

  
**KANNUR UNIVERSITY**  
(Abstract)

Scheme and Syllabus for M.Sc. Microbiology & M.Sc. Biotechnology Programmes under Choice Based Credit Semester System - University Departments- Implemented with effect from 2014 Admission – Orders issued.

ACADEMIC BRANCH

U.O.No.Acad.C4/12013/2014.

Civil Station, P.O, Dated: 30-09-2014

Read:- 1. U.O.No.Acad/C3/2049/2009 dated 11-10-2010.  
2. U.O.No.Acad/C3/2049/2009 dated 05-04-2011.  
3. Letter No. 12013 dated: 10-09-2014 from the Head of the Department, Department of Biotechnology & Microbiology.

ORDER

1. The regulations for Post Graduate Programmes under Choice Based Credit Semester System were implemented in the University with effect from 2014 admissions as per paper read (1) above and certain modifications were effected to the same vide paper read (2).

2. The Head of the Department, Department of Biotechnology & Microbiology, vide paper (3), has forwarded the revised Scheme and Syllabus for PG Programmes in Microbiology and Biotechnology in line with the Choice Based Credit Semester System, for implementation with effect from 2014 admission. .

3. The Vice Chancellor, after considering the matter in detail and in exercise of the powers of the Academic Council, conferred under section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with has accorded sanction to implement the revised Scheme and Syllabus for PG Programmes in Microbiology and Biotechnology under Choice Based Credit Semester System in University Department with effect from 2014 admission subject to report to the Academic Council.

4. Orders are issued accordingly.

5. The revised Scheme and Syllabus appended.

Sd/-  
DEPUTY REGISTRAR (Acad)  
For REGISTRAR

To  
The Head of the Department,  
Department of Biotechnology & Microbiology  
Thalassery Campus.

Copy to:  
1. The Examination Branch (through PA to CE).  
2. PS to VC/PA to PVC/PA to R.  
3. DR/AR I. (Acad.)  
4. SF/DF/FC

Forwarded/By Order

  
SECTION OFFICER

R1/1014



*Bi*  
*1/10/14*



**KANNUR UNIVERSITY**



**COURSE STRUCTURE & SYLLABUS FOR  
M.Sc. MICROBIOLOGY PROGRAMME  
Under CCSS**

**2014 Admission Onwards  
Department of Biotechnology & Microbiology  
Thalassery Campus**

**Kerala - 670 661, INDIA**



## COURSES OFFERED IN THE M.Sc. MICROBIOLOGY PROGRAMME

### SEMESTER I

Sl. No.	Course Code	Title of the course	Contact Hours/Week			Marks			Credits
			L	T/S	P	ESE	CE	Total	
<b>CORE COURSES</b>									
1	BMM1 C01	Biochemistry	3	2	3	60	40	100	4
2	BMM1 C02	Cell Biology	3	2	3	60	40	100	4
3	BMM1 C03	Genetics	3	2	3	60	40	100	4
4	BMM1 C04	General Microbiology	3	2	3	60	40	100	4
<b>ELECTIVE COURSES</b>									
5	BMM1 E01	Biostatistics	3	2	0	60	40	100	3
6	BMM1 E02	Instrumentation	3	2	0	60	40	100	3

### SEMESTER II

Sl. No.	Course Code	Title of the course	Contact Hours/Week			Marks			Credits
			L	T/S	P	ESE	CE	Total	
<b>CORE COURSES</b>									
7	BMM2 C05	Biophysics	3	2	3	60	40	100	4
8	BMM2 C06	Human Physiology	3	2	3	60	40	100	4
9	BMM2 C07	Immunology	3	2	3	60	40	100	4
10	BMM2 C08	Intermediary Metabolism	3	2	3	60	40	100	4
<b>ELECTIVE COURSES</b>									
11	BMM2 E03	Molecular Biology	3	2	0	60	40	100	3
12	BMM2 E04	Food Microbiology	3	2	0	60	40	100	3
13	BMM2 E05	Ethics, Patency & Intellectual Property rights	3	2	0	60	40	100	3

### SEMESTER III

Sl. No.	Course Code	Title of the course	Contact Hours/Week			Marks			Credits
			L	T/S	P	ESE	CE	Total	
<b>CORE COURSES</b>									
14	BMM3 C09	Microbial Technology	3	2	3	60	40	100	4
15	BMM3 C10	Systematic Bacteriology	3	2	3	60	40	100	4
16	BMM3 C11	Virology, Mycology and Protozoology	3	2	3	60	40	100	4
17	BMM3 C12	Environmental Microbiology	3	2	3	60	40	100	4
<b>ELECTIVE COURSES</b>									
18	BMM3 E06	Bioinformatics	3	2	0	60	40	100	3
19	BMM3 E07	Biotechnology in Medicine, Health, Agriculture and Environment	3	2	0	60	40	100	3
20	BMM3 E08	Recombinant DNA Technology	3	2	0	60	40	100	3
21	BMM3 E09	Enzymology	3	2	0	60	40	100	3

### SEMESTER IV

Sl. No.	Course Code	Title of the course	Contact Hours/Week			Marks			Credits
			L	T/S	P	ESE	CE	Total	
22	BMM4 Pr	Project				100	0	100	16
23	BMM4 C13	Viva Voce				100	0	100	4

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**BMM1C01  
BIOCHEMISTRY**

**UNIT I**

Introduction: Molecular logic of living system, Biological macromolecules. Role of biochemistry in contemporary medicine and its perspectives.

**UNIT II**

Membranes: Structure and functions of different membranes and reasons for their composition. Membrane transport. Passive transport, co-transport, anti-transport, active transport, secondary active transport. Pumps & channels and their significance. Membrane proteins.

**UNIT III**

Carbohydrates: Definition and classification. Structure, conformation and functions of monosaccharides, disaccharides, polysaccharides. Starch, glycogen, dextrin, cellulose, amino sugars, Glycoproteins, Glycolipids, Mucopolysaccharides.

**UNIT IV**

Proteins: Properties of peptides and proteins, Amino acids, their properties, and their classification according to the polarity of their side chains and according to the acid-base properties. Essential and non-essential amino acids. Structure of peptides and proteins, their primary structure. Structures of higher order and their meaning for the function of peptides and proteins. Protein - protein interaction.

**UNIT V**

Lipids: Definition and classification, structure, function, physical and chemical properties - Fatty acids, Fats, Waxes, Phospholipids, Sphingo lipids, cerebrosides, Ganliosides, sterols, lipoproteins. Eicosanoids - Formation of prostaglandins; prostocyclins and thromboxanes from unsaturated fatty acids, Saponification number, acid number and iodine number of fats.

**UNIT VI**

Nucleic acids: Definition and classification, structure, function, physical and chemical properties - Purines and pyrimidines, base pairing, Hogsteen base pairing.

**UNIT VII**

Vitamins and minerals: chemistry, source and functions of water soluble and fat soluble vitamins. Vitamins as cofactors. Source and functions of macro elements and trace elements

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## UNIT VIII

Hormones & Related Molecules: Chemistry, synthesis and functions of various hormones (Plant & Animal), pigments (Plant & Animal), Pheromones and neurotransmitters

### PRACTICAL

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. Denaturation studies on proteins.
8. Estimation of lycopene from tomato
9. Estimation of Urea
10. Estimation of Uric acid

### REFERENCES

1. Lehninger's Principle of Biochemistry. Nelson L D and M M Cox.
2. Biochemistry. Jeremy M. Berg John and Tymoczko Lubert Stryer.
3. Biochemistry with Clinical Correlation. Thomas M Devlin. Wiley- Liss
4. Biochemistry. Donald Voet, Judith G Voet, Charlottew pratt. John Wiley
5. Biochemistry. Jeoffrery Zubay. Wm C Brown Pub.
6. Biochemistry. Mathews CK and KE. van Holde. Benjamin Cumming Pub.
7. Biochemistry. Vol 1&2 David Metzler .

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**BMM1C02  
CELL BIOLOGY**

## UNIT I

General organization of prokaryotic and eukaryotic cells. Constituents of the Extra-cellular matrix. Differentiation of the cell surface, Cell junctions: tight junctions, desmosomes and gap junctions, cell coat. Cell-cell adhesion, Constituents of the Extra-cellular matrix. Cytoskeleton: microtubules, microfilaments and intermediate filaments



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## UNIT II

Cell communication: general principles, signaling pathways, Endoplasmic reticulum, Golgi complex, processing and trafficking of biomolecules, lysosomes, Structure and function of Peroxisomes and Glyoxisomes

## UNIT III

Nucleus: Nuclear envelope, nuclear matrix. Organization of chromatin: nucleosomes, higher order folding. Lampbrush and polytene chromosomes. Structure of centrioles, structure of mitotic spindle, synaptonemal complex. Nucleolus, Replication of prokaryotic, eukaryotic DNA. Enzymes and proteins of replication. DNA repair.

## UNIT IV

Cell cycle: Cascade of phosphorylation and dephosphorylation associated with cell cycle progress. Kinases, cyclins and related proteins and their role in cell cycle regulation. Apoptosis and Cancer biology.

