticulum, golgi complex, ribosomes, lysosomes, peroxisomes (glyoxysomes), and plastids. Structure, function and molecular level organization of chloroplast, and mitochondria.

### UNIT III

Cytoskeleton and cell motility: Microtubules, microfilaments and intermediate elements. Structure and function of cell membrane. Structure of nuclear membrane, transport through the nuclear membrane. Nature of the genetic material, Proteins associated with nuclei. Packaging of genetic material: nucleosome model. Organisation of chromatin: chromosome structure.

### UNIT IV

Cell communication and cell signalling, receptors, signaling through G protein coupled receptors.

### UNIT V

Cell cycle: Molecular control of cell cycle. Cancer biology: Genetic rearrangements in progenitor cells, oncogenes, tumour suppressor genes, cancer & the cell cycle. Interaction of cancer cells with normal cells, apoptosis.

### References:

1. Cell biology- concepts and experiments. Gerald Karp. Mc Graw Hill.
2. Cell and molecular biology. De Robertis. Holt- Saunders.
3. Lehninger's Principles of Biochemistry. Nelson DL. & Cox M.M., WH Freeman & Co.
4. Molecular biology of the cell. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Roff, Keith Roberts, Peter Walter. Garland Science Taylor and Francis group.
5. The world of the cell. Becker, Kleinsmith, Wayne M Lewis J. Pearson edn.
6. The cell- molecular approach. Geoffrey M. Cooper, Robert E. Housman. ASM press.

### UNIT I

History and scope of Microbiology. Microscopy and specimen preparation: light microscope- bright field microscope, dark field microscope, phase contrast microscope, fluorescence microscope. Electron Microscope - transmission and scanning electron microscope. Confocal Microscopy.

### UNIT II

Controlling microbial growth: Physical control methods, chemical control methods. Evaluation of antimicrobial agent effectiveness. Determination of antibiotic sensitivity.

### UNIT III

Whittaker's five kingdom concept, three domain concept of Carl Woese. Polyphasic taxonomy. Classification of Bacteria. Criteria for bacterial classification, major categories and group of Eubacteria and Archaeobacteria. Morphology, reproduction and classification of algae, and fungi. General properties and classification of viruses. Viroids and Prions.

### UNIT IV

Eukaryotic and prokaryotic cell structures: The nucleus/nucleoid, cytoplasmic structures, motility organelles. Gram-positive and Gram-negative cell envelope. Staining.

### UNIT V

Microbial growth: Reproduction in prokaryotic and eukaryotic microorganisms. Microbial growth curve. Nutritional requirements of growth. Culture media- selective and differential culture media. Pure culture techniques. Culture preservation.

### References

1. Microbiology. Jacquelyn G Black. WILEY publications.
2. Alcamo's fundamentals of microbiology. Jafrey C Pommerville. Jones & Bartlett Pub.
3. Microbiology. Lansing M Prescott, John P Harley et al. McGraw Hill publication.
4. Brock Biology of microorganisms. Michael F. Madigan et al. Prentice Hall Pub.
5. An introduction to microbiology. Tortora, Funke et al. Pearson education Ltd.
6. Bergey's manual of systematic bacteriology. DJ Brenner, NR Krieg, et.al. Springer
7. Introductory Microbiology. J Heritage, EGV Evans et.al. Cambridge Univ. Press.
8. General Microbiology. Hans G Schlegel. Cambridge University Press.



**BTG1P01:  
PRACTICAL- I**

(Practical of BTG1C01 and BTG1C02)

1. Qualitative analysis of carbohydrates.
2. Qualitative analysis of proteins.
3. Qualitative analysis of lipids.
4. Estimation of protein.
5. Estimation of lipids (cholesterol, phospholipids, triacylglycerols).
6. Estimation of carbohydrates (glucose, fructose, lactose, starch).
7. Estimation of nucleic acid (DNA and RNA).
8. Preparation of buffers using  $\text{KH}_2\text{PO}_4$  and  $\text{K}_2\text{HPO}_4$ , acetic acid and sodium acetate,  $\text{K}_2\text{HPO}_4$  and  $\text{H}_3\text{PO}_4$ .
9. Purification of substances by dialysis
10. Denaturation studies on proteins.
11. Separation of Sugars & Amino Acids by Paper and TL Chromatography
12. Determination of saponification value and iodine number of fat.



**BTG1P02:  
PRACTICAL- II**

(Practical of BTG1C03 and BTG1C04)

1. Study of mitosis.
2. Study of meiosis.
3. Study of polytene chromosome.
4. Cell fractionation.
5. Formaldehyde-glutaraldehyde fixation of plant tissues.
6. Embedding in and sectioning wax.
7. General tissue staining (Toluidine blue, Orange G, Safranin etc.)
8. Estimation of DNA by Diphenylamine test.
9. Estimation of RNA by Orcinol method.
10. Micrometry: measurement of micro organisms.
11. Motility determination: hanging drop method.
12. Staining: simple, Gram's, acid-fast, spore, capsule and granular staining.
13. Media preparation: liquid, solid.
14. Pure culture techniques: streak plate, pour plate, spread plate.
15. Anaerobic cultivation: RCM, anaerobic jar.
16. Biochemical tests for identification of bacteria.

### **UNIT I**

History and scope of Immunology. Types of immUNITY - innate, acquired, passive and active. Antigens types, haptens, epitopes. Immunoglobulin structure, distribution and function. Innate Immune response: Mechanism, Inflammation, Complement system.

### **UNIT II**

Lymphoid tissues - ontogeny and physiology of immune system - origin and development, differentiation of lymphocytes. Lymphocyte subpopulation of human being. Structure and function of class I and II histocompatibility antigens. Antigen processing and presentation. HLA in human health and diseases.

### **UNIT III**

Molecular biology of Immunoglobulin synthesis. Effector mechanisms in immUNITY - macrophage activation. Cell mediated cytotoxicity. Cellular interaction in immune response. Antigen recognition, T & B cell receptors, MHC restriction. Lymphocyte activation, clonal proliferation, differentiation.

### **UNIT IV**

In vitro and in vivo assays of cell mediated immUNITY. Cytokines and their role. Immunoregulation- specific helper and suppressor cells, specific factors, idiotype network. Immune response genes. Immunological tolerance.

### **UNIT V**

Antigen-antibody interactions: Agglutination, precipitation, complement fixation, immuno diffusion, immunoelectrophoresis, ELISA, radio immuno assays, western blotting, immunofluorescence, immunoelectron microscopy.

### **UNIT VI**

Hypersensitive reactions, types, prevention. Autoimmune disorders: Organ specific and systemic autoimmune diseases.

### **UNIT VII**

Transplantation immunology: Immunologic basis of graft rejection, clinical manifestations of graft rejection, tissue typing, immunosuppressive therapy. Cancer and the immune system: Oncogenes and cancer induction, tumor specific and tumor associated antigens. Immune response to tumors: role of NK cells and macrophages.

### **UNIT VIII**

Immunology of infectious diseases: viral, bacterial, fungal infections, protozoan diseases. Vaccines: Active and passive immunization. Live, killed, attenuated, sub UNIT vaccines. Vaccine technology- role and properties of adjuvants, recombinant DNA and protein based vaccines, plant-based vaccines. Chimeric and hybrid monoclonal antibodies.

### **References**

1. Immunology. Janis Kuby et al. W H Freeman and Company.
2. Immunology. Roitt, Brostoff, Male Mosby.
3. Immunobiology. Janeway, et.al. Churchill Livingstone.
4. Immunology. Tizard. Thomson Publishers.
5. Medical Immunology. Tristram G Parslow, et.al Mc Graw Hill.
6. Practical immunology. Frank C Hay et al. Black Well science

### UNIT I

Organisation of genes and chromosomes: Operon, interrupted genes, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin.

### UNIT II

DNA replication, repair and mutation: UNIT of replication, enzymes involved, replication origin and replication fork, fidelity of replication, DNA damage and repair mechanisms, types of mutation.

### UNIT III

RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, inhibitors of transcription, RNA processing, RNA editing, splicing, polyadenylation, structure and functions of different types of RNA, biosynthesis of tRNA and rRNA.

### UNIT IV

Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, aminoacyl tRNA synthetase, translational inhibitors, post translational modification of proteins.

### UNIT V

Control of gene expression at transcription and translation level: Bacterial operons (lac, trp), regulation of phages and viruses, chromatin activity and gene regulation in eukaryotes.

### UNIT VI

Methods for analysis of gene expression at RNA and protein level: Whole genome analysis, DNA microarray, genome analysis for global patterns of gene expression using fluorescent labelled cDNA or end labelled RNA probes.

### References

1. Molecular Biology. Robert F Weaver. McGraw Hill International Edition.
2. Cell and molecular biology- Concepts and experiments. Gerald Karp. Wiley & sons.
3. Molecular biology of the Gene. James D Watson, et al. Pearson Education.
4. Genes IX. Benjamin Lewin. Jones and Bartlett Publishers.
5. Molecular cell biology. Lodish, et.al W H Freeman & Co. New York.



