KANNUR UNIVERSITY

(Abstract)

M.Sc. Biotechnology & Micro Biology Programme under Choice Based Credit Semester System in the University Department– Revised Scheme, Syllabus & Model Question Papers Implemented with effect from 2015 admission- Orders issued.

ACADEMIC 'C'SECTION

U.O. No.Acad/C4/ 12013/2014 Civil Station P.O, Dated, 05-11-2015

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. Meeting of the Syndicate Sub-Committee held on 16.01.2015.
4. Meeting of the Curriculum Committee held on 10.04.2015.
5. U.O No.Acad/C4/14536/2014 dated 29.05.2015.
6. Meeting of the Department Council held on 01.06.2015.
7. Letter from the HOD, Dept. of Biotechnology & Micro Biology, Palayad Campus, Thalassery
8. Meeting of the Curriculum Committee held on 03.09.2015.

ORDER

1.The Regulations for Post Graduate Programmes under Choice Based Credit Semester System were implemented in the Schools/Departments of the University with effect from 2010 admission as per the paper read (1) above and certain modifications were effected to the same vide paper read (2).

2. The meeting of the Syndicate Sub-Committee recommended to revise the Scheme and Syllabus of all the Post Graduate Programmes in the University Schools/Departments under Choice Based Credit Semester System (CCSS) with effect from 2015 admission vide paper read (3) above.

3. As per the paper read (4) above, the meeting of the Curriculum Committee recommended certain modifications/ additions to the Regulations for Post Graduate Programmes under Choice Based Credit Semester System and the Regulations were modified in the University w.e.f. 2015 admission vide paper read (5).

4. The Department Council vide paper read (6) above has approved the Scheme, Syllabus & Model Question Papers for M.Sc. Biotechnology & Micro Biology Programme under Choice Based Credit Semester System(CCSS) for implementation with effect from 2015 admission.

5. The Course Director, Dept. of Biotechnology & Micro Biology vide paper read (7) above, has forwarded the Scheme, Syllabus & Model Question Papers for M.Sc. Biotechnology & Micro Biology Programme in line with the revised Regulations for Choice Based Credit Semester System for implementation with effect from 2015 admission.

P.T.O.

6. The meeting of the Curriculum Committee held on 03.09.2015 approved the Scheme; Syllabus & Model Question Papers for M.Sc. Biotechnology & Micro Biology Programme under Choice Based Credit Semester System in the Department vide paper read (8) above.

7. 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 KU Act 1996, and all other enabling provisions read together with, has accorded sanction to implement the Scheme, Syllabus & Model Question Papers for M.Sc. Biotechnology & Micro Biology Programme under Choice Based Credit Semester System, offered in the University Department w.e.f 2015 admission, subject to report to the Academic Council.

8. Orders are, therefore, issued accordingly.

9. The revised Scheme, Syllabus and Model Question Papers of M.Sc. Biotechnology & Micro Biology Programme effective from 2015 admission are appended.

Sd/-
JOINT REGISTRAR (ACADEMIC)
FOR REGISTRAR

To

The HOD, Department of Biotechnology & Micro Biology
Palayad Campus, Thalassery

Copy To:

1. The Examination Branch (through PA to CE)
2. PS to VC/PA to PVC/PA to R/PA to CE/PA to FO
3. JR/AR I Academic
4. The Computer Programmer *(for uploading in the website)*
5. SF/DF/FC

KANNUR UNIVERSITY
CIVIL STATION P.O.
KANNUR
PIN-670 002
THAVAKKARA

Forwarded/By Order

SECTION OFFICER

For more details: log on www.kannur university .ac.in

Bio & Micro.

KANNUR UNIVERSITY

COURSE STRUCTURE & SYLLABUS FOR

M.Sc. BIOTECHNOLOGY PROGRAMME

Under CCSS

2015 Admission Onwards

Department of Biotechnology & Microbiology

Thalassery Campus

Kerala – 670 661, INDIA

Scheme and Syllabus of M.Sc. Biotechnology Programmes
Under the Choice Based Credit and Semester System with effect from 2015 Admission

The Department of Biotechnology and Microbiology of Kannur University was established in the year 2000 for conducting M.Sc. programmes in Biotechnology and Microbiology as well as doctoral research. The department has the vision to emerge as a most reputed postgraduate study and research center in the region. The department is an approved research centre of Kannur University in Life Sciences.