## PRACTICAL

1. Cell Fractionation-chloroplast-differential centrifugation.
2. Cell Fractionation-mitochondria-differential centrifugation.
3. Isolation of DNA/RNA from liver/spleen.
4. Estimation of nucleic acid by spectrophotometric method.
5. Estimation of RNA by Orcinol test.
6. Estimation of DNA by Diphenylamine test.
7. Estimation of Protein by Lowry's method.
8. Study of Barr body (Buccal smear), Polytene Chromosome (*Drosophila*)

## REFERENCES

1. *Molecular Cell Biology*, Gerald Karp
2. *Molecular Biology of The Cell*, Alberts
3. *Molecular Biology*, David Friefelder.
4. *Genes VIII*, Benjamin Lewin.
5. *DNA replication*, Arthur Kornberg and Tania Baker.
6. *Molecular Biology of the Gene*, Watson et.al.

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**BMM1C03  
GENETICS**

**UNIT I**

Mendel and his contribution to Genetics. Monohybrid crosses and principle of segregation. Dihybrid crosses and principle of independent assortment. Rediscovery of Mendel's principles.

**UNIT II**

Mitosis & Meiosis. Chromosome theory of inheritance. Sex determination. Analysis of sex linked traits in humans. Cellular basis of differentiation, Gametogenesis and fertilization

**UNIT III**

Multiple alleles. Modification of dominance relationships. Gene interactions. Essential and lethal genes. Environmental impact on genes. Genetic linkage. Chromosomal exchange. Genetic maps. Tetrad analysis, Mitotic recombination. Chromosomal and gene mutations.

**UNIT IV**

Conjugation in bacteria. Transformation in bacteria. Transduction in bacteria. Mapping of genes in bacteria. Mapping of genes in bacteriophages. Bacterial transposons. Eukaryotic Transposable elements.

**UNIT V**

Genetic basis of cell differentiation. Gene expression control. Oncogenes

**UNIT VI**

Cytosomic inheritance, Inheritance through mitochondria and chloroplasts and their mapping. Genetic variation in populations and measuring. Inbreeding. Genetic Drift. Gene flow. Natural selection. Molecular evolution.

**PRACTICAL**

1. Study of mutations by Ames test.
2. Assay of antibiotics and demonstration of antibiotic resistance.
3. Bacterial transformation.
4. Transduction.
5. Isolation of plasmids.
6.  $^{14}\text{CO}_2$  fixations by photosynthetic microbes.
7. Mitosis
8. Meiosis

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## REFERENCES

1. Genetics by Strick Berger
2. Plant breeding by B D Singh
3. A text Book of Genetics by Veer Bala Rastogi
4. Genetics by Gardner, Simmons and Snustad
5. Genetics by Ursula Goodenough
6. Basic Genetics. Robert F. Weaver II edn. Philip W. C. B 1995.

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## BMM1C04 GENERAL MICROBIOLOGY

### UNIT I

Milestones in the history of Microbiology.

### UNIT II

Five Kingdoms and Woese's Three Domain classifications of living system. Bacterial, fungal and viral classifications. Bergey's Manual of determinative bacteriology. Laboratory procedures for identification of bacteria.

### UNIT III

Study of microbial morphology: Bright field, dark field, fluorescent, phase contrast, interference, polarization and electron microscopies. Specimen preparation, staining for various microscopic examinations.

### UNIT IV

Ultra structure of bacterial cells. Difference between bacterial and fungal cells: Different staining procedures and study of bacterial morphology, Cell wall, cell membrane and transport system, chromosome and extra chromosomal genetic materials; flagella, pili, capsule, endospore, Structure and multiplication of Virus, Fungal Reproduction

### UNIT V

Requirements and modes of microbial nutrition: Nutritional groups of bacteria. Photoautotrophy and bacterial photosynthesis, Chemoautotrophy, Heterotrophic metabolism. Aerobic and anaerobic respiration (fermentation).

### UNIT VI

Growth curve, Cultivation of bacteria, Culture media and methods, Storage and transport of microbes





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## UNIT VII

Physical and chemical methods of sterilization, Methods of testing antimicrobial substances, Drug resistance of microbes. Genetically Modified Microorganisms.

### PRACTICAL

1. Microscopy- structure and organization of compound microscope
2. Sterilization Techniques
3. Staining: simple, negative, gram's, capsular, spore, metachromatic granule,
4. Preparation of media & inoculation, Isolation of organisms from various environments.
5. Serial dilution of samples
6. Effect of pH, temp, oxygen and salinity on bacterial growth in liquid media.
7. Preparation of storage and transport media
8. Anaerobic culturing by liquid paraffin overlay and pyrogallol.
9. Starvation induced sporulation of bacteria.
10. Efficiency testing of bacteria proof filters and autoclave
11. Growth curve using breeds count, turbidimetry and CFU
12. Antibiotic sensitivity tests , Biochemical Tests for identification of Bacteria

### REFERENCES

1. Microbiology - Prescott
2. General Microbiology - Stanier
3. Fundamentals of microbiology - Frobischer
4. Principles of Microbiology - Ronald M Atlas
5. Antimicrobial Drug Resistance, Bryan, L E (eds.) Academic Press
6. Microbiology- Bernad D Davis et al, Harper International edition
7. Microbiology Concepts and Applications Pelzar Jr. Chan. Kreic. McGraw - Hill, Inc. Microbiology.
8. Zinsser Microbiology Prentice- Hall International Inc. Manual of Methods for General Bacteriology. Gerhaldt P et al (eds.) American Society for Microbiology
9. Textbook of Microbiology 9th Edition, Ananthanarayan, Paniker, Universities Press



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**BMM1E01  
BIOSTATISTICS**

**UNIT I**

Collection, Classification of data: Variables and constants, Different types of numerical data, Collection of data, classification, frequency distribution, Population and sample, methods of sampling.

**UNIT II**

Graphical/diagrammatic representation of data: line charts, Bar charts, Pie chart, Histograms, frequency polygons, ogives.

**UNIT III**

Measures of central tendency- arithmetic mean, median, mode, geometric and harmonic mean

**UNIT IV**

Measures of dispersion- Range, interquartile range, variance and standard deviation, coefficient of variation

**UNIT V**

Skewness and kurtosis, Karl Pearsons coefficient, moments

**UNIT VI**

Correlation and regression: correlation coefficient, regression coefficient, regression line. Fitting straight lines by least-squares method

**UNIT VII**

Probability: Permutation and combination, types of events, Definition of probability, addition and multiplication theorems of probability. Probability distributions: Binomial, Poisson and Normal distributions

**UNIT VIII**

Tests of significance: Estimation, confidence limit, level of significance, Standard error, testing of hypothesis for large and small samples, Tests of significance of: means, difference between two means and proportion

**UNIT X**

Chi-square test, Analysis of variance.

**REFERENCES**

1. Principles of Biostatistics - Pagano M. & Kimberlee G. Duxbury Press



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2. Probability and Statistical Inference - Hogg R. V. Tanis E. A., Prentice Hall, New Jersey
  3. Experimental Design Data Analysis for Biologists- Quinn G. P. & Keough M. J. Cambridge University Press
  4. Statistical Methods in Biology - 3<sup>rd</sup> edition, Bailey N.T.J., Cambridge University Press
  5. Biostatistical analysis - 4<sup>th</sup> edition, Zar, J.H. Pearson Education.
  6. Fundamentals of Biostatistics - P. Hanmanth Rao and K. Janardhan, I.K. International Publishing House, New Delhi.
  7. Introduction to Biostatistics and Research Methods- P.S.S. Sundar Rao and J. Richard, PHI learning Pvt Ltd, New Delhi.
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**BMM1E02  
INSTRUMENTATION**

**UNIT I**

Chromatography: Basic principles and applications, partition coefficient and relative mobility, Techniques of chromatography: Planar and column, Types of chromatography: Paper, Thin layer, Size exclusion, ion exchange, affinity, GLC, HPLC.

**UNIT II**

Electrophoresis: Basic principles and application. Various types of electrophoresis, PAGE, Specialized electrophoresis techniques, Isoelectric focusing.

**UNIT III**

Basic principles and application of centrifugation and density gradient sedimentation.

**UNIT IV**

Principles and application of Geiger-Mueller counter, scintillation counter, autoradiography, precautions to work with radioisotopes.

**UNIT V**

Spectroscopic techniques: Principles and biological applications of UV, IR, ORD, CD, NMR, Microwave, Fluorescent and Raman spectroscopies.

**UNIT VI**

Surface Plasmon resonance, Isothermal Titration Calorimetry and Differential Scanning Calorimetry. Principles and applications in biological research.



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### UNIT VII

Mass spectrometric techniques--various modes of ionization principles and applications. GCMS, LCMS, MALDI

### UNIT VIII

Basic principles and applications of X-ray crystallography and its utility in structural biology.

### UNIT IX

Spectrophotometry and colorimetry: Absorption and emission spectrum, qualitative and quantitative spectrophotometric assays.