**UNIT I**

Concepts of Genetics its scope and significance. Mendelian genetics and physical basis of heredity. Concept of multiple alleles. Modification of dominance relationship. Gene interactions: Epistasis, pleiotropy, genomic imprinting, penetrance and expressivity.

**UNIT II**

Sex linked, sex limited and sex influenced traits with suitable examples. Chromosomal and genic balance theory of sex determination. Human sex anomalies -Klinefelter's and Turner's syndrome.

**UNIT III**

Linkage and crossing over: Coupling and repulsion hypothesis, theories of crossing over, three point test cross. Linkage maps, tetrad analysis. Recombination: Homologous and non-homologous recombination, transposition and site specific recombination. Transposable elements.

**UNIT IV**

Extra chromosomal inheritance: Criteria for extra chromosomal inheritance. Inheritance of mitochondrial and chloroplast genes.

**UNIT V**

Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications. Human genetics: Pedigree analysis.

**UNIT VI**

Microbial genetics: bacterial chromosomes and plasmids, conjugation, transduction and transformation in bacteria. Bacteriophages and their genetic systems. Lytic and lysogenic phases of  $\lambda$  phage. Genetic recombination and its molecular mechanism.

**UNIT VII**

Mutations: Types, causes and detection. Mutant types- lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants and insertional mutagenesis. Mechanism of gene mutations.

**UNIT VIII**

Population genetics: Populations, gene pool, gene frequency, Hardy-Weinberg law. Concepts and rate of change in gene frequency through mutation, random genetic drift, migration, inbreeding and natural selection. Speciation. Molecular evolution: Concepts of neutral evolution, molecular divergence and molecular clocks.

**References**

1. Genetics. A conceptual approach. Benjamin A Pierce. W H freeman and company.
2. Genetics. Monroe W Strickberger. Prentice Hall of India.
3. Genetics. Peter J Russel. Pearson education.
4. Concepts of Genetics. William S Klug. Pearson edn.
5. Essentials of Human Genetics. Manu L Kothari. University Press.
6. Principles of genetics. Snustad. John Wiley and sons.

### UNIT I

Enzymes: Basic definition, classification and nomenclature- classical and EC recommendation. Coenzyme structure and function- Active site and factors influencing enzyme activity. UNITs of enzymatic action. Enzyme structure and function. Isolation and purification of enzymes. Criteria for purity. Measurement of enzyme activity; specific activity and molar activity.

### UNIT II

Enzyme kinetics: Single substrate-Single intermediate, Michaelis-Menten and Briggs Haldane kinetics, graphical analysis of kinetic data, determination of  $K_m$  and  $V_{max}$ ; Experimental aspects. Sequential and ping-pong mechanism

### UNIT III

Enzyme inhibition: Mechanism and rate studies. Degree of enzyme inhibition; competitive and non competitive and uncompetitive inhibition. Activation; graphical analysis; primary and secondary kinetic plots.

### UNIT IV

Mechanism of enzyme action: catalytic strategies; Covalent catalysis; mechanism of chymotrypsin; metal ion catalysis; General acid base catalysis. Catalysis by approximation.

### UNIT V

Enzyme regulation: Allosteric regulation; isozymes, zymogen activation, reversible covalent modification. Cooperativity; MWC and sequential model of allosteric enzymes

### UNIT VI

Enzyme engineering: Active site mapping; immobilized enzymes and its application in industry and medicine; abzymes; drug design based on active site of an enzyme.

### References:

1. Fundamentals of Enzymology. Nicholas C. Price & Lewis Stevens, Ox.Uni. Press.
2. Enzymes. M. Dixon, et al, Longmans, London.
3. Enzymes: Biochemistry, Biotechnology, Clinical chemistry. T Palmer. East West Press
4. Principles of Biochemistry. Jeffrey Zubay, Wm C. Brown Publ.
5. Understanding Enzymes. Trevor Palmer, Ellia Horwood Scientific Publisher.
6. The Proteins: (2<sup>nd</sup> Ed. 4 volumes.).Hans.
7. Chemical Kinetics of Enzyme Action. KJ Laidler & PS. Bunting, Oxford Univ. Lond.
8. Steady State Kinetics. R. F. Boyer.
9. Enzyme Structure and Functions. Fersht, W. H. Freeman & Co, NY.

**UNIT I**

Basic laboratory Instruments: Principle and working of pH meter, Laminar-air flow. Centrifugation: Types of centrifuge machines, preparative and analytical centrifuges, differential centrifugation, sedimentation velocity, sedimentation equilibrium, density gradient methods and their applications.

**UNIT II**

Chromatography: Principles, classification of chromatography, procedures and application of chromatography, adsorption, partition, molecular sieve, ion exchange, affinity, GC and HPLC.

**UNIT III**

Electrophoresis: Principles and classification of electrophoresis viz., moving boundary and zone electrophoresis. Procedures and application of electrophoresis. starch gel, agarose, native and denaturing PAGE, isoelectric focusing.

**UNIT IV**

Colorimetry, spectrophotometry and spectroscopy : Basic principles and application, UV-Visible, IR, atomic absorption emission spectrophotometry. UV, IR, Raman, CD spectroscopy. NMR, ESR, mass spectroscopy. X-ray crystallography.

**UNIT V**

Radioisotopic techniques: Use of radioisotopes in life sciences, detection and measurement of  $\alpha$ ,  $\beta$ ,  $\gamma$  rays using scintillation counters, Geiger-Muller counters, autoradiography.

**References**

1. Practical Biochemistry Principles and techniques. Keith Wilson and John Walker. Cambridge University Press.
2. Physical Biochemistry. D Friefelder, W H Freeman & Company.
3. The Physical Basis of Biochemistry. Peter R Bergethon. Springer-Verlag.
4. Bioseparations. Principles and techniques. Sivasankar. Prentice- Hall India.
5. Principle of physical chemistry. Puri, Sharma, Pathania. VPC publications.



### UNIT I

Biological oxidation and Bioenergetics: Mitochondrial and Photosynthetic Electron transport. Reducing equivalents, High energy molecules, Importance of ATP. Methods to study intermediary metabolism.

### UNIT II

Digestion and absorption of carbohydrates., Starch and disaccharides. Citric acid cycle. glyoxylate cycle, pentose phosphate pathway of glucose oxidation, importance of the pathway and its regulation.

### UNIT III

Glycogenesis, glycogenolysis, gluconeogenesis, regulation of pathways, disaccharide biosynthesis, role of nucleoside bi phosphate sugars in carbohydrate biosynthesis and in sugar interconversion. Biosynthesis of other polysaccharides, starch, cellulose, structural polysaccharides (bacterial and animal coats).

### UNIT IV

Digestion and absorption of triacyl glycerides and sterols, biosynthesis of saturated and unsaturated fatty acids, oxidation of fatty acids and different pathways for such oxidation, biosynthesis and degradation of phospholipids, glycolipids, sterol biosynthesis.

### UNIT V

Amino acid metabolism, urea cycle, transamination and the role of pyridoxal phosphate, oxidative deamination, pathways of degradation of amino acids (fates of carbon atoms of degraded amino acids). Biosynthesis of essential amino acids.

### UNIT VI

Nucleotide metabolism: Purine ribonucleotide metabolism; Denovo synthesis (purines and pyrimidines) and its regulation, salvage pathway (purines and pyrimidines), catabolism of purine and pyrimidine nucleotide and bases, enzymatic reduction of ribonucleotides, thymidine metabolism.

### References:

1. Lehninger's Principle of Biochemistry. Nelson LD & MM Cox. Macmillan-Worth Pub
2. Biochemistry. Jeremy M. Berg John and Lubert Stryer. W H Freeman & Co.
3. Biochemistry with Clinical Correlation. Thomas M Devlin. Wiley- Liss Publication
4. Biochemistry. Donald Voet, Judith G Voet, Charlottew Pratt. John Wiley and Sons
5. Biochemistry-Jeoffrery Zubay-Wm C Brown Pub.
6. Biochemistry-Mathews C K and K.E.van Holde-Benjamin Cumming Pub.Co.
7. Biophysical chemistry. Cantor and Schimmel. W H Freeman & Co. NY

**BTG2P03:**  
**PRACTICAL III**  
(Practical of BTG2C05)

1. Histology of lymphoid organs-study with permanent slides.
2. Preparation of lymphocytes from blood and solid lymphoid organs.
3. Immunization and production of polyclonal antiserum.
4. Haemmagglutination reaction.
5. Latex agglutination.
6. Single radial immunodiffusion.
7. Double diffusion in two dimensions.
8. Immunoelectrophoresis.
9. Bradford method for total protein estimations.
10. Purification of antibodies.
11. Affinity and ion exchange chromatography

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**BTG2P04:**  
**PRACTICAL IV**  
(Practical of BTG2C06)

1. Isolation of DNA from Bacteria.
2. Isolation of DNA from Plant (CTAB method.)
3. Isolation of DNA from animal tissue.
4. Quantitation of DNA.
5. Isolation of RNA from Plant (GITC method).
6. Extraction of proteins from serum
7. SDS-PAGE of proteins.
8. Protein finger printing in Bacteria.
9. Bacterial gene expression using Lac promoter.
10. Blotting and hybridization (Southern/Northern/Western)

**BTG2P05:**  
**PRACTICAL V**  
(Practical of BTG2C07)

1. Study of bacterial conjugation
2. Study of transformation
3. Isolation or identification of auxotroph mutants in bacteria.
4. Detection of mutation by Ames test.
5. Detection of Barr body.
6. Chromosome staining.
7. Study of human karyotypes
8. Study of Multiple alleles in human (Blood grouping)
9. Analysis of quantitative traits.
10. Genetic problems

**UNIT I**

Different types of numerical data: ranked data, discrete and continuous data. Frequency distribution tables: Relative and cumulative frequency, Graphical representation of data: line charts, Bar charts, Pie chart, Histograms.