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M.Sc. PROGRAMMES

M.Sc. Biotechnology – 12 Seats (Merit) + 2 Seats (Payment) + 1 Seat (NRI)
M.Sc. Microbiology – 12 Seats (Merit) + 2 Seats (Payment) + 1 Seat (NRI))

OBJECTIVE OF THE PROGRAMME

To train students drawn from different disciplines at Post-Graduate level in frontier areas of multidisciplinary, applied field of Biotechnology and Microbiology to enable them to contribute in research and entrepreneurship.

DURATION OF THE PROGRAMME

The whole programme is divided into four semesters

ADMISSION PROCEDURE

Admissions are notified in national newspapers inviting applications for the M.Sc Programmes (Biotechnology, Microbiology) of the Department.

ELIGIBILITY

Indian nationals with a bachelor's degree in any of the subjects such as Biotechnology/ Microbiology/ Biochemistry/ Chemistry/ Zoology/ Botany/ Life Science or any other subject with Microbiology/ Biotechnology as one of the subjects of study at degree level with not less than 50% marks in aggregate (excluding languages). Eligible relaxation in the percentage of marks will be given to candidates belonging to backward communities and SC & ST. All the eligible applicants have to appear for a written entrance test. Duration of the entrance test will be 120 minutes with 200 objective type multiple choice questions for 100 marks. The questions will be of undergraduate standard. There will be 25% negative marks for wrong answers. A rank list will be prepared based on the entrance test.

Those who are awaiting final year B.Sc. results also can apply but they have to fulfill the eligibility criteria before the date of admission.

Foreign nationals / NRIs and candidates for payment seats need not appear for the entrance test. They shall be admitted directly based on the marks in the qualifying examination.

M. SC CURRICULA

The M.Sc curriculum of both Biotechnology and Microbiology closely follows to the level and extent as conceived by the national curricula development centers of UGC/ DBT.

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COURSES AND CREDITS

Core courses (except the project work) usually will have 4 credits and elective courses will have 3 credits. A 4-credit course shall have three hours lecture and one practical session of 3 hours per week. Elective courses usually do not have practical. A minimum of 80 credits are mandatory for the successful completion of the programme. No regular student shall register for more than 24 credits and less than 16 credits per semester.

PROJECT WORK

All the M.Sc. students have to do a research project of 3-4 months duration in the fourth semester. For the research projects the students are encouraged to go to national research institutes, in order to acquire familiarity with such environments. The students may also get opportunity to undergo 1-2 weeks training in industrial / productive institutions in the field of applied biology.

COURSES OFFERED IN THE M.Sc. BIOTECHNOLOGY PROGRAMME

SEMESTER I

Sl. No.	Course Code	Title of the course	Contact Hours /Week			Marks			Credits
		CORE COURSES	L	T/S	P	ESE	CE	Total	
1	BMB1 C01	Biochemistry	3	2	3	60	40	100	4
2	BMB1 C02	Cell Biology	3	2	3	60	40	100	4
3	BMB1 C03	Genetics	3	2	3	60	40	100	4
4	BMB1 C04	General Microbiology	3	2	3	60	40	100	4
		ELECTIVE COURSES							
5	BMB1 E01	Biostatistics	3	2	0	60	40	100	3
6	BMB1 E02	Instrumentation	3	2	0	60	40	100	3

SEMESTER II

Sl. No.	Course Code	Title of the course	Contact Hours/Week			Marks			Credits
		CORE COURSES	L	T/S	P	ESE	CE	Total	
7	BMB2 C05	Biophysics	3	2	3	60	40	100	4
8	BMB2 C06	Molecular Biology	3	2	3	60	40	100	4
9	BMB2 C07	Immunology	3	2	3	60	40	100	4
10	BMB2 C08	Intermediary Metabolism	3	2	3	60	40	100	4
		ELECTIVE COURSES							
11	BMB2 E03	Human Physiology	3	2	0	60	40	100	3
12	BMB2 E04	Food Microbiology	3	2	0	60	40	100	3

SEMESTER III

Sl. No.	Course Code	Title of the course	Contact Hours/Week			Marks			Credits
		CORE COURSES	L	T/S	P	ESE	CE	Total	
13	BMB3 C09	Microbial Technology	3	2	3	60	40	100	4
14	BMB3 C10	Cell and Tissue Manipulation	3	2	3	60	40	100	4
15	BMB3 C11	Recombinant DNA Technology	3	2	3	60	40	100	4
16	BMB3 C12	Enzymology	3	2	3	60	40	100	4
		ELECTIVE COURSES							
17	BMB3 E05	Virology, Mycology and Protozoology	3	2	0	60	40	100	3
18	BMB3 E06	Environmental Microbiology	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	
19	BMB4 C13	Project				300	0	300	12
20	BMB4 C14	Viva Voce				100	0	100	2
		ELECTIVE COURSES							
21	BMB4 E07	Biotechnology in Medicine, Health, Agriculture and Environment*	3	2	0	60	40	100	3
22	BMB4 E08	Bioinformatics *	3	2	0	60	40	100	3
23	BMB4 E09	Ethics, Patency & Intellectual Property rights *	3	2	0	60	40	100	3

* Six Electives are compulsory. Two electives are to be selected from IV semester.