### UNIT X

Structural organization of digital computers, hardware and software, character codes, operating systems, computer languages, flow charts, computer networks, databases.

### REFERENCES

1. Chromatography- Brown D.R., Ivy Publishing House, Delhi.
2. Encyclopedia of Separation Technology - Ruthren D. M. (Ed), JohnWiley & Sons
3. Experimental Biochemistry - 3<sup>rd</sup> edition, Switzer, R.L. & Garrity, L. F. W.H.Freeman & Company
4. Foundations of Spectroscopy- Duckett, S. & Gilbert, B., Oxford University Press.
5. Gel Electrophoresis of Proteins - 3<sup>rd</sup> edition, Hames, B.D.
6. Introductory practical biochemistry- Sawhney, S.K. and Singh, R. (eds). Narosa Publishing House, New Delhi.
7. Practical Biochemistry:Principles and Techniques- Wilson, K. & Walker, J., Cambridge University Press.

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### BMM2C05 BIOPHYSICS

### 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. Chemical kinetics: rate, order and molecularity of a reaction, energy of activation.



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## UNIT II

Concepts and importance of following in biology: pH and buffers, water structure, surface tension, adsorption, osmosis, dialysis, colloids, detergents, redox potential, Mitochondrial and photosynthetic electron transport.

## UNIT III

Stabilizing interactions in biological macromolecules – Van der Waals, Hydrophobic interactions, Salt bridges, Hydrogen bonding interactions.

## UNIT IV

Basic principles of nucleic acid structure: conformation of nucleotides, oligonucleotides, double helical structure, Watson-Crick model of DNA, base-pairing and base stacking, Hoogsteen base-pairing, DNA polymorphism, DNA super coiling and t-RNA structure.

## UNIT V

Basic principles of protein structure: main chain and side chain torsion angles, cis and trans peptides, primary, secondary, tertiary and quaternary structure of proteins, motifs and domains. Ramachandran plot. Lysozyme, haemoglobin, rubisco and immunoglobulins as examples. Protein folding and methods for studying it. . Protein-Nucleic acid interactions, H-L-H, Zn-finger and Leucine zipper motifs, Example

## UNIT VI

Free Radicals: Oxygen derived free radicals, antioxidation protection in organism, Properties of molecular oxygen, tendency to form free radicals: superoxide ion, hydroperoxyl radical, hydrogen peroxide, hydroxyl radical. Radical reactions, peroxidation of lipids. Protection: superoxide dismutase, peroxidases, catalase, glutathione peroxidase, glutathione reductase. Relationship to the pentose cycle, possible disorders. Other free radical (not oxygen derived), negative effect of biotransformation. Free radical scavengers, antioxidants.

## PRACTICAL

Buffers, Osmosis, Dialysis, Spectrophotometry, Denaturation studies on proteins, melting temperature of DNA, Chromatography, Electrophoresis, Optical activity of molecules. Use of Protein Data Bank for visualization of cis/trans peptide geometry, disulphide bond, primary, secondary, tertiary and quaternary structures, Ramachandran map and subunit Interactions in hemoglobin and Rubisco,. Use of PDB/NDB for visualization of A, B and Z conformation of DNA and t-RNA structure

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## REFERENCES

1. Biological thermodynamics - Donald T. Haynie, Cambri Univ 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, New York.
6. Principles of Protein Structure - G.E.Schulz & R.H.Schirmer, Springer Verlag, Berlin.
7. Principles of Nucleic Acid Structure - W. Saenger,
8. Protein Folding - Thomas E. Creighton (Ed),
9. Structure and Mechanism in Protein Science - Alan Fersht
10. Biophysical Chemistry- Part I, II, III - Charles R. Cantor and PR. Schimmel, W.H. Freeman & Co

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**BMM2C06**  
**HUMAN PHYSIOLOGY**

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### UNIT I

Introduction: Homeostasis. Digestive system: digestive processes in various regions of digestive system. Acid secretion regulation of gastrointestinal function- gastrointestinal hormones.

### UNIT II

Circulatory system: Blood-cellular composition. Hemopoiesis colony stimulating factors, Hemostasis Heart- structure, electrical activity, cardiac cycle and cardiac output, cardiovascular regulatory mechanisms

### UNIT III

Respiration: Mechanisms of respiration, gas exchange in the lungs, regulation of respiration and respiratory adjustments in health and disease.

### UNIT IV

Renal function: Kidney, Nephron, Juxtaglomerular Apparatus, glomerular filtration, tubular function, formation of urine, regulation of water and mineral excretion.

### UNIT V



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Physiology of muscular contraction: Classification of muscles, skeletal and smooth muscle, neuro muscular junction, electrical properties and ionic fluxes

#### **UNIT VI**

Nervous system: Different areas of brain and their functional significance. Structure of neuron and synapse, synaptic transmission, neurotransmitter systems. Autonomic nervous system.

#### **UNIT VII**

Endocrine system: General features, mechanism of action of hormones, hormones of pituitary, thyroid, adrenal, pancreas and gonads- secretion, biochemical nature of hormones, regulation of secretion, mechanism of action and biological effects.

#### **PRACTICAL**

1. Urinarydiastate or amylase
2. Identification of Vit A and C, glycerol, cholesterol, oleic and stearic acid
3. Urine analysis, normal
4. Urine test for abnormal constituents
5. Estimation of titrable acidity and ammonia in urea
6. Estimation of chloride in urine
7. Estimation of urea in urine
8. Estimation of proteins in urine
9. Gastric analysis
10. Peptic activity of gastric juice
11. Chemistry of bile
12. Spectroscopic examination of blood pigments
13. Determination of sugar in blood (Folin-Wu method)
14. Determination of urea in blood (Diacetyl monoxime method)
15. Liver function tests

#### **REFERENCES:**

1. Human Physiology, Guyton
2. Physiology, Ganong
3. Physiology, Best and Taylor



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**BMM2C07  
IMMUNOLOGY**

**UNIT I**

Overview of the Immune system, Cells of the Immune system

**UNIT II**

Innate immune mechanisms, classical and alternative pathways of complement activation and its regulation and functions. Adaptive immunity: Properties of immunogens and antigens, factors governing immunogenicity, haptens, epitopes, adjuvants.

**UNIT III**

Structure of immunoglobulins. Antigen binding site of antibody. Forces involved in antigen - antibody complex formation.

**UNIT IV**

Primary and secondary lymphoid organs, structure and cellular organization, Receptors, co-receptors and CD antigen on T & B cells, Generation of receptor diversity, Pathways of antigen processing and presentation, Cytokines, Primary and secondary immune responses.

**UNIT V**

B cell development in activation and differentiation. T cell development, activation and differentiation to helper, cytotoxic T cells. Signal transduction in B&T cell. Humoral and cytotoxic response, MHC complex and MHC restriction.

**UNIT VI**

Hypersensitivity and immunology of transplantation, Immuno-deficiencies, autoimmunity, immune suppression, tolerance, Tumour immunology.

**UNIT VII**

Principle and applications of Antigen - antibody interactions. Agglutination, immunodiffusion, immunoelectrophoresis, immunofluorescence, RIA and ELISA and assays for cytotoxic responses.

**PRACTICAL**

1. Histology of lymphoid organs-study with permanent slides.
2. Immunization of Rabbit.
3. Preparation of Antiserum
4. Purification of Antibodies.
5. Single Radial Immunodiffusion.

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6. Double Immunodiffusion.
7. Immunoelectrophoresis.
8. Haemmagglutination Reaction
9. ELISA.

## REFERENCES

1. Immunology Kuby
2. Immunobiology Janeway
3. Fundamental Immunology, Paul, W.E (ed) Raven Press, 1984.
4. Topley and Wilson Principles of Bacteriol, Virology & Immunology Vol1
5. Essential Clinical Immunology. H Chapel & M Haemey. ELBS – Black Well Scientific Publications.
6. Introduction to Immunology John, W., Kimbal, Maxell, MacMillan
7. Essential Immunology. Roitt ELBS.
8. Basic and Clinical Immunology Stites, Stovo Fundenberg Wells (eds) Lange Medical Publications
9. Microbiology and Immunology, 2<sup>nd</sup> edn, David H Hentges 1995
10. Text Book of Microbiology, R Ananthanarayanan and C K Jayaram Panicker, Orient Longman

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## BMM2C08 INTERMEDIARY METABOLISM

### UNIT I

Methods to study intermediary metabolism. Bioenergetic principle, activated carriers in metabolism and importance of ATP.

### UNIT II

Digestion and absorption of carbohydrate, breakdown of Polysaccharides and disaccharides. Glycolysis and its regulation, Entry of other carbohydrates into glycolytic sequences, alcoholic fermentation, Citric acid cycle and its regulation, Glyoxylate cycle, Pentose phosphate pathway and its regulation..

### UNIT III

Mitochondrial and Photosynthetic Electron transport. Reducing equivalents, High energy molecules, Importance of ATP.