**UNIT II**

Measures of central tendency: arithmetic mean, median, mode, geometric and harmonic mean. Measures of dispersion: range, interquartile range, variance and standard deviation, coefficient of variation. Correlation and regression: correlation coefficient, regression coefficient, regression line.

**UNIT III**

Probability: Permutation and combination, types of events, Definition of probability, addition and multiplication theorems of probability.

**UNIT IV**

Sampling theory: Population and sample, methods of sampling, random sampling. Tests of significance: Estimation, confidence limit, level of significance, Standard error, testing of hypothesis. Student's t test, chi-square test.

**UNIT V**

Principles of experimental designs; completely randomized, randomized complete block design. Latin square designs, augmented block design, simple factorial experiments, analysis of variance (ANOVA).

**UNIT VI**

Introduction to Bioinformatics: Scope of Bioinformatics, bioinformatics and the internet. Data acquisition-sequencing DNA, RNA and proteins.

**UNIT VII**

Protein sequence data bank: NBRF-PIR-SWISSPROT. Nucleic acid sequence data bank: Gen bank, EMBL. Database searches: FASTA and BLAST data base searches.

**UNIT VIII**

Genomics: Genome mapping, genome sequencing, annotation, comparative genomics, Functional genomics-ESTs, SAGE, DNA micro arrays.

**UNIT IX**

Bioinformatics tools for analysis of proteomics data (Tool available at ExPASy proteomics server), Structure visualization tools: Rasmol, SPDBV.

## References

1. Principles of Biostatistics. Pagano M. & Kimberlee G. Duxbury Press
2. Probability and Statistical Inference. Hogg R. V. Tanis E. A., Prentice Hall
3. Experimental Design Data Analysis for Biologists. Quinn G. P. & Keough M. J. Cambridge University Press
4. Statistical Methods in Biology. Bailey NTJ., Cambridge University Press
5. Biostatistical analysis. Zar, JH. Pearson Education.
6. Fundamentals of Biostatistics. Khan and Khanum; Ukaas publications
7. Biostatistics-How it works. Steve Selvin; Pearson Education
8. Bioinformatics. BaxevanisAD & Quellerie BFF, John Wiley & Sons Inc.
9. Bioinformatics. Sequence and Genome analysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
10. Bioinformatics. A beginner's guide by Jean-Michel Claverie, Wiley & Sons.
11. Bioinformatics. Methods and applications, Rastogi, S.C. Mendiratta, N. and Rastogi P, Prentice. Hall of India Pvt. Ltd, New Delhi
12. Essential Bioinformatics. Jin Xiong, Cambridge University Press
13. Evolutionary computations in Bioinformatics. Fogel & Corne, Morgan Kafman publishers
14. Introduction to Bioinformatics. Attwood & Parry-Smith, Pearson Education
15. Introduction to Protein structure. Brandel C. and Tooze, J.
16. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
17. Structure and Mechanism in Protein science. Fersht WH freeman & Co

SYLLABUS



## RECOMBINANT DNA TECHNOLOGY

**UNIT I**

Enzymes involved in genetic engineering: Nucleases, Ligases and polymerases. Restriction digestion and restriction mapping. Nucleic acid labelling and blotting

**UNIT II**

Cloning vectors: Plasmid vectors, Phage vectors and Cosmids. Expression vectors: pET based vectors, plant based vectors, Ti and Ri as vectors, shuttle vectors. Introduction of DNA into living cells: Transformation and transfection, identification of transformants and recombinants. Selectable markers and reporter genes. Genomic and cDNA libraries, identification of desired clone.

**UNIT III**

PCR: Primer design- Fidelity of thermostable enzymes, types of PCR- Multiplex, Nested, Reverse transcriptase, Real time. Cloning of PCR products in T vector, applications of PCR. DNA sequencing methods.

**UNIT IV**

Heterologous protein production in prokaryotes-Fusion proteins and recombinant protein purification (His tag, GST tag, MBT tag etc.). Heterologous protein production in eukaryotes - Yeast expression system, mammalian cell expression system.

**UNIT V**

Random and site directed mutagenesis. Gene silencing techniques: Antisense RNA technology, introduction to siRNA technology, micro RNA, construction of siRNA expression vectors and applications of gene silencing. Gene targeting and gene knock-out. Cloning of yeast genes by complementation strategy.

**UNIT VI**

Genetic engineering in plants: *Agrobacterium* mediated gene transfer, direct gene transfer methods. Applications of plant genetic engineering in crop improvement. Genetic engineering in animals: Gene transfer methods in animals, gene cloning vectors, gene transfer and expression of induced genes. Transgenic animal models.

**UNIT VII**

Recombinant DNA in medicine: Recombinant insulin, monoclonal antibodies and vaccines. Applications of recombinant DNA in Forensic science. Gene therapy. DNA based diagnosis of genetic disorder

**UNIT VIII**

Common tools in recombinant DNA technology: Electrophoresis of DNA and RNA - Pulse field gel electrophoresis of DNA - Nucleic acid staining - Gel elution - mRNA purification - RACE - RFLP - RAPD - AFLP - Micro and mini satellites - SNP - ARMS - SSCP - DNA microarrays.

**References**

1. Recombinant DNA. James D. Watson, Scientific American books.
2. Gene Cloning and DNA analysis. TA Brown. Blackwell publishing.
3. Molecular Biotechnology. Bernard R Glick, ASM press.
4. Molecular Cloning Vol 1-3. Sambrook and Russel, CSHL press.
5. Recombinant DNA. Genes and Genomes. James D Watson, CSHL press.
6. PCR primer. Carl W Dieffenbach, CSHL Press.
7. Principles of gene manipulations and Genomics. SB Primrose and RM Twyman, Blackwell

### UNIT I

An introduction to plant cell and tissue culture - Totipotency and cytodifferentiation, types of culture. Basic plant biology for cell culture.

### UNIT II

Callus cultures, types of callus, organogenesis and factors affecting organogenesis, somatic embryogenesis- induction, development and maturation of somatic embryoids, artificial seed; somaclonal variation and crop improvement.

### UNIT III

Isolation, purification and viability factors affecting protoplast; Protoplast culture-culture conditions and media. Protoplast fusion, somatic hybridization and its applications.

### UNIT IV

Growth regulators and control of growth and differentiation of plant cells in culture. Hormone habituation, germplasm storage and cryopreservation. Application of biotechnology for the conservation of endangered plants.

### UNIT V

In vitro pollination and fertilization, in vitro production of haploids and triploids, embryo culture.

### UNIT VI

Principles of plant micropropagation, in vitro phenomenon in mass propagation like genetic instability, contamination, disease indexing and eradication, hardening of plants.

### UNIT VII

Cell suspension culture, production of commercially useful compounds by cell culture, cell line selection, physical and chemical factors that influence the production of secondary metabolites, biotransformation.

### UNIT VIII

Gene transfer strategies in plants- direct and indirect methods- electroporation, biolistics, liposome mediated, Agrobacterium mediated transformation, production of transgenic plants tolerant to biotic and abiotic stress. Molecular markers in crop improvement.

### References:

1. Plant tissue culture; Kalyan Kumar De; New Central Book Agency (P) Ltd.
2. Introduction to Plant Tissue Culture; M.K.Razdan; Oxford and IBH publishing group.
3. Introduction to Plant Biotechnology; H.S.Chawla; Oxford and IBH publishing group.
4. Plant Tissue Culture Theory & Practice; S.Bhojwani & M.K.Razdan; Elsevier Health Science Publication.

**UNIT I**

Biology of cultured cells- cell adhesion, cell proliferation and differentiation. Development of continuous cell lines. Equipments and materials for animal cell culture technology.

**UNIT II**

Introduction to balanced salt solutions and simple growth medium. A brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium. Role of carbon dioxide. Role of serum and supplements. Serum and protein free media and their applications.

**UNIT III**

Primary and established cell line cultures. Measuring parameters of growth. Measurement of viability and cytotoxicity. Basic techniques of mammalian cell culture in vitro-disaggregation of tissue and primary culture; maintenance of cell culture. Cell separation. Scaling up of animal cell culture.