BMB1C01
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-port, 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, Muco-polysaccharides.

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, Saphonification 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

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 .

BMB1C02
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

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)

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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.

BMB1C03
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. $^{14}CO_2$ fixations by photosynthetic microbes.
7. Mitosis
8. Meiosis

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.

BMB1C04
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

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

BMB1E01
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

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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 IX

Chi-square test, Analysis of variance.

REFERENCES

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

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 University7 Press
4. Statistical Methods in Biology - 3rd edition, Bailey N.T.J., Cambridge University Press
5. Biostatistical analysis - 4th 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.

BMB1E02
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.

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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.

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 - 3rd 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 - 3rd 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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BMB2C05
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.

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-paring 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

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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

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. Tooz. , 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

BMB2 Co6
MOLECULAR BIOLOGY

14

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 (flurography, 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.

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REFERENCES

1. Lodish, H., Baltimore, D. Berk, A., Zipursky, S. L. Matsudaira, P. and Darnell. J. 1995 molecular Cell Biology, 3rd 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 Publishers.
4. Alberts, B., Bray, D. Lewis, Julian, Raffn M. Roberts, K. and J. D. Watson, J. D. 1994. Molecular Biology of the Cell, 3rd edn, Garland Publishing Inc..
5. Hayes, W., 1994. Genetics of Bacteria and their viruses. 2nd Edn, CBS Publishers and Distributors, New Delhi.
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, Tokyo.

BMB2C07
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 immunogenecity, 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.

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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.

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, 2nd edn, David H Hentges 1995
10. Text Book of Microbiology, R Ananthanarayanan and C K Jayaram Panicker, Orient Longman

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BMB2C08
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_2 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 absobation 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.

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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

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. Jeoffrery 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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BMB2E03
HUMAN PHYSIOLOGY

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

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

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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

BMB2E04
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

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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

BMB3C09
MICROBIAL TECHNOLOGY

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

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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.

BMB3C10
CELL AND TISSUE MANIPULATION

UNIT I

Plant tissue culture: Laboratory requirements and general techniques. Tissue culture media.

UNIT II

Major Plant cell types Major plant cell types; cell types in culture, separation of cell types, growth regulators and control of growth and differentiation of plant cells in culture. Hormone habituation growth of cells in suspension.

UNIT III

Pathways of plant regeneration, factors controlling regeneration, organogenesis, root - shoot transformation in vitro. Induction, development and maturation of somatic embryogenesis.

UNIT IV

Isolation, purification and viability factors affecting protoplasts. Protoplast culture, culture conditions, culture media. Introduction to protoplast fusion. Techniques of protoplast fusion. Enzymes involved in cell wall digestion. Factors affecting protoplast fusion and fate of products of protoplast fusion. Symmetric and asymmetric hybrids, cybrids.

UNIT V

Haploid production of plant tissues, triploid production of plant tissues, embryo culture and embryo rescue.

UNIT VI

Plant genetic transformation: Concepts, gene constructs, selection systems, transformation methods – agrobacterium mediated, biolistics.

UNIT VII

Principles and commercial practices of plant micro propagation, in vitro phenomena in mass propagation like genetic instability, vitrification, and contamination. Germplasm conservation: Synseeds, Cryopreservation, Slow growth and DNA banks, genetic stability assessment, Disease indexing and eradication.

UNIT VIII

Animal cell culture: Conditions of viability of animal cells in culture. Growth factors of animal cells in culture. Production of hybridomas and monoclonal antibodies. Cloning of hybrid cells. Biology and charecterisation of cultured cells, Parameters of growth, Scaling up of animal cell culture.animal cell transformation, cell culture- applications, Vaccines. Organ and histotypic cultures, apoptosis, measurement of cell death, 3-D culture.

PRACTICAL

1. Preparation of media.
2. Surface sterilization.
3. Organ culture – shoot tip, meristem, node, leaf, embryo, orchid seed
4. Callus induction
5. Organogenesis
6. Transfer of plant lets to soil.
7. Protoplast isolation and culture.
8. Anther culture.
9. Preparation of media and membrane filtration (animal cell culture).
10. Preparation of single cell susupension from spleen and thymus.
11. Cell counting and cell viability.
12. Trypsinization of monolayer and subculturing.