### UNIT IV

Glycogenesis, glycogenolysis, gluconeogenesis, regulation of pathways, disaccharide biosynthesis, role of nucleoside biphosphate sugars in



carbohydrate biosynthesis and in sugar inter-conversion. Metabolism of storage and structural polysaccharides (bacterial and animal coats Photosynthetic CO<sub>2</sub> fixation, Rubisco.

#### **UNIT V**

Digestion and absorption lipids, Biosynthesis and oxidation of fatty acids and conjugate lipids, Biosynthesis and conversion of cholesterol to steroid hormones, Eicosanoids

#### **UNIT VI**

Digestion and absorption of protein. Protein degradation, role of Ubiquitin, transamination, oxidative deamination, urea cycle, Biosynthesis and degradation of individual amino acids, one carbon metabolism; THF, SAM, enzymes and regulation of amino acid metabolism.

#### **UNIT VII**

Function of nucleotides, sugar nucleotide complexes, purine ribonucleotide metabolism; denovo synthesis (purines and pyrimidines) and its regulation, Salvage pathway, inter conversion of purine and pyrimidine ribonucleotides, catabolism of purine and pyrimidine nucleotides, deoxy ribonucleotides, regulation deoxynucleotide metabolism, biosynthesis of nucleotide coenzymes.

#### **UNIT VIII**

Specific aspects of neural tissue metabolism. Oxygen and glucose consumption, Metabolism of ketone bodies and amino acids in brain.

#### **UNIT IX**

Xenobiochemistry, Mechanisms of biotransformation, two-step system. Possible toxic and cancerogenic effect of biotransformation. Integration of metabolism.

#### **PRACTICAL**

1. Estimation of SGOT and SGPT
2. Estimation of ALP AND ACP
3. Estimation of creatinine
4. Estimation of urea
5. Estimation of GGT
6. Estimation of glutathione peroxidase
7. Estimation of Bilirun
8. Quantitative analysis of Amino acids
9. Determination of SOD & Catalase activity
10. Isolation and estimation of protein

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11. C and N terminal analysis of peptide
12. Enzymatic estimation of glucose in blood
13. Determination of acid values of fat and oils
14. Determination of iodine number of fats and oil
15. Extraction and estimation of total lipids from seed
16. Extraction of total nucleic acids from plant tissue
17. Estimation of DNA by Diphenylamine method
18. Determination of RNA by Orcinol method
19. Quantitative estimation of Sodium, Potassium and Calcium
20. Estimation of ascorbic acid in lemon juice

#### REFERENCES:

1. Biochemistry. Jeremy M. Berg John and Tymoczko Lubert Stryer.
2. Biochemistry with Clinical Correlation. Thomas M Devlin. Wiley- Liss
3. Biochemistry. Donald Voet, Judith G Voet, John Wiley
4. Biochemistry. Jeoffrey Zubay. Wm C Brown Pub.
5. Biochemistry. Lubert Strayr
6. Biochemistry. Mathews CK & vanHolde. Benjamin Cumming pub.
7. Biochemistry. Vol. 1&2 Metzler
8. Biochemistry, Harper's.
9. Lehninger's Principle of Biochemistry. Nelson LD & MM Cox.

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### BMM2E03 MOLECULAR BIOLOGY

#### UNIT I

The genome: Content, Mapping (Linkage, Restriction cleavage, Sequencing), Variations, Repetitive and Non-repetitive sequences, Organalle DNA - Mitochondrial and Chloroplast. Genome sequences and Gene numbers.

#### UNIT II

Transcription in Prokaryotes -Biosynthesis of RNA, Enzymatic machinery, Promoter selection and role of RNA Polymerase and ancillary factors.

#### UNIT III

Transcription in eukaryotes: RNA polymerases, Eukaryotic promoter structure, enhancer elements and transcription factors, transcriptionally active chromatin, biosynthesis of ribosomal, transfer and messenger RNAs. Post transcriptional modifications, transfer and messenger RNAs, antibiotic inhibitors of transcription. Gene silencing.



#### UNIT IV

Protein synthesis: Genetic code and gene protein relationships, nonsense and missense mutations and suppressers, ribosome structure (prokaryotic and eukaryotic) mRNA structure, polycistronic v/s monocistronic, specificity of aminoacyl tRNA synthetases, polypeptide chain elongation and termination, factors of protein synthesis (pro & eukaryotic) and their role, inhibitors of protein synthesis and their mechanism of action, translational regulation, post-translational modification, biosynthesis of secretory proteins.

#### UNIT V

Regulation of gene expression, bacterial operons (lac, gal, ara, trp, hut, etc) and viral models (T4 and T7), stringent and relaxed control, regulation in eukaryotes, chromatin activity and gene regulation.

#### UNIT VI

Methods, measurements of RNA synthesis and protein synthesis, complementary sequence analysis by nucleic acid hybridization including southern blotting, isolation methods for eukaryotic mRNA, identification of translation products (fluorography, western blotting). Genome sequencing - chemical.

#### PRACTICAL

1. Isolation of genomic DNA.
2. Southern blotting.
3. Isolation of RNA.
4. Northern blotting.
5. Western blotting.
6. *In vitro* translation
7. Metabolic labeling of proteins and immunoprecipitation.

#### REFERENCES

1. Lodish, H., Baltimore, D. Berk, A., Zipursky, S. L. Matsudaira, P. and Darnell. J. 1995 molecular Cell Biology, 3<sup>rd</sup> ed, WH.Freeman & Co.
2. Stent, G. S. and Calender, R. Molecular Genetics 1986. An Introductive Narrative, CBS Publishers and Distributors, New Delhi.
3. Weaver, RE & Hedrick, PW. 1985 Basic Genetics, WMC. Brown Pub.
4. Alberts, B., Bray, D. Lewis, Julian, Raffn M. Roberts, K. and J. D. Watson, J. D. 1994. Molecular Biology of the Cell, 3<sup>rd</sup> edn, Garland Publishing Inc..
5. Hayes, W., 1994. Genetics of Bacteria and their viruses. 2<sup>nd</sup> Edn, CBS Publishers and Distributors, New Delhi.



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6. Maloy, S. R., Gonan. J. E. Jr., & Friefelder, D. 1994. Microbial Genetics, Second Edition Jonas & Barlett Publishers, Boston, London.
  7. Benjamin Lewin, Genes IX Oxford University Press, Oxford, New York,
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**BMM2E04**  
**FOOD MICROBIOLOGY**

**UNIT I**

Factors which influence microbial growth, survival and death in foods, spores and their significance, indicator microorganisms and microbiological criteria

**UNIT II**

Microbial spoilage of foods: Factors predisposing to food spoilage at different levels – intrinsic and extrinsic factors, spoilage of meat, poultry, and sea foods, milk and dairy products, fruits, vegetables and grains, Spoilage at low temperature

**UNIT III**

Preservation methods and preservatives: physical methods of preservation, chemical preservatives and natural antimicrobial compounds, biologically based preservation system. Probiotics

**UNIT IV**

Food fermentations : fermented dairy products, fermented vegetables, fermented meat, poultry and fish products, traditional fermented foods, cocoa and coffee, beer and wine

**UNIT V**

Food borne pathogens: Food poisoning, intoxications like botulism and aflatoxins. Food hygiene and control - food sanitation in food manufacture and in the retail trade. Food control agencies and their regulations. HACCP. Advanced techniques in food microbiology. Food security, food safety and GM foods.

**REFERENCES**

1. Food microbiology – Adams MR and Moss MO
2. Food Microbiology – Frazier WC and Westhoff
3. Food Microbiology (2nd Ed) – Doyle et al.
4. Basic food microbiology – Banwart GJ
5. Dairy Microbiology – Robinson RK
6. Valorization of Food Processing By-Products, Fermented Foods and Beverages Series , (Ed) M Chandrasekaran CRC Press

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**BMM2E05**  
**ETHICS, PATENCY &**  
**INTELLECTUAL PROPERTY RIGHTS**

**UNIT I**

Ethical aspects of interfering in natural process, hidden dangers in altering genetic make up. patentable subjects and protection in biotechnology

**UNIT II**

Objectives of the patent system, basic principles and general requirements of patent law, technological inventions and patent law, legal development. International treaties on IPR, IPR Policy, IPR audit., international convention for the protection of new varieties - Strasbourg convention, UPOV convention.

**UNIT III**

The patentability of microorganisms - claims, characterization and repeatability, deposition in culture collections, legal protection for plants and other higher organism, new plant varieties by rights, transfer of technology.

**UNIT IV**

Patentability of inanimate products of nature - vectors, FDA, FPA, patent office practice - trade secrets, copyrights, infringement problems, harmonization of patent laws. IPR and plant genetic resources, GATT and TRIPS.

**UNIT V**

Biosafety: Objectives, definition, recombinant DNA safety, classification of pathogenic microorganisms, biological containment (BC) and physical containment (PC), biosafety levels.

**UNIT VI**

Guidelines for rDNA research activities - large-scale experiments, release to the environment, import and shipment, quality control of biologicals produced by rDNA technology, mechanism of implementation.

**UNIT VII**

Biosafety practices - code of practice, the containment laboratory design and facilities, large scale operations - physical containment condition for large scale (201) fermentation experiment and production criteria for rDNA.