**UNIT IV**

Cell synchronisation- Cell cloning and micromanipulation- cell transformation. Stem cell cultures: embryonic stem cells and their applications. Somatic cell genetics- organ and histotypic cultures- measurement of cell death- Apoptosis, three-dimensional culture and tissue engineering.

**UNIT V**

Hybridoma technology and monoclonal antibodies. Biotechnological approach to vaccine production. DNA fingerprinting and RFLP in domestic animals.

**UNIT VI**

Transgenic animals: Gene transfer methods in animals- Microinjection-Embryonic stem cell mediated and Retroviral mediated. Transgenic animal models, animal pharming and industrialization of transgenic animals.

**References:**

1. Culture of Animal Cells-A Manual of basic Technique; RI Freshny; Wiley & Sons
2. Animal Biotechnology-Recent Concepts to Development; P.Ramadass, MJP Pub.
3. Animal Cell Biotechnology-Methods and Protocols; Nigel Jenkins, Humana Press

**BIOSAFETY, BIOETHICS AND INTELLECTUAL PROPERTY RIGHTS****UNIT I**

Biosafety- Objectives, Recombinant DNA safety, classification of pathogenic microorganisms. Biosafety practices - code of practice, containment laboratory design and facilities. Biological containments and physical containments. Biosafety levels.

**UNIT II**

Guidelines for rDNA research activities- largescale experiments, release to environment, import and shipment, mechanism of implementation of biosafety guidelines. Quality control of biologicals produced by rDNA technology. Revised guidelines for research in transgenic plants.

**UNIT III**

Bioethics - Ethical aspects of interfering in natural processes and hidden dangers in altering the genetic makeup.

**UNIT IV**

Intellectual property rights - copyright, patents, trademarks. Copyright- subject matter, criteria for protection, duration, infringement and defences. Trade secret.

**UNIT V**

Patents - nature of patents and general requirements, patentable subject matter, procedure for grant of patent and patent infringement, patentability of microorganisms, plant patent, animal patent, patentability of genes and vectors - FDA, trade related aspects of intellectual property rights (TRIPS) and GATT, transfer of technology and benefit sharing.

**UNIT VI**

Legal protection for plants and other higher organisms. Life patents, plant breeders' rights and farmers' rights. Sui-generis plant variety protection - traditional knowledge protection. IPR and plant genetic resources.

**References**

1. Intellectual Property laws: Containing Acts, rules & regulations. Univ. Law Pub. Co.
2. CRC Handbook of Laboratory Safety. A Keith Furr, CRC Press
3. Intellectual Property law. A Chandrashekar, C Sitaraman and Co Pvt. Ltd.
4. Intellectual Property Protection and Sustainable Development, Philippe Cullet
5. Bioethics. Shaleesha. A Stanley, Wisdom Education Services.
6. Recombinant DNA Safety Guidelines.1990. Dept. of Biotechnology, Ministry of Science and Technology, Govt. of India



**UNIT I**

Food Fermentation Technology: Origin, Scope, and development of fermented products, Primary feed stock, raw materials and conversions, Fermented food and microbial starters, commercial potential, Food fermentation industries, their magnitude, R & D innovations

**UNIT II**

Fermented beverages: Wines and different types of wines, Distilled liquors (brandy, rum and vodka)-Fermented milk products-Cheese, Butter and Yoghurt-Fermented vegetables- Sauerkraut and other indigenous fermented foods

**UNIT III**

Development of Novel Food and food ingredients: Single cell protein, Polysaccharides, Low calorie sweeteners, Naturally produced flavor modifiers, Amino acids, Vitamins, Food supplements, Nutraceuticals, Water binding agents

**UNIT IV**

Bioreactors in Food Fermentation: Cultivation of microorganisms, Instrument regulation and process control, Laboratory scale submerged and solid state fermentation, Pilot scale submerged and solid state fermentation

**UNIT V**

Food Spoilage and Preservation: General principle of spoilage, Microbial toxins (endotoxins and exotoxins), Contamination and preservation, Factors affecting spoilage, Methods of food preservation (Thermal processing, Cold preservation, Chemical preservatives, food dehydration, Food irradiation, Biological control), Monitoring of food quality

**UNIT VI**

Packaging of Food: Need for packaging, Requirements for packaging, Containers for packaging (Glass, Metal, Plastics, Moulded pulp and Aluminium foil), Dispensing devices

**References**

1. Principles of fermentation technology. Stanbury PF, A Whitaker et.al. Pergmon Press
2. Fermentation Microbiology and Biotechnology. Mansi, Bryee, Demain & Allman.
3. Bioprocess technology. P T Kalaichelvan, I Arun Pandi. MJP publishers.
4. Biotechnology. Textbook of Industrial Microbiology. Crueger & Crueger. Panima Pub.
5. Food Biotechnology-S.N Tripathy-Dominant pub
6. Biotechnology: Food Fermentation Vol I and II, V.K Joshi and A.Pandey
7. Food Processing: Biotechnological Applications- S.S Marwaha and J.K. Arora
8. Microbial Biotechnology. Fundamentals of applied microbiology. Alexander N Glazer, Hiroshi Nikalido. Cambridge University Press.

**UNIT I:**

Brief study on classification of drugs. Developments leading to various medical classes of drugs: Hypnotics and analgesics, antipyretics, antiseptics, cardiac stimulants, infectious disease drugs etc. Natural products as potential drugs. Alkaloids as a source of drugs.

**UNIT II:**

Physico-chemical properties of drugs, receptors and drug action, distribution and elimination of drug. Peptide and protein drugs.

**UNIT III:**

Brief account of drugs affecting neurotransmission, central nervous system, cardiovascular system, immune system- nonsteroidal anti-inflammatory agents, antihistamine. Drugs affecting hormonal system- insulin and oral hypoglycemic drugs, adrenocorticoids, estrogen, progesterone, androgens, thyroid drugs.

**UNIT IV:**

Chemotherapeutic agents. Antibacterial and antimicrobial agents, antiparasitic agents, antifungal drugs, antiviral drugs, protease inhibitors and chemotherapy.

**References**

1. The Practice of Medicinal Chemistry. Camille Georges Wermuth, Acad Press.
2. Medicinal Chemistry. Thomas Nogrard & DF Weaves, Oxford Univ Press.
3. Medicinal Chemistry. G Patrick, Viva Books Pvt. Ltd.
4. Principles of Medicinal chemistry. William O & Foye BI, Waverks Pvt. Ltd
5. Foye's Principles of Medicinal Chemistry. David A Williams and Thomas L Lemke, Lippincott Williams & Wilkins.

**BTG3P06:**  
**PRACTICAL VI**  
(Practical of BTG3C09)

1. Isolation of Plasmid DNA.
2. Isolation of DNA from Plant.
3. Isolation of DNA from Blood.
4. RNA isolation from Bacteria.
5. RNA isolation from Plant (TRI solution method).
6. Agarose gel electrophoresis of DNA.
7. SDS-PAGE of proteins
8. DNA staining methods (EtBr, Silver, Safe blue and Safe Green).
9. Restriction digestion of DNA.
10. DNA Ligation.
11. DNA amplification (PCR).
12. RT-PCR (cDNA synthesis)
13. RFLP analysis
14. RAPD analysis
15. Agro bacterium mediated genetic transformation in plant
16. Recombinant DNA in forensics (DNA isolation from dried blood, Hair, semen, Nail, saliva etc.).

**BTG3P07:**  
**PRACTICAL VII**  
(Practical of BTG3C10 and BTG3C11)

1. Various media preparation- MS, B<sub>5</sub>.
2. Explant selection, sterilization and inoculation.
3. Role of different hormones and their concentration in inducing shoot generation and root generation in monocot and dicot plant.
4. Callus and cell suspension culture.
5. Measurement of cell viability.
6. Somatic embryogenesis from callus and cell suspension culture.
7. Plant regeneration by organogenesis.
8. Meristem and shoot tip culture.
9. Anther and pollen culture, viability of pollen grains.
10. Artificial seed.
11. Collection and separation of different parts of herbs.
12. Preparation of animal cell culture medium and membrane filtration
13. Cryopreservation and thawing
14. Hemagglutination test

**UNIT I**

Genetic and chromosomal disorders, single cell disorders and complex traits. Autosomal; sex chromosomal; karyotype analysis. G banding, in situ hybridisation (**FISH** and **on FISH**) and comparative genome hybridisation (**CGH**).

**UNIT II**

DNA diagnostics: PCR based diagnostics, Ligation chain reaction, Southern blot diagnostics, array based diagnostics, DNA sequencing, genetic profiling and single nucleotide polymorphism.

**UNIT III**

Molecular pathology of single gene disorders. Hemoglobinopathies, Skeletal disorders. Retinopathies. Diseases of skin. Immunodeficiencies. Genes involved in development.

**UNIT IV**

Molecular pathology of diabetes mellitus, atherosclerosis and coronary artery disease, neurogenetic and neuropsychiatric disorders, sexual orientation. Cancer. Prevention of genetic diseases, genetic counselling, prenatal diagnosis of Muscular and Neuronal disorders. X-linked disorders.