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## REFERENCES

1. Beir, F.K, Crespi, R.S and Straus J: 1982 Biotechnology and patent protection- Oxford and IBH Publishing Co. New Delhi.
2. Chowdhary, N. K and Aggarwal J. C: Dunkal's Proposals I. Implications for India and the third world.
3. Chowdhary, N. K and Aggarwal J. C: Dunkal's Proposals II. The Final Act. Significance for India and World trade.
4. Department of Biotechnology, (1990) Recombinant DNA Safety guidelines. Govt. of India, New Delhi.
5. Krattinger, A.F Lesser, W and Mudge G: Implementation of Biosafety Regulatory Mechanisms under the Biodiversity Convention.
6. Narayanaswami, K: 1994 Safety and regulatory arrangements in Biotechnology in Sohal and Srivastava (eds) Environment and Biotechnology.

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**BMM3C09**  
**MICROBIAL TECHNOLOGY**

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### UNIT I

Introduction to fermentation processes: The range and components

### UNIT II

Isolation and screening and preservation of industrially important microbes. The improvement of industrial microorganisms with special reference to primary and secondary metabolite over production: Natural variants, Induced mutants and recombinants. Modification of properties other than yield.

### UNIT III

Bioreactors - design and types, Bioprocess control instrumentation, Monitoring variables such as, temperature, aeration, agitation, pressure and pH. Biosensors in Bioprocess monitoring.

### UNIT VI

Bioprocess media- formulation and sterilization of media, Sterilization of fermenter, Agro-Industry byproducts as bioprocess media. Development of inoculum.



## UNIT V

Kinetics of fermentation process, Transport phenomena in bioprocess-mass transfer and heat transfer. Scale up process, Separation and recovery of bioprocess products.

## UNIT VI

Cell Immobilization and its applications. Solid State Fermentation and its advantages

## UNIT VII

Microbial production of Food, Beverages, Amino acids, Vitamins, Polysaccharides, Vitamins, Antibiotics, vaccines, Enzymes, Biopesticides, Biofertilizers.

## UNIT VIII

Industrial alcohol, Industrial waste treatment - aerobic/anaerobic systems.

## PRACTICAL

1. Strain development
2. Determination of Dissolved oxygen (DO)
3. Determination of Biological oxygen demand
4. Study of industrially important Yeast and Molds
5. The fermenter and Types
6. Production of Enzymes under Submerged Fermentation (Upstream and Downstream processing)
7. Production of Enzymes under Solid State Fermentation (Upstream and Downstream processing)
8. Production of red wine and alcohol
9. Alcohol fermentation using molasses
10. Production of Mushrooms

## REFERENCES

1. Principles of Fermentation Technology by Peter F Stanbury, A. Whittaker, S.J, Hall
2. Fermentation Microbiology and Biotechnology by E.M.T El-Mansi, C.F.A Bryce, A.L Demain, A.R. Allman (Second Edn)
3. Bioprocess engineering principles Pauline M Doran
4. Biotechnology- The Science and the Business by V. Moses & R. E. Capes.
5. Comprehensive Biotechnology Ed. By Murray Mono Young.
6. Biological fundamentals- Biotechnology Ed. By H. J. Rehm and G. Reed.
7. Fundamentals of Biotechnology Ed. By Paul Prave et al.
8. Industrial Microbiology by Prescott and Dunns.





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**BMM3C10**  
**SYSTEMATIC BACTERIOLOGY**

**UNIT I**

Diseases caused by the following pathogens with special importance to their structure, epidemiology, pathogenesis, diseases, laboratory diagnosis and control.

*Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Corynebacterium diphtheriae, Bacillus, Clostridium perfringens, Clostridium tetani, Clostridium botulinum. Enterobacteriaceae-Proteus, Shigella, Salmonella, E.coli, and Klebsiella, Vibrio cholerae, Pseudomonas aeruginosa, Bordetella pertussis, Hemophilus influenzae, Yersinia pestis, Listeria monocytogenes, Mycobacterium-M.Tuberculosis, M.Leptrae, Spirochetes-Treponema pallidum, Leptospira Mycoplasma, Rickettsiaceae-Rickettsia prowazekii, Coxiella, Chlamidia trachomatis.*

**PRACTICAL**

1. Acid fast staining
2. Preparation of permanent slides of pathogenic microbes
3. Preparation of antibiotic discs
4. Antibiograms of common bacterial pathogens
5. Determination of MIC
6. Insoluble antibacterial sensitivity by ditch plate method
7. Detection of betalactamase production
8. Identification of common bacterial pathogens using biochemical tests.
9. Widal test, VDRL, ELISA

**REFERENCES**

1. Text of Microbiology: R. Ananthanarayanan and C.K. Jayaram Panicker
2. Macie & McCartney: Medical Microbiology- Vol.1: Microbial Infection.
3. Vol2; practical Medical Microbiology
4. Microbiology in Clinical Practices: D.C.Shanson, Wright PSG, 1982.



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**BMM3C11**

**VIROLOGY, MYCOLOGY & PROTOZOOLOGY**

**UNIT I**

General properties of viruses and bacteriophages:- Architecture, classification, replication, cultivation and enumeration.

**UNIT II**

Systematic study of important animal viruses - Picorna viruses, Myxo viruses, Arboviruses, Rhabdo viruses, Hepatitis viruses, Miscellaneous viruses, Oncogenic viruses, Human immunodeficiency viruses.

**UNIT III**

Mycology - Different types of Mycoses-Cutaneous, Sub cutaneous and Systemic Mycosis. Opportunistic fungal infections. - Lab diagnosis and treatment of fungal Infections.

**UNIT IV**

Study of protozoa of medical importance: -Rhizopoda, Sporozoa, mastigophora, ciliata, toxoplasma, pneumocystis

**PRACTICAL**

**Virology:**

1. Egg inoculations for viral culturing.
2. Isolation and enumeration of coliphages from sewage
3. ELISA, Western blot for viral receptors

**Mycology:**

4. Slide cultivation of fungi.
5. Lactophenol cotton blue staining for fungal cultures.
6. Morphology & staining features of *Candida albicans*

**Parasitology:**

7. Collection and observation of permanent slides of medically important protozoans
8. Faecal examination-saline wet mount and iodine wet mount
9. Concentration of cyst/ova by sedimentation and floatation method
10. Cultivation of *Entamoeba histolytica* from stool sample
11. Demonstration of Malarial parasite in blood

**REFERENCES**

1. A.J.Salle, Fundamental Principles of Bacteriology.
2. Brock T.D, Madigan M.T, Biology of microorganisms
3. Pelczar M.J., Chan E.C.S, Kreig N.R. Microbiology

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**BMM3C12**  
**ENVIRONMENTAL MICROBIOLOGY**

**UNIT I**

Microbial behaviour in ecosystems: Microbial biodiversity, Interactions among microbial populations. Animal-microbe and plant-microbe interactions.

**UNIT II**

Microbiology of soil: Soil as habitat for microorganisms. Soil microflora, Decomposition of organic matter - Soil as source of industrial strains. Biodegradation of recalcitrants by soil microbes. Geocycles of C, N, S, P. iron and sulphur oxidation. N<sub>2</sub> fixation.

**UNIT III**

Microbiology of water: Microbial communities in aquatic environments, factors affecting microbial population in natural waters, Air water interface, Microbial Corrosion, Bacteriological analysis of drinking water. Water purification and various steps involved.

**UNIT IV**

Microbiology of air: Composition of air microflora, Significance of air microflora, Airborne diseases, Hazards of laboratory techniques, Air sanitation. Biological weapons, their regulation and precautions.

**UNIT V**

Microorganisms in extreme environments : Environmental Determinants that Govern Extreme environments,, Extremes of pH & temperature, salinity, Hydrostatic pressure, Nutrient limitation.

**UNIT VI**

Microbial Biofilms : Physiology. Morphology and Biochemistry of microbial biofilms

**UNIT VII**

Pollution and environment, Biosensors and Biological indicators, Waste water management and sewage treatment, BOD concepts, Solid waste management and land filling, Degradation of xenobiotics, Microbes and bioremediation.

**UNIT VIII**

Production of microbial biofertilizers -cyanobacteria, *Rhizobium*, *Azotobacter*, *Azospirillum*, *Phosphobacteria* and VAM, Biopesticides, Microbes as a health food (SCP)- *Spirulina* and its production methods. Probiotics - use of *Lactobacilli* and *Bifidobacterium*- therapeutic and nutritional value, Microbial

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enhanced oil recovery, Microbial production of fuels. Microbial leaching of ores and biomining, Biopolymers and biosurfactants.

### **PRACTICAL**

1. Study of various types of Micro-organisms present in soil, water and air
2. Isolation of bacteria from root nodules of different legumes
3. Enrichment of Azotobacter and Rhizobium as biofertilizers and testing its efficacy.
4. Isolation of starch degraders from soil.
5. Isolation of cellulose degraders from soil
6. Isolation of phosphate solubilisers from soil.
7. Standard qualitative analysis of water.
8. Comparison of microflora in Bt-treated/chemical pesticide-treated soils.
9. Extracellular enzyme activities of microorganisms
10. Amylase, cellulose, protease, lipase, phosphatase

### **REFERENCES**

1. R. M. Atlas and R. Bartha (1998) Microbial Ecology-Fundamentals and Applications. Addison Wesley Longman, Inc.
2. N.S.Subbarao, Biological Nitrogen Fixation
3. Microbiology of Soil Alexander and Martin
4. Soil Microbiology. Mark Coyne Thompson Learning

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## **BMM3E06 BIOINFORMATICS**

### **UNIT I**

Biological database: Nucleic acid databases, Protein databases (sequence, structure, classification), genome databases, specialized databases, data format (FASTA, PDB), Data storage and retrieval.

### **UNIT II**

Sequence alignment: Pair-wise sequence alignment, dot plot. Global and local alignment: methods, scoring matrices (PAM, BLOSUM). Database similarity searching- FASTA and BLAST.

### **UNIT III**

Multiple sequence alignment: methods, tools and applications- identification of sequence patterns, motifs and profiles, gene prediction. Phylogenetic



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analysis: type of phylogenetic trees, methods of its construction-distance based methods and character based methods.

#### **UNIT IV**

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

#### **UNIT V**

Proteomics: 2D PAGE, MALDI, Tandem mass spectroscopy, peptide mass fingerprinting, Protein micro arrays, protein expression analysis, protein-protein interactions, prediction of post-translational modifications.

#### **UNIT VI**

Structural bioinformatics: Determination of 3D structure- crystallography and NMR, structure visualization tools: Rasmol, SPDBV. Structure comparison.

#### **UNIT VII**

Protein structure prediction: Protein folding problem, Secondary and tertiary structure prediction- homology modeling, ab initio prediction.

#### **UNIT VIII**

Molecular modeling and docking: potential energy functions, energy minimization, local and global minima, conformational search, molecular dynamics, docking, ligand protein interactions.

#### **UNIT IX**

Computer aided drug designing: Drugs and drug targets. Steps in drug discovery- lead compounds, pharmacophore, ligand design methods, De novo design, QSAR, ADME property prediction.

#### **REFERENCES**

1. Bioinformatics - BaxevanisAD & Quellerie BFF, John Wiley & Sons Inc.
2. Bioinformatics - Sequence and Genome analysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
3. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley.
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Evolutionary computations in Bioinformatics - Fogel & Corne, Morgan Kaufman publishers
7. Introduction to Bioinformatics - Attwood & Parry-Smith, Pearson Edu.
8. Medicinal Chemistry - Patrick G, Viva Books Pvt Ltd.

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9. Pharmacology & Pharmacotherapeutics - Sataskar, Bhandakan & ainapur, Popuar Prakashan Mumbai
10. Principles of Medicinal chemistry- William O&Foye BI, Waverks Pvt. Ltd
11. Protein folding - Creighton TE (ed) WH Freeman & Co.
12. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
13. Structure and Mechanism in Protein science - Fersht WH freeman & Co
14. Fundamental concepts of Bioinformatics - Krane D.E and Raymer M.L., Pearson Education
15. Bioinformatics: Databases and Algorithms- N. Gautham, Narosa Publishing House, New Delhi.

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**BMM3E07**

**BIOTECHNOLOGY IN MEDICINE, HEALTH,  
AGRICULTURE AND ENVIRONMENT**

**Medicine and Health**

**UNIT I**

Developments in gene therapy. Molecular basis, identification and cure of genetic disorders like Hemoglobinopathies. Retinopathies. Immunodeficiencies, Diabetes mellitus, Atherosclerosis, Coronary artery disease, Neurogenetic disorders, cancer, Duchenne Muscular Dystrophy, cystic fibrosis, myotome dystrophy, X- linked disorders and mitochondrial disease.

**UNIT II**

Diagnosis based genomic and cDNA microarray., Therapies based on RNA and stem cells. Prevention of genetic disease, genetic counselling, prenatal diagnosis

**UNIT III**

Application of monoclonal antibodies in biomedical research, clinical diagnosis and treatment. Principles and strategy for developing vaccines, new methods of vaccine preparation. Biotechnologically produced clinical products.

**UNIT IV**

Nanomedicine: Nanodevices medical microbotics, nanorobotics, nanomedicine, nanosurgery for cancers and neurological disorders.

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## Agriculture

### UNIT V

Problems related to gene-cloning in plants. Marker assisted selection of qualitative and quantitative traits.

### UNIT VI

Plants as bioreactors. Engineering for secondary metabolites, herbicide resistance and improvement of food quality. Diagnosis of plant diseases

## Environment

### UNIT VII

Monitoring pollution (air water and soil). Biosensors. Biological indicators. Strategy of waste management and control. Biotechnology in forestry, wildlife and veterinary sciences.

## REFERENCES

1. Biotechnology - The Science and the Business by V. Moses and R E. Capes.
2. Agricultural Microbiology by Subba Rao.
3. Plant Breeding by B. D. Singh.
4. Industrial Microbiology by Prescott & Dunns.
5. Biotechnology by Higgins.
6. Plant Physiology, Biochemistry & Mol Biology, DT Dennis & DM. Turpin.
7. Biochemistry of Plants: Proteins & Nucleic Acids by Stump of PK & EE. Connel.
8. Nanomedicine - Design and Application of Magnetic Nanomaterials, Nanosensors and Nanosystems.,(2008) Vijay Varadan, Linfeng Chen and Jining Xie
9. Techniques for Wildlife Investigation and Management, 6th Ed., C. Braun, 2005. The Wildlife Society, Bethesda, MD.
10. Introduction to Forest Science., (2006) 2nd Edition by Raymond A. Young, Ronald L. Giese (Editor)
11. Introduction to Veterinary Science (2003) by James Lawhead, MeeCee Baker

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**BMM3E08**  
**RECOMBINANT DNA TECHNOLOGY**

**UNIT I**

Historical events that led to the methods of creating recombinant DNA molecules, preparation of Gene libraries, c DNA libraries and subtracted libraries, identification of desired clones (includes plasmid vectors and preparation of plasmid DNA); hybrid arrest, translational systems. Genome sequencing-library

**UNIT II**

Chemical and functional nature of genes; their location and expression methods to analyze gene sequences and function in vitro

**UNIT III**

Enzymes involved in Recombinant DNA technology research; commercial availability and applications, polymerases, nucleases, ligases, 5' capping enzymes and ribozymes; PCR reaction and its importance, various

**UNIT VI**

Random and site specific mutagenesis to study gene structure and function, expression vectors, viral vectors and transfer of genes into mammalian cells, transient transfection selectable markers to identify gene transfer in cells. Map based cloning.

**UNIT V**

Antisense RNA and targeted gene replacement to extinguish gene function knock out mouse to study the importance of genes in the control of growth and development

**UNIT VI**

Shuttle vectors, Retroviruses cloning of yeast genes by complementation strategies, genetic experiments in yeast to study biochemical questions like protein- protein interactions; importance of recombinant DNA technology to analyse transposon function. Alternative strategies of gene cloning, Cloning interacting genes, 2&3 hybrid systems, cloning differentially expressed genes, Nucleic acid microarrays

**UNIT VII**

Applications of Recombinant DNA to biotechnology, genetic engineering of plants, generation of agriculturally important plants and animals, recombinant DNA in medicine and industry. Gene silencing.

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### UNIT VIII

Recombinant DNA technology to understand molecular analysis of the cell cycle and genes that control the development, DNA based diagnosis of genetic diseases.

### UNIT IX

Southern and fluorescent in situ hybridization, Chromosome micro dissection, micro cloning, molecular mapping-RFLP, AFLP, RAPD analysis.

### PRACTICAL

1. Isolation of genomic DNA
2. Southern blotting-Preparation of proteins
3. RFLP analysis
4. Bacterial & antibiotic culture media preparation of compliment cells
5. Isolation of plasmid DNA
6. Isolation of Lamda phage DNA
7. Agarose gel electrophoresis&restriction mapping of DNA
8. Construction of restriction map of plasmid DNA
9. Cloning in plasmid/ phagmid vectors
10. Preparation of single stranded DNA template
11. DNA sequencing
12. Gene experiment in E.coli&analysis of gene product
13. PCR
14. Reporter Gene assay (GUS/CAT/b-GAC)

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### REFERENCES

1. Principles of gene manipulation- An Introduction to Genetic Engineering. Old, RW & Primrose, S.B - 1994 5<sup>th</sup> Edn. Blackwell Sci Pub.
2. Molecular Cloning- A Laboratory Manuel Sambrook, J., Fritsch, E. F. and Maniatis, T. 1989.. Second Edition. Cold Spring Harbor Laboratory Press.
3. Recombinant DNA technology- Concepts and Biomedical Applications Steinberg, M., Guyden, J., Calhann, D, Staiano-Coico, L., Coico, R, 1993. Ellice Horwood Prentice Hall.
4. Recombinant DNA Watson, J. D., Gilman, M., Witkowski, J. and Zoller, M. 1992. Second Edition. Scientific American Books, WH Freeman & Co.
5. From Genes to Clones: Introduction to Gene - Winnacker, E. L. 1987.