**UNIT V**

Gene therapy- Ex-vivo, In-vivo and In-situ gene therapy. Vectors used in gene therapy. Gene therapy trials- Familial hypercholesterolemia, Cystic fibrosis, Cancer, cardiovascular diseases rheumatoid arthritis and AIDS. Xenotransplantation. Stem cell and potential use of stem cell- cell based therapies and Nanomedicine

**References**

1. Genetics for clinicians- Shubha R.Phadke; PRISM BOOKS.
2. An introduction to Recombinant DNA in medicine- Alan EH. Emery; Wiley and sons
3. Human Molecular Genetics- T. Strachan and Andrew Read; Amazone
4. Molecular Diagnosis of Infectious Diseases (Methods in Molecular Medicine)- Johen Decker, U. Reischl; Amazone



**ENVIRONMENTAL AND AGRICULTURAL BIOTECHNOLOGY****UNIT I**

Biosensors - Types and applications in environmental pollution detection and monitoring. Principles of Remote Sensing and its applications in environmental monitoring. Biological monitoring of water quality and indicator species.

**UNIT II**

Sewage treatment methods - Sludge treatment and disposal - Anaerobic digestion - Agricultural waste - Industrial waste - Types and sources of pollution - Inorganic, Organic and Biotic. Pollutions: Air, water and land pollutions. Environmental impact of pollution and measurement methods. Bioremediation: Synthetic compounds, Petrochemical compounds, Inorganic waste. Bioremediation strategy and Phytoremediation.

**UNIT III**

Bioresources: Combustion of biomass - Biogas, Biodiesel, Bioethanol, Hydrogen. Natural resource recovery - Oil recovery, Recovery of metals (Bioleaching).

**UNIT IV**

Biodiversity and Conservation Biotechnology: Definition, historical and geographical causes for diversity; Types of diversity; Molecular taxonomy; Maintenance of ecological biodiversity. Collection and conservation of biodiversity; Principles of conservation, major approaches to conservation management. Conservation of animal genetic resources; Methods of biodiversity conservation: Gene banks, Cryopreservation; Assessing, analysing and documenting biodiversity.

**UNIT V**

Plant metabolic engineering: The concept of secondary metabolites. Historical and current views. Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles. Importance of secondary metabolites in medicine and agriculture. Secondary metabolite production from genetically engineered plant cell cultures.

**UNIT VI**

Aquatic biotechnology: Introduction to aquatic biotechnology. Aquaculture: increasing world's food supply through biotechnology - Molecular genetics of aquatic organisms - Medical applications of aquatic biotechnology - Non medical products. Environmental applications of aquatic biotechnology.

**UNIT VII**

Biofertilizers, Types of biofertilizers. Nitrogen fixation (symbiotic and non symbiotic) using mycorrhizae. Vermicompost. Biopesticides: pesticide discovery and development. Applications of biotechnology in target specific pesticides and pest tolerant genetically modified crops.

**References:**

1. Environmental Science and Biotechnology: A.G.Murugesan, C.Rajakumari; MJP Publishers.
2. Environmental Biotechnology; Alan Scragg; Oxford University Press.
3. Environmental Biotechnology; M.H.Fulekar; Oxford & IBH Publishing Co. Pvt. Ltd.
4. Textbook of Agricultural Biotechnology; Ahindra Nag; PHI Learning Pvt. Ltd.
5. Biodiversity and Biotechnology; Samith Ray and Arun. K. Ray; New Central Book Agency.
6. Plant Biotechnology; S. Ignacimuthu; Oxford and IBH Publishing Co Pvt. Ltd
7. Introduction to Plant Biotechnology; H.S.Chawla; Oxford and IBH publishing group.

**UNIT I**

Basic principles of bioprocess fermentation - Solid state and submerged fermentation. Isolation and screening, strain improvement and preservation of industrially important microbes. Application of modern biotechnological tools for strain improvement.

**UNIT II**

Bioreactors- design and types, bioprocess control and monitoring- variables (pH, temp, pressure, DO). Bioprocess media-formulation and sterilization of media and development of inoculum. Scale up in bioprocess. Downstream processing.

**UNIT III**

Microbial production of amino acids (glutamic acid, lysine, threonine), vitamin (vitB12, vitA), antibiotics (penicillin, tetracycline, streptomycin), enzymes (amylase, protease), organic acids (citric acid, acetic acid), fermented foods and beverages.

**UNIT IV**

Immobilization of cells and enzymes-Biotransformation.

**UNIT V**

Microbes in food and agricultural biotechnology: bio-insecticides, biofertilizers, SCP, Probiotics and its application.

**UNIT VI**

Biofuels: Production of bioethanol, biogas, biodiesel, lignocellulosic material for ethanol production. Biorefineries and Bioleaching.

**References**

1. Microbial Biotechnology. Fundamentals of applied microbiology. Alexander N Glazer, Hiroshi Nikaido. Cambridge University Press.
2. Principles of Fermentation technology. Stanbury PF, A Whitaker et.al. Pergmon Press
3. Microbial Technology. Fermentation Technology. Peppler HJ\$ D Perlman Acad Press
4. Fermentation microbiology and biotechnology. Mansi, Bryee, Demain & Allman.
5. Industrial microbiology. A H Patel. MacMillian.
6. Bioprocess technology. P T Kalaichelvan, I Arun Pandi. MJP publishers.
7. Industrial microbiology. Prescott and Dunn. A V I Publishing Co USA.
8. Biotechnology. Textbook of Industrial Microbiology. Crueger & Crueger. Panima Pub
9. Industrial Microbiology. L E Casida. AGE International Publications.
10. Industrial Microbiology: An Introduction. Michael J Waites, Neil L Morgan, John S Rockey, Gary Higton. Blackwell science.

**BIOMOLECULAR MODELLING AND DRUG DESIGN****UNIT I**

Structural parameters in drugs, proteins and nucleic acids. X-ray crystallography and homology modelling. Molecular mechanics-energy minimisation (local & global). Solvent simulation.

**UNIT II**

Molecular dynamics & conformational energy searching (Montecarlo Stochastic simulation). Aims of Drug Design, steps in Drug Design - Computer aided Drug Design. Drug targets-enzymes, receptors, carrier proteins, structural proteins etc. Pharmacokinetics. Drug Discovery - The lead compound - sources of lead compounds. Pharmacophore - SAR.

**UNIT III**

Agonist and antagonist - biological activity (intrinsic activity) & efficacy. Stimulus-response relationships. Ion-channels. Interactions - Intermolecular interactions - Hydrogen bonding, hydrophobicity etc. Intermolecular interactions -inter molecular flexibility & conformation.

**UNIT IV**

Effect of solvent on drug receptor interactions - energy changes during drug binding - stability of drug receptor complex - Drug docking - Design of drug with increased activity based on molecular docking information in conjunction with protein and knowledge (homology modelling) engineering.

**References:**

1. Molecular Modelling and Simulation - An Interdisciplinary Guide; Tamar Schlick
2. Molecular Modelling - Principles and Applications; Andrew Leach; Prentice Hall.
3. Medicinal Chemistry - A Molecular and Biochemical Approach; Thomas Nogard, Donald F. Weaver; Oxford University Press.
4. An Introduction to Medicinal Chemistry; Graham L. Patrick; Oxford Univ Press.
5. Intellectual Property laws: containing Acts, Rules & Regulations 2008; Universal Law Publishing Co.

### UNIT I

Introduction: Definition, Interdisciplinary nature, learning from nature (linear and rotary molecular motors, abalone shells) and scope.

### UNIT II

Bio-nanostructures: Protein based nanostructures, self assembly engineered nanopores, protein micro-arrays, Magnetosomes, bacteriorhodopsin and their application. DNA based nanostructures- DNA-Protein nanostructure, DNA-templated electronics, DNA nanoparticle conjugates-chip based DNA detection, DNA Nanostructures for mechanics and computing, nanoparticles as non-viral transfection agent.

### UNIT III

Nanoparticles: Silica nanoparticles for analytical microbial biofilms structure and applications. Artificial cells. Nanostructured fluids and soft material-applications in drug solubilization and delivery nutraceuticals enhanced oil recovery, antimicrobial and cosmetic nanoemulsions, food colloids, templating of nanoparticles

### UNIT IV

DNA-Nanotechnology: Structural DNA assembly, nanopore DNA sequencing, DNA coupled to carbon nanotubes, DNA-modified surfaces, polyelectrolyte behavior in DNA, self assembling toroidal nanoparticles

### UNIT V

Applications of nanoparticles: Nanoparticles for biological assays as drug delivery vehicles and as contrast agent.

### UNIT VI

Applications of nanotechnology/nanobiology/nano-biotechnology in biomineralization, medicine and surgery (stem cell biology, artificial organs, tissue engineering, cardiology and cardiac surgery, organ transplantation and cancer).