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**BMM3E09**  
**ENZYMOLGY**

**UNIT I**

Enzymes: basic definitions, nomenclature (EC recommended and classical), enzyme isolation and purification, measurement of enzyme activity, specific activity, molar activity (turn over number), criteria for purity. Synthetic enzymes, abzymes, isoenzymes and ribozymes.

**UNIT II**

Enzyme kinetics: Single substrate - single intermediate, Michaelis - Menten and Briggs - Haldane kinetics, graphical analysis of kinetic data, progress curves and linear plots, determination of  $V_{max}$  and  $K_m$  - experimental aspects.

**UNIT III**

Enzyme inhibition: Mechanisms and rate studies, degree of inhibition, competitive, non-competitive and uncompetitive inhibition, activation, graphical analysis (primary and secondary kinetic plots), two substrate reactions, sequential and Ping -Pong mechanisms, nature of rate equations, examples.

**UNIT IV**

Allosteric enzymes: SubUNIT Interactions, regulation of enzyme activity, feedback inhibition, Jacob and Monod model of allosteric enzymes, Koshland model, detailed discussion using haemoglobin, ATPase (Effects of ATP and CTP) as examples.

**UNIT V**

Enzyme structure and function, single and double displacement reactions, folding of the polypeptide chain, active site and its location, binding site, immobilized enzymes, applications in industry and medicine, coenzymes - structure and their function in metabolism.

**PRACTICAL**

1. Determination of  $V_{max}$  &  $K_m$  value
2. Determination of enzyme inhibition
3. Determination of superoxide dismutase activity
4. Determination of catalase activity
5. Determination of Glutathione S transferase activity
6. Determination of Glutathione activity

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## REFERENCES

1. Enzymes- Dixon and Webb
  2. Enzyme Kinetics- Bowden and Wharton
  3. Immobilised Enzymes- Trevan
  4. Hand book of Enzyme Technology- Alan Weisman- 3<sup>rd</sup> ed Prentice- Hall
  5. Enzyme Technology- Chapline and Bucke – Cambridge University Press
  6. Protein Biotechnology – GWalsh & D Headon (1994) John Wiley & Sons
  7. Lehninger A.L, Nelson D L and Cox M M 1993. Principles of Biochemistry CBS Publishers and Distributers.
  8. Biochemistry – Donald Voet & Judith Voet 1995. John Wiley and Sons, Inc
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Sd/-

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**Kannur University**

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
First (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
February 2015

COURSE: BMM1 C01 - BIOCHEMISTRY

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Describe role of Vitamins as cofactors
2. What are neurotransmitters? Explains the function of acetylcholine

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Hyaluronic acid
4. Tertiary structure of Proteins
5. Structure of zDNA.
6. Gibberellins
7. Membrane proteins
8. Female hormones

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Sphingolipids
10. tRNA
11. Glycoproteins
12. Cholesterol
13. Cellulose
14. Thromboxane

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
First (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
February 2015

COURSE: BMM1 C02 - CELL BIOLOGY

**Time 3 Hours**

**Max Marks = 60**

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Describe DNA replication. What are the enzymes involved? How is DNA repaired?
2. What are cell cycle check points? Describe the molecular events during mitosis

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Collagen
4. Muscle contraction
5. Clathrin coat
6. Dolichol phosphate and glycosylation
7. Cam-Kinase
8. Nucleosome

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. JAK-STAT pathway
10. Lysosomes
11. Density gradient centrifugation
12. Extrinsic pathway in Apoptosis
13. NLS
14. Tight junction

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
First (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
February 2015

COURSE: BMM1 C03 - GENETICS

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Explain the molecular mechanisms of crossing over.
2. Describe Mendel's laws and exceptions to it.

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Prophase I
4. Polyploids
5. Point mutation
6. Epistasis
7. Chloroplast mediated inheritance
8. Tumour suppressor genes

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**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Tetrad analysis
10. Developmental noise
11. Gene mutations
12. Mitotic recombination
13. Lethal genes
14. Maternal effect



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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
First (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
February 2015

COURSE: BMM1 C04- GENERAL MICROBIOLOGY

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Various types of Microscopy
2. Biochemical tests for identification of bacteria

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Size and Morphology of Bacteria.
4. Energy Classes of Bacteria
5. Bacterial Plasma Membrane.
6. Bacterial Structure.
7. Extra Chromosomal Genetic Materials
8. Extremophiles

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Bacterial polysaccharides
10. Citrate Utilization test
11. Pasteurization
12. Lysogeny
13. Spore staining
14. Bacterial Cell wall

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**DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY**  
**Kannur University**  
**First (End) Semester M.Sc. Biotechnology/Microbiology Examination -**  
**February 2015**

**COURSE: BMM1 E01 - BIOSTATISTICS**

**Time 3 Hours**

**Max Marks = 60**

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Diagrammatic representation of statistical data.
2. Measures of central tendency

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Calculate standard deviation for the data given below.

Size of the item	10	11	12	13	14	15	16
Frequency	2	5	11	15	10	5	2

4. Write on regression analysis.
5. Explain multiplication theorem of probability with suitable examples
6. Write on Poisson distribution
7. The mean life time of a sample of 400 bulbs produced by a company is found to be 1570 hours with standard deviation 150 hours. Test the hypothesis that the mean life time of the bulb is 1600 hours at 1% level of significance. Table value is 2.57
8. What is student's t test?

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Write on range and inter-quartile range
10. Four coins are tossed. Find the probability that at least one head turns up.
11. Write a short note on population and sample.
12. Write on different types of events
13. Write on confidence limit
14. What is chi-square test?

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
First (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
February 2015

COURSE: BMM1 E02 - INSTRUMENTATION

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Discuss any three spectroscopic techniques.
2. Discuss various electrophoretic techniques.

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Scintillation counter.
4. NMR
5. Spectrophotometry
6. Operating systems.
7. Electron microscopy
8. Phase problem in crystallography.

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Network databases
10. Precautions with radioisotopes
11. Ion exchange chromatography
12. HPLC
13. Autoradiography.
14. Growing protein crystals

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Second (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
September 2015

COURSE: BMM2 C05 - BIOPHYSICS

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Write an essay on principles of nucleic acid structure and explain tRNA structure
2. Discuss the laws of thermodynamics and illustrate their significance in living systems

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Super coiling of DNA
4. HTH motif and leucine zipper motif
5. Levels of structure in carbohydrates
6. Structure of RUBISCO
7. RNA protein interactions
8. Surface tension

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**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Ramachandran plot
10. Quaternary structure of proteins
11. Colloids
12. Detergents
13. Hydrogen bonding
14. Osmosis



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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Second (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
September 2015

COURSE: BMM2 C06- HUMAN PHYSIOLOGY

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Comment on the Major areas of brain and their functional significance
2. Explain the process of Urine formation

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Smooth and striated muscles and their functions
4. Biochemical nature of hormones
5. Digestive enzymes
6. Thyroid hormones
7. Respiratory cycle
8. Blood clotting factors and blood cells

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Pancreatic hormone
10. Neurotransmitter systems
11. Detection of Blood pressure
12. Cardia
13. Accessory glands
14. Hemostasis

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Second (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
September 2015

COURSE: BMM2 C07 - IMMUNOLOGY

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Mechanisms of generation of Antibody diversity
2. What are the mechanisms of antigen presentation

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Phagocytosis
4. Classical pathway
5. Selection of B cells
6. Cytokines
7. Hypersensitivity IV
8. NK cells and Tumor

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Germinal center
10. Epitope
11. Adjuvant
12. Th1 vs Th2
13. Hashimotos Thyroiditis
14. MLR

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Second (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
September 2015

COURSE: BMM2 C08 - INTERMEDIARY METABOLISM

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. *De novo* synthesis of purine bases
2. Beta oxidation of palmitic acid

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Tetrahydrofolate
4. Phenyl alanine degradation
5. Chloroplast
6. Gluconeogenesis
7. Ubiquitin
8. Carbamoyl phosphate

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Oxidative Deamination
10. RuBisCO
11. Oxidative phosphorylation
12. Pyridoxal Phosphate
13. Phenyl ketonuria
14. Metabolism of propionyl CoA

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Second (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
September 2015

COURSE: BMM2 E03 - MOLECULAR BIOLOGY

**Time 3 Hours**

**Max Marks = 60**

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Distinguish between the RNA polymerases in prokaryotes and eukaryotes
2. Genome sequencing methods

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Trp operon
4. Northern blot
5. Enhancers
6. t-RNA
7. Anti termination
8. Spliceosome

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**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. DNA methylation
10. Initiator tRNA
11. Reverse transcription
12. Measurement of protein synthesis
13. FISH
14. Micro RNAs



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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Second (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
September 2015