### References:

1. Biomineralization: From Biology to Biotechnology and Medical applications- Bauerlin E- Wiley VCH-Verlag
2. Nano and Microscience: engineering Technology and Medical Series-Lyshevski and Sergey Edward\_CRC press
3. Nanostructures and Nanomaterials-Cao G-Imperial College Press
4. Nanoscale Technology in Biological systems-Ralph S-CRC press

**DIAGNOSTIC TECHNIQUES IN MICROBIOLOGY****UNIT I**

Basic concepts of infectious disease diagnosis; collection and transport of specimen; examination and processing of cultures, reporting of results.

**UNIT II**

Conventional and Rapid methods for identification of bacteria and fungi: extremely rapid biochemical and enzymatic tests, conventional biochemical tests, modification of conventional biochemical tests.

**UNIT III**

Molecular methods in clinical microbiology: Nucleic acid hybridization, direct detection probes, Nucleic acid amplification methods. Genotyping bacteria by using variable number tandem repeats. Microarray-based microbial identification and characterization.

**UNIT IV**

Diagnostic immunological methods: principles of serologic tests, Immunoassays for the diagnosis of infectious diseases, detection technologies of antigen and antibody- classical and contemporary immunoassays.

**References**

1. Advanced Techniques in Diagnostic Microbiology. Yi-Wei Tang and Charles W. Stratton Springer.
2. Textbook of Diagnostic Microbiology. Connie R. Mahon, Donald C. Lehman George Manuselis. Saunders publishers.
3. Diagnostic Microbiology. Betty A Forbes, Daniel F Sahn. Mosby publishers.
4. Manual of Clinical Microbiology. Patrick R Murray, Ellen Jo Baron, Michael A Pfaller, Fred C Tenover, Robert H Yolken. ASM Press.



**BTG4P08:**  
**PRACTICAL VIII**  
(Practical of BTG4C12 and BTG4C13)

1. ELISA
2. Detection of Cancer (Uterine / Cervix)  
(Amplification of Human papilloma virus)
3. Detection of Urinary Tract infection (UTI)
4. Detection of Thalessemia
5. Analysis of sewage water (pH, alkalinity, acidity, total hardness, solids)
6. Analysis of organic constituents-Dissolved oxygen, BOD, COD and ammonical nitrogen
7. Analysis of inorganic constituents- Sulphate, flouride, phosphate etc
8. Analysis of metallic constituents- zinc, nickel etc
9. Analysis of soil: Determination of total phosphorous, calcium, magnesium, total nitrogen, heavy metals etc.
10. Microbial analysis of water, waste water and soil
11. Isolation of Rhizobium from legume root
12. Antifungal and antibacterial activity of medicinal plant
13. Induction of crown gall using Agrobacterium.



**BTG4P09:**  
**PRACTICAL IX**  
(Practical of BTG4C14)

1. Screening and isolation of antibiotic and enzyme producers.
2. Production & characterization of wine (estimation of alcohol), citric acid.
3. Comparison of ethanol production using various organic waste/ raw material (free cells and immobilized cells).
4. Microbial production of dextran by *Leuconostoc mesenteroides*.
5. Production of SCP.
6. Biogas production.
7. Immobilization of microbial cell and enzymes.
8. MIC determination of antibiotics by broth dilution technique and filter paper disc assay.
9. Test for the degradation of aromatic hydrocarbons by bacteria.
10. Production of Cheese
11. Production of Yoghurt
12. Production of Sauerkraut

# MODEL QUESTION PAPER

*M.Sc. Biotechnology Syllabus - KUCBSS-2014 - Kannur University*

**KANNUR UNIVERSITY**  
**I SEMESTER M.Sc. BIOTECHNOLOGY DEGREE EXAMINATION, 2014**  
**(KUCBSS SCHEME)**

**COURSE - BTG1C01: BIOCHEMISTRY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What are the features of peptide bond?
2. Mention the forces stabilizing the structure of protein
3. Name two purines and draw their structure.
4. What are epimers? Give one example
5. What are the structural differences between glucose and fructose?
6. Define stereoisomerism. What is its significance in protein chemistry?
7. Define isoelectric pH.
8. Explain Chargaff's rule.
9. Define vitamins. Give examples.
10. What are neurotransmitters? Give example.

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

11. Describe the structure of tRNA.
12. Give a brief account on heteropolysaccharides.
13. Write short notes on protein hormones.
14. Describe the sequence of events which leads to the origin of life.
15. Write short notes on polysaccharides.
16. Explain DNA polymorphism.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1 = 10 marks)

17. Describe the chemistry and functions of lipids.
18. Explain the mechanisms of neurotransmission.

**KANNUR UNIVERSITY**  
**I SEMESTER M.Sc. BIOTECHNOLOGY DEGREE EXAMINATION, 2014**  
**(KUCBSS SCHEME)**

**COURSE - BTG1C02: BIOPHYSICS**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. Define enthalpy.
2. Differentiate between nucleoside and nucleotide.
3. What is meant by mutarotation?
4. Define redox potential.
5. What are the functions of rubisco?
6. Define osmotic pressure.
7. Explain glycosidic linkage.
8. Define free energy of a system.
9. What are detergents?
10. What is meant by energy of activation?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

11. Describe surface tension and its application
12. Explain DNA supercoiling
13. Discuss on membrane transport.
14. Explain the structure of lysozyme.
15. Give an account of secondary structure of protein.
16. Write a short note on membrane potential.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1 = 10 marks)

17. Describe the laws of thermodynamics.
18. Explain the structure and properties of water.

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**KANNUR UNIVERSITY**  
**I SEMESTER M.Sc. BIOTECHNOLOGY DEGREE EXAMINATION, 2014**  
**(KUCBSS SCHEME)**  
**COURSE - BTG1C03: CELL BIOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What are the features of collagen type 1?
2. Write down the importance of cyclins
3. Mention the functions of peroxisomes
4. Write a note on barr bodies
5. Highlight the role of microtubule in the formation of mitotic apparatus
6. What are tumour suppressor genes
7. What are heterophagosomes
8. Explain the types of oncogenes
9. What is heteroploidy
10. Describe the role of histones in chromosome organization

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4= 20 marks)

11. Schematically represent the different stages of cell cycle.
12. Write short notes on proteoglycan and fibronectin.
13. Describe the functions of golgi bodies.
14. Explain various types of ribosomes. Mention its role in protein synthesis.
15. What is apoptosis? Explain its significance.
16. Describe active transport in detail.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1=10 marks)

17. What is cell cycle check point? Where do checkpoints occur in cell cycle? How do cell cycle check points regulate cell cycle
18. Describe the structure and functions of rough endoplasmic reticulum.

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**COURSE - BTG1C04: GENERAL MICROBIOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What are bacteriophages?
2. Explain the functions and types of flagella
3. What are Koch postulates?
4. Briefly describe three domain classifications.
5. Describe the features of slime molds.
6. Briefly describe the spread plate method.
7. What is lyophilization?
8. Describe the influence of pH on microbial growth.
9. Explain the principle of spore staining.
10. What is phenol coefficient?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

11. What are the different criteria used in bacterial classification?
12. Explain the features of archaeobacteria and how they differ from eubacteria.
13. Describe the classification of fungi.
14. Explain in detail on growth curve.
15. Discuss different types of culture media.
16. Explain the ultra structure of Gram positive bacterial cell wall.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1=10 marks)

17. Explain the physical and chemical methods used to control microbial growth.
18. Describe the principle and functions of different types of microscopes.

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**COURSE - BTG2C05: IMMUNOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. Explain TATA.
2. List the four characteristics attributes of adaptive immunity.
3. Define the structure and function of class I MHC molecules.
4. List some of the roles of cytokines.
5. What are haptens and its role in antigenicity?
6. What are adjuvants and its types?
7. Write two applications of western blotting.
8. Explain MHC restriction and how it helps in the differentiation of T cells.
9. What are the types of T cells?
10. What are the characteristics of Hashimoto's thyroiditis?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

11. What are the pathways of B cell tolerance?
12. What is hypersensitivity? Write a note on its types.
13. Explain classical and alternative pathways of complement activation.
14. Discuss the technique ELISA and mention its application.
15. Explain different types of vaccines.
16. Describe the role of NK cells and macrophages against tumor.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1 = 10 marks)

17. Explain in detail the processing and presentation of exogenous and endogenous antigen?
18. What are the mechanisms involved in transplant rejection? Describe some of the immunosuppressive therapy in organ transplantation.

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**COURSE - BTG2C06: MOLECULAR BIOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What are repressor proteins?
2. What is the importance of sigma factor in transcription initiation?
3. Give two post translational modifications in eukaryotes.
4. Explain the role of enhancer in gene regulation.
5. What are RNA probes?
6. What are the enzymes involved in 5' capping?
7. Write two functions of TATA binding protein.
8. What are the constituents of spliceosome complex?
9. Explain the role of T7 RNA Polymerase in regulation of phages.
10. What are DNA microarrays?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4= 20 marks)

11. Give an account of inhibitors of transcription.
12. Explain the salient features of genetic code.
13. Write an account on structure and function of tRNA.
14. Explain the enzymes involved in DNA replication.
15. Briefly explain the different repair mechanisms.
16. Describe the structure of chromatin.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1=10 marks)

17. Discuss the basic principles involved in bacterial operons. Explain the mechanism behind repressible and inducible system with example.
18. Discuss the various stages of translation in eukaryotes. Explain each stage with specific diagrams.