COURSE: BMM2 E04 - FOOD MICROBIOLOGY

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Explain Physical methods for food preservation
2. Explain various natural antimicrobial agents used for food preservation

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Explain Bacteriocins
4. Explain extrinsic factors
5. Describe various enzymes involved in food preservation
6. Explain Indicator microorganisms
7. Explain cheese preparation
8. Explain various fermented fish products

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**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Raw meat fermentation
10. Mycotoxicosis
11. Radiation in food preservation
12. Role of Reuterin in food preservation
13. Soy Sauce
14. Lactic acid bacteria



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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Second (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
September 2015

COURSE: BMM2 E05 - ETHICS, PATENCY &  
INTELLECTUAL PROPERTY RIGHTS

**Time 3 Hours**

**Max Marks = 60**

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Discuss the main objectives and requirements of patent. Give an account on patent office practice
2. Discuss the role of copy right as an intellectual property right

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Discuss the concerns of environmental ethics.
4. Explain Trade related intellectual property rights
5. How microorganisms are classified based on hazards?
6. What are main objectives of UPOV convention?
7. Discuss TRIPS
8. Briefly discuss the guidelines for rDNA research activities

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**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. What are the benefits of GATT?
10. Explain plant breeder's right.
11. Comment on trademarks.
12. Comment on gene patent
13. What is meant by benefit sharing?
14. What is meant by FDA





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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Third (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
March 2016

COURSE: BMM3 C09- MICROBIAL TECHNOLOGY

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Steps involved in upstream and downstream processing
2. Design of a Bioreactor

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Rotating Biological Contactors (RBCs).
4. Production of penicillin by fermentation
5. Fermented dairy products.
6. Inoculum for large scale bioprocess.
7. Media used for commercial bioprocesses
8. Industrial Enzymes.

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**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Hop Flower and beer fermentation
10. Anti foam agents in fermentation.
11. Production of Vitamin B<sub>12</sub> by fermentation.
12. Molasses
13. Probiotics
14. Biosensors

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Third (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
March 2016

COURSE: BMM3 C10 - SYSTEMATIC BACTERIOLOGY

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Discuss the cultural characters, pathogenesis and laboratory diagnosis of *Vibrio cholera*.
2. Toxins, virulent factors and pathogenesis of *Streptococcus pyogenes*.

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Laboratory diagnosis of *Str.pneumoniae*.
4. Haemolysins of *Str.pyogenes*.
5. Serological tests for Spirochetes.
6. Lepromin test
7. Type III secretion system
8. Pathogenicity of *Bordetella pertussis*.

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**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Serum Opacity factor
10. Klebs-Loeffler Bacillus
11. Botulism
12. Trachoma
13. Quellung test.
14. Wool sorter's disease



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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Third (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
March 2016

COURSE: BMM3 C11 - VIROLOGY, MYCOLOGY  
& PROTOZOOLOGY

**Time 3 Hours**

**Max Marks = 60**

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Discuss the pathogenesis, symptoms and lab diagnosis of Hepatitis B
2. Discuss the life cycle and pathogenesis & lab diagnosis of Trypanosoma cruzi

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Bacteriophage life cycle
4. Mumps
5. Entamoeba histolytica
6. Poliomyelitis
7. Rabies
8. Dermatophytosis

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**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Ring worm
10. Prions
11. Rubella
12. Yellow fever
13. Mycetoma
14. Antigenic variation of influenza virus



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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Third (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
March 2016

COURSE: BMM3 C12 - ENVIRONMENTAL MICROBIOLOGY

Time 3 Hours

Max Marks = 60

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Discuss air, water and soil pollution and its impact on the environment.
2. Explain different methods of sewage treatment.

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Probiotics
4. Plant - microbe interactions.
5. Biofuel production.
6. Microbial corrosion
7. Biosensors
8. Biological nitrogen fixation

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. B.O.D
10. Synergism
11. SCP
12. Rhizobium
13. Oxidation ponds
14. Biosurfactants

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Third (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
March 2016

COURSE: BMM3 E06- BIOINFORMATICS

**Time 3 Hours**

**Max Marks = 60**

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Discuss applications of multiple sequence alignment
2. Describe important interactions that stabilize protein structures.

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. DNA sequence data bases
4. Scoring matrices
5. Peptide mass fingerprinting
6. Protein loop modeling.
7. Shielding constant and Chemical shift
8. Structure Activity Relationship

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. PDB
10. Protein motif
11. DNA micro array
12. Energy minimization
13. Chou-Fasman method
14. Docking.

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Third (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
March 2016

COURSE: BMM3 E07 - BMHAE

**Time 3 Hours**

**Max Marks = 60**

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Write an essay on the current and conventional techniques used for crop improvement
2. What are the uses of Monoclonal Antibodies? Write briefly on the making of Mab

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Cystic fibrosis
4. Genetic counseling
5. siRNA
6. Biotechnology in wildlife
7. Production of secondary metabolites
8. Waste water management

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Embryonic stem cell
10. Dendrimers
11. RFLP and AFLP
12. Bioreactors
13. Biosensors
14. DNA vaccines

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Third (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
March 2016

COURSE: BMM3 E08 - RECOMBINANT DNA TECHNOLOGY

**Time 3 Hours**

**Max Marks = 60**

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Comment on Various Enzymes involved in recombinant technology
2. Applications of recombinant technology in Agriculture, Medicine, Industry & Environment.

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Describe nature of Genes, location and its expression methods
4. DNA sequencing methods
5. Important vectors used in rDNA technology
6. Random and site specific mutagenesis
7. Transposons and transposable elements in Bacteria.
8. Gene therapy and its applications

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Gene knock out
10. Ribozyme technology
11. Gene silencing
12. cDNA Library
13. Transient transfection
14. Shuttle vectors

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY  
Kannur University  
Third (End) Semester M.Sc. Biotechnology/Microbiology Examination -  
March 2016

COURSE: BMM3 E09 - ENZYMOLOGY

**Time 3 Hours**

**Max Marks = 60**

**Section A**

Write an essay on **ANY ONE** of the following

1 x 15 = 15 marks

1. Write in detail about different types of inhibition of enzymes and explain how the kinetic parameters  $K_m$  and  $V_{max}$  are affected by each type of inhibition.
2. Write an essay on enzyme structure and function.

**Section B**

Write notes on **ANY FIVE** of the following

5 x 6 = 30 marks

3. Immobilized enzymes.
4. Co enzymes.
5. Determination of  $V_{max}$  and  $K_m$ .
6. Purification of enzymes.
7. Nomenclature of enzymes.
8. Haemoglobin as an allosteric protein.

**Section C**

Write short notes on **ANY FIVE** of the following

5 x 3 = 15 marks

9. Single and double displacement reactions
10. Active site and its location.
11. Feedback inhibition.
12. Graphical analysis of kinetic data.
13. Specific activity.
14. Concerted symmetry model of allosterism

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**COURSE WISE MARKS/GRADE REGISTER: PG-CCSS EXAMINATION**  
....., 20.....

Name of the Department:  
 Year of admission:  
 Programme Name:  
 Semester No:  
 Course code:  
 Name of the course:

**(CORE)**

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SL NO.	REGISTER NO.	NAME OF THE STUDENT	CE (40)					ESE (60)				TOTAL MARKS (100)	GRADE POINT	LETTER GRADE			
			THEORY (30 MARKS)			PRACTICAL (10 MARKS)		THEORY (45 MARKS)							PRACTICAL (15 MARKS)		
			ASSIGNMENT (6 MARKS)	CLASS TEST (12 MARKS)	SEMINAR / DISCUSSION ETC (12 MARKS)	LAB TEST (7 MARKS)	RECORD (3 MARKS)	CE TOTAL (40)	1 <sup>ST</sup> VALUATION	2 <sup>ND</sup> VALUATION	3 <sup>RD</sup> VALUATION				AVERAGE (45 MARKS)	LAB TEST (15 MARKS)	ESE TOTAL (60)
1																	
2																	
3																	

COURSE WISE MARK REGISTER IN THE CASE OF COURSES HAVING THEORY AND PRACTICAL COMPONENTS



**COURSE WISE MARKS/GRADE REGISTER: PG-CCSS EXAMINATION**  
**..... 20.....**

Name of the Department:

Year of admission:

Programme Name:

Semester No:

Course code:

Name of the course: (ELECTIVE)

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SL NO.	REG NO.	NAME OF THE STUDENT	CE THEORY (40)				ESE THEORY (60)				TOTAL MARKS (100)	GRADE POINT	LETTER GRADE
			ASSIGNMENT (8 MARKS)	TEST (16 MARKS)	SEMINAR / DISCUSSION ETC (16 MARKS)	CE TOTAL (40)	1 <sup>ST</sup> VALUATION	2 <sup>ND</sup> VALUATION	3 <sup>RD</sup> VALUATION	AVERAGE (60 MARKS)			
1													
2													
3													

COURSE WISE MARK REGISTER IN THE CASE OF COURSES HAVING ONLY THEORY



**Department of Biotechnology & Microbiology  
Kannur University  
Thalassery Campus  
Kerala - 670 661, INDIA**