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**COURSE - BTG2C07: GENETICS**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What is Lyon hypothesis?
2. Explain genetic map.
3. Differentiate idiogram and karyotype.
4. What are auxotrophs?
5. Highlight the importance of *Arabidopsis thaliana*.
6. Distinguish deletion and inversion.
7. Explain principle of segregation.
8. Define penetrance.
9. Write the properties of z-DNA.
10. What is chiasma?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4= 20 marks)

11. Discuss the significance of meiosis.
12. What is cytoplasmic inheritance? How does it differ from mendelian inheritance?
13. Write a note on multiple alleles.
14. Discuss various mechanisms of sex determination.
15. Write a note on human genetic disorders.
16. What are transposons? Explain various mechanisms of transposition.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1=10 marks)

17. What is Hardy-Weinberg law? Discuss various sources that change the gene frequencies of population.
18. Describe the genetic transfer mechanisms in bacteria.



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**COURSE - BTG2E01: ENZYMOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What are isozymes?
2. Explain  $K_m$  and  $V_{max}$ .
3. What is ping-pong mechanism?
4. Define specific activity of an enzyme.
5. Write notes on allosteric inhibition of enzymes.
6. Differentiate between coenzymes and cofactors.
7. Explain the active site of an enzyme.
8. What is reversible covalent modification?
9. Write notes on abzymes.
10. Explain acid-base catalysis.

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

(5x4 = 20 marks)

11. Explain active site mapping of enzymes.
12. What are coenzymes? List the major coenzymes involved in metabolic reactions.
13. Explain enzyme catalysis.
14. Differentiate between competitive and uncompetitive inhibition.
15. Describe Michaelis-Menten kinetics.
16. Explain the factors influencing enzyme activity.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1=10 marks)

17. What are the different types of mechanisms involved in enzyme activity regulation? Describe the significance of allosteric regulation.
18. Write an essay on enzyme engineering. Explain the industrial and medical applications of immobilized enzymes.

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**COURSE - BTG2E02: BIOINSTRUMENTATION**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. Define sedimentation.
2. What is electrode potential (or) half cell potential?
3. Explain HEPA.
4. Comment on peptide mass fingerprinting.
5. What is isoelectric focussing?
6. Give the characteristics of ionizing radiations.
7. What is NMR?
8. Explain Beer-Lambert law
9. What is ultrafiltration?
10. Explain Geiger-Muller counters.

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

11. Define electrophoresis and explain different types of electrophoresis.
12. Describe the principle and operation of colorimeter.
13. Write an account on autoradiography and its safety guidelines.
14. Write short note on X-ray crystallography
15. How a pH meter works?
16. Explain common types of centrifugation.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1 = 10 marks)

17. Give an account of different types of chromatography with special reference to HPLC.
18. Describe the different spectroscopic techniques you have studied.

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**COURSE - BTG2E03: INTERMEDIARY METABOLISM**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What is substrate level phosphorylation?
2. Differentiate between catabolism and anabolism.
3. Write notes on ketogenic aminoacids.
4. What is glyoxylate cycle?
5. What are the coenzymes involved in citric acid cycle?
6. Differentiate between glycogenesis and glycogenolysis.
7. Expand PLP. Write a note on its significance.
8. Write an account on sterols.
9. Explain essential aminoacids.
10. Describe reducing equivalents.

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

11. Explain transamination and oxidative deamination.
12. Write notes on gluconeogenesis.
13. Explain the biosynthesis of cholesterol.
14. Discuss fatty acid oxidation.
15. Describe photosynthetic electron transport.
16. Explain pentose phosphate pathway.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1 = 10 marks)

17. Write an essay on high energy molecules. Explain the significance of ATP.
18. Explain the de novo and salvage pathway of nucleotide biosynthesis and its regulation.

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**COURSE - BTG3C08: BIOSTATISTICS AND BIOINFORMATICS**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. Define frequency distribution of a random variable.
2. Define SAGE.
3. Why is arithmetic mean considered as the best among the other averages?
4. Explain genome and proteome.
5. What are the desirable properties of a good measure of dispersion?
6. State the addition and multiplication theorems of probability.
7. Distinguish between census and sample survey.
8. What is DNA microarray?
9. What are the advantages of completely randomized experimental design?
10. What is boot strap analysis?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

11. What are the uses of graphs and diagrams? Explain different methods of presenting data graphically.
12. Explain different measure of central tendency.
13. Write a note on oligonucleotide design.
14. The probability that a student passes statistics test is  $\frac{2}{3}$  and the probability that he passes both statistics and mathematics test is  $\frac{14}{45}$ . The probability that he passes at least one test is  $\frac{4}{5}$ . What is the probability that he passes mathematics test?
15. Describe the similarity-based approaches to gene prediction.
16. How does the maximum likelihood method work?

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1 = 10 marks)

17. Write a note on the following: relative and cumulative frequency, coefficient of variation, permutation and combination, paired t- test, ANOVA.
18. Discuss various methods for protein identification through database searching.

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**COURSE - BTG3C09- RECOMBINANT DNA TECHNOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What is the significance of restriction endonuclease?
2. What are shuttle vectors?
3. What is knock out mouse?
4. Describe real time PCR.
5. What are monoclonal antibodies?
6. Comment on RACE.
7. Expand RAPD.
8. What are micro and minisatellites?
9. Explain HRT.
10. Differentiate SiRNA and miRNA.

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4= 20 marks)

11. Explain recombinant protein purification in prokaryotes
12. What is site directed mutagenesis? Write notes on its types.
13. Explain antisense RNA technology and gene silencing.
14. Describe the production of transgenic animals.
15. What are selectable markers and reporter genes? How it helps in identification of desired gene?
16. Discuss the enzymes involved in genetic engineering.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1=10 marks)

17. Discuss the methodology of transgenic plant production. Give an account on the applications of transgenic plants on crop improvement
18. Discuss the role of recombinant DNA technology for the diagnosis of genetic disorders.



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**COURSE - BTG3C10: PLANT BIOTECHNOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What are cryoprotectants?
2. Write the steps involved in organogenesis.
3. Define biotransformation.
4. List examples for cytokinins.
5. What is invitro pollination?
6. Differentiate hybrid and cybrid.
7. Write the action of enzymes in protoplast isolation.
8. Briefly explain liposome mediated transformation.
9. What are the types of callus?
10. Write two applications of somaclonal variations.

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4= 20 marks)

11. What are the methods of haploid production?
12. What is somatic embryogenesis? Write a note on its importance.
13. Explain the protoplast culture methods.
14. Discuss the invitro phenomenon in mass propagation.
15. Explain the role of growth regulators in growth and differentiation of plant cells in culture.
16. Describe the production secondary metabolites by cell culture.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1=10 marks)

17. Explain in detail the principles and methods of plant micropropagation?
18. What are the Agrobacterium based vectors? Explain the Agrobacterium mediated transformation of plants.

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**COURSE - BTG3C11: ANIMAL CELL BIOTECHNOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What are cell lines?
2. Write the cell adhesion molecules in animal cells.
3. Write the enzymes used in disaggregation.
4. Differentiate apoptosis and necrosis.
5. What is cell synchronisation?
6. Write two cell separation methods.
7. Explain balanced salt solution?
8. What are monoclonal antibodies?
9. Briefly explain organ culture?
10. Write two applications of embryonic stem cells.

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

11. Describe the growth medium used in animal cell culture.
12. Explain hybridoma technology?
13. Discuss the methods of tissue engineering?
14. Explain the maintenance of animal cells in culture.
15. What are transgenic animals? Give two examples.
16. What are recombinant vaccines? Write a note on its production.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1 = 10 marks)

17. Explain in detail the gene transfer methods in animals?
18. Discuss the DNA fingerprinting and RFLP techniques?

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**COURSE - BTG3E04: BIOSAFETY, BIOETHICS AND INTELLECTUAL  
PROPERTY RIGHTS**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

**(1x10 = 10 marks)**

1. Define biological containment.
2. What are the benefits of GATT?
3. Explain plant breeders right .
4. Comment on trademarks.
5. Comment on gene patent
6. What is meant by benefit sharing.
7. What is meant by FDA
8. What are objectives of Institutional Biosafety Committee
9. What is meant by trade secret?
10. What is meant by biosafety?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

**(5x4= 20 marks)**

11. Discuss the concerns of environmental ethics.
12. Explain Trade related intellectual property rights
13. How microorganisms are classified based on hazards?
14. What are main objectives of UPOV convention?
15. Discuss the role of copy right as an intellectual property right
16. Briefly discuss the guidelines for rDNA research activities

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

**(10x1=10 marks)**

17. What are the objectives of Biosafety? Discuss the code of practice, lab design and biosafety levels
18. Discuss the main objectives and requirements of patent. Give an account on patent office practice

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**COURSE - BTG3E05: FOOD BIOTECHNOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What is meant by brewing
2. Comment on microbial toxins
3. Differentiate submerged and solid state fermentation
4. Comment on monitoring device for food quality
5. Comment on Food dehydration
6. Comment on Water binding agents
7. Enlist any two examples novel food supplements
8. Comment on HACCP
9. What is meant by food spoilage
10. Comment on Sauerkraut

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4= 20 marks)

11. Explain the production of distilled liquors
12. Give an account on the production of fermented vegetables
13. Describe the role chemical preservatives in food preservation
14. Enlist two examples of novel food ingredients
15. Discuss the production of different types of wines
16. Discuss the production of SCP

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1=10 marks)

17. Discuss the food preservation methods in detail
18. Discuss the principle of Food fermentation. Explain the design of food fermentation bioreactors

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**COURSE - BTG3E06: MEDICINAL CHEMISTRY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. Differentiate hypnotics and analgesics.
2. What are nutraceuticals.
3. What is quinine.
4. List out few cardiac stimulants.
5. Comment on peptide mass fingerprinting.
6. What is prodrug?
7. What are antihistamines?
8. Explain the use of thiabendazole.
9. Give the factors affecting drugs metabolism.
10. What are the antiretroviral drugs used in the treatment of HIV infection?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

11. Write in detail about the occurrence, chemistry and biosynthesis of Penicillin.
12. Discuss about drug receptor interactions.
13. Give an account on the natural products as potential drugs.
14. Write short note on chemistry of insulin.
15. Explain in detail various process such as drug absorption, metabolism, distribution and elimination.
16. Describe briefly on the drugs affecting neurotransmission.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1 = 10 marks)

17. Give an account of polyene and azole drugs used in the treatment of pathogenic fungi.
18. Discuss the salient features involved in the isolation, identification and purification peptide drugs.

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**COURSE - BTG4C12: MEDICAL BIOTECHNOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What is Fluorescent In-Situ Hybridization
2. Comment on Xenotransplantation
3. Differentiate Ex-vivo and In-vivo gene therapy
4. Explain the concept comparative genome hybridization
5. Comment on Huntington's chorea
6. Comment on the molecular pathology of retinopathies
7. Enlist any two examples neurological disorders.
8. Comment on  $\beta^0$  thalassemia
9. What is meant by DNA microarray diagnostics
10. Comment on Single stranded confirmation Polymorphism

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

11. Explain the molecular diagnosis of atherosclerosis
12. Give an account on stem cells and stem cell based therapies.
13. Describe the role of rDNA for the diagnosis of cystic fibrosis
14. Enlist the different techniques used to diabetes melitus.
15. Discuss the applications of nanobiotechnology in medicine
16. Discuss PCR based diagnosis in medicine with suitable examples

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1 = 10 marks)

17. Discuss the prenatal diagnosis of duchene muscular dystrophy.
18. Discuss the strategies of gene therapy. Give an account on gene therapy trials of cancer and AIDS



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**COURSE - BTG4C13- ENVIRONMENTAL AND AGRICULTURAL**  
**BIOTECHNOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

**(1x10 = 10 marks)**

1. What are biosensors
2. Define biodiversity
3. Comment on biodiesel
4. Explain the concept of ecological biodiversity
5. Comment on Gene bank .
6. What is meant by Bioleaching
7. Enlist any two examples of biofertilizers
8. What is meant by Phytoremediation
9. Comment on Symbiotic nitrogen fixation
10. What are biosensors?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

**(5x4= 20 marks)**

11. Explain the mechanisms of conservation biotechnology management
12. Describe the production of secondary metabolites from transgenic plants
13. Discuss the role biotechnology for improvement of aquatic organisms
14. Enlist the different types of biopesticides
15. Describe the role of Biotechnology on the production of pest tolerant genetically modified crops
16. Discuss the role of microorganisms in the degradation of pesticides.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

**(10x1=10 marks)**

17. Discuss the different sewage treatment methods
18. Explain the mechanism of biosensors and remote sensing for environmental monitoring and pollution detection. Give an account on biological indicator species

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**COURSE - BTG4C14: MICROBIAL TECHNOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. Which method is adopted for the isolation of growth factor producers?
2. Define SCP with two examples.
3. Name two probiotic bacteria.
4. Define whey.
5. Write a note on heap leaching.
6. What is membrane filtration technique?
7. What are the two biochemical processes involved in the production of vinegar?
8. What is scale-up process?
9. Mention the role of hops in beer brewing.
10. What are biosensors?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4 = 20 marks)

11. Explain the production and recovery of penicillin.
12. Describe the steps involved in the separation of solids from culture media.
13. What is meant by enzyme immobilisation? Describe the different methods used for enzyme immobilisation.
14. Explain the method of production of biogas.
15. Give a detailed account on different strain improvement programmes.
16. What are bioinsecticides? Write a note on mode of action of BT toxin.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1 = 10 marks)

17. Comment on the effect of aeration, temperature, pH and dissolved oxygen on bioprocess.
18. With the help of a neat labelled diagram describe the important parts of a bioreactor. Discuss various types of bioreactors.

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**COURSE - BTG4E07: BIOMOLECULAR MODELING**  
**AND DRUG DESIGN**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

**(1x10 = 10 marks)**

1. Define Pharmacophore
2. What are Receptors
3. Explain Monte Carlo Stochastic simulation
4. Comment on SAR.
5. Comment on Multi Anomalous Diffraction
6. Explain Homology modelling
7. What are the different sources of lead compound
8. Comment on local minima
9. List out four advantages of protein engineering.
10. What is meant by efficacy?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

**(5x4= 20 marks)**

11. Discuss the process of simulating solvent environment
12. Discuss the different steps in drug design.
13. Explain the effect of solvent on drug receptor interactions
14. Briefly discuss the principle and procedure of X-ray crystallography
15. Discuss hydrogen bonding and hydrophobic interaction during binding
16. Discuss the principles of molecular dynamics

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

**(10x1=10 marks)**

17. Discuss molecular mechanics and energy minimization in molecular modelling
18. Explain drug docking. Discuss the applications drug docking in drug discovery

**KANNUR UNIVERSITY**  
**IV SEMESTER M.Sc. BIOTECHNOLOGY DEGREE EXAMINATION, 2014**  
**(KUCBSS SCHEME)**

**COURSE - BTG4E08: NANOBIO TECHNOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**

(1x10 = 10 marks)

1. What are nanopores
2. Write the applications of antimicrobial nanoemulsion
3. Comment silica particles
4. Comment on nutraceuticals
5. What is meant by polyelectrolyte behaviour
6. Comment on Bacteriorhodopsin.
7. Explain DNA templated electronics
8. What are magnetosomes
9. What are food colloids
10. Write two applications of artificial cells.

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**

(5x4= 20 marks)

11. Describe the applications of protein micro-arrays
12. Explain Nanopore DNA sequencing
13. Discuss the applications of nanoparticles as drug delivery vehicles
14. Explain the methodology of tissue engineering.
15. Briefly discuss Biomineralization
16. Discuss the applications of nanotechnology in cardiac surgery

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**

(10x1=10 marks)

17. Explain DNA microarray technology
18. Discuss the applications of Nanobiotechnology in medicine

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**KANNUR UNIVERSITY**  
**IV SEMESTER M.Sc. BIOTECHNOLOGY DEGREE EXAMINATION, 2014**  
**(KUCBSS SCHEME)**

**COURSE - BTG4E09: DIAGNOSTIC TECHNIQUES**  
**IN MICROBIOLOGY**

**Time: 3 Hrs**

**Maximum Marks: 40**

**Section A**

**Write about each of the following in 2 or 3 sentences. Each question carries 1 mark.**  
(1x10 = 10 marks)

1. Define maintenance media. Give an example.
2. What is anamnestic immune response?
3. What are anticoagulants?
4. What is latex agglutination test?
5. What are infectious diseases?
6. What is ribotyping?
7. Define benchmarking.
8. Mention the use of Moeller decarboxylase base medium.
9. State the difference between O/F patterns in bacteria.
10. What are incomplete antibodies?

**Section B**

**Write notes on or discuss any four of the following. Each question carries 5 marks.**  
(5x4= 20 marks)

11. Write down the principle and procedure for calcofluor white staining.
12. What is liposome mediated agglutination. Add a note on its advantages.
13. Compare the various automated methods for the rapid identification of bacteria.
14. Describe the principle and application of immunofluorescent assay.
15. Explain in brief about the various methods adopted for the collection, transport, and processing of respiratory specimens.
16. Write a note on the immunological diagnosis of viral diseases.

**Section C**

**Write an essay on any one of the following. The question carries 10 marks.**  
(10x1=10 marks)

17. Discuss the concept of nucleic acid amplification reaction. Explain how these techniques can be applied in a microbiology laboratory.
18. Describe the important physiological and biochemical tests used in medical Bacteriology.



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