13. Cryopreservation and thawing.
14. Measurement of doubling time.
15. Cell fusion with PEG.

REFERENCES

1. Principles of Gene manipulation by R. M. Old and S. B Primrose
2. Plant tissue culture by S.S Bhojwani.
3. Methods in Molecular Biology Vol. 28. Protocols for Nucleic acid analysis by non - radioactive probes. Edited by Issac P. G. Human Press,
4. Molecular Cloning: A laboratory manual by Maniatis, Fritsch E. R and Sambrook J. Volume Series.
5. A guide to Genetic Engineering- Pamela Peterson.
6. Biotechnology by Trehan.

BMB3C11
RECOMBINANT DNA TECHNOLOGY

25

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 IV

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.

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 microdissection, microcloning, 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)

REFERENCES

1. Principles of gene manipulation- An Introduction to Genetic Engineering. Old, RW & Primrose, S.B – 1994 5th 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.

BMB3C12
ENZYMOLOGY

27

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: Sub**UNIT I**nteractions, 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 Vmax & Km 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

REFERENCES

1. Enzymes- Dixon and Webb
2. Enzyme Kinetics- Bowden and Wharton
3. Immobilised Enzymes- Trevan
4. Hand book of Enzyme Technology- Alan Weisman- 3rd 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

BMB3E05
VIROLOGY, MYCOLOGY AND 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:

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

Mycology:

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

Parasitology:

Collection and observation of permanent slides of medically important protozoans
Faecal examination-saline wet mount and iodine wet mount
Concentration of cyst/ova by sedimentation and floatatation method
Cultivation of Entamoeba histolytica from stool sample
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

BMB3E06
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_2 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

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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BMB4E07
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.

Agriculture

UNIT V

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

UNIT VI

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

32

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

BMB4E08
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.

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UNIT III

Multiple sequence alignment: methods, tools and applications- identification of sequence patterns, motifs and profiles, gene prediction. Phylogenetic 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 & Quellette BFF, John Wiley & Sons Inc.
2. Bioinformatics – Sequence and Genome anlysis, 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 Kafman publishers
7. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Edu.
8. Medicinal Chemistry – Patrick G, Viva Books Pvt Ltd.
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.

BMB4E09
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.

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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.

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.

Sd/-

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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY
Kannur University
First (End) Semester M.Sc. Biotechnology/Microbiology Examination – February 2016

COURSE: BMB1 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 2016

COURSE: BMB1 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 2016

COURSE: BMB1 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

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 2016

COURSE: BMB1 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 2016

COURSE: BMB1 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 2016

COURSE: BMB1 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 2016

COURSE: BMB2 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

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 2016

COURSE: BMB2 C06 - 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

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 2016

COURSE: BMB2 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 2016

COURSE: BMB2 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 2016

COURSE: BMB2 E03- 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 2016

COURSE: BMB2 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

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
Third (End) Semester M.Sc. Biotechnology/Microbiology Examination – March 2017

COURSE: BMB3 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.

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_{12} 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 2017

COURSE: BMB3 C10 - CELL AND TISSUE MANIPULATION

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 process of production hybridomas and monoclonal antibodies via animal cell culture.
2. Discuss the principle and techniques involved in rapid clonal propagation of plants.

Section B
Write notes on **ANY FIVE** of the following 5 x 6 = 30 marks

3. Methods of detection of viruses in culture
4. Role of growth regulators in plant tissue culture
5. Scaling up in animal cell culture
6. Organogenesis
7. Vitrification
8. Somatic embryogenesis

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Section C
Write short notes on **ANY FIVE** of the following 5 x 3 = 15 marks

9. GA
10. Browning
11. Anther culture
12. Embryo Rescue
13. Cell lines
14. Trypsinization

DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY
Kannur University
Third (End) Semester M.Sc. Biotechnology/Microbiology Examination – March 2017

COURSE: BMB3 C11 - 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 2017

COURSE: BMB3 C12 – 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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DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY
Kannur University
Third (End) Semester M.Sc. Biotechnology/Microbiology Examination – March 2017

COURSE: BMB3 E05 - 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

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 2017

COURSE: BMB3 E06 - 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

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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

DEPARTMENT OF BIOTECHNOLOGY AND MICROBIOLOGY
Kannur University
Fourth (End) Semester M.Sc. Biotechnology/Microbiology Examination – September 2017

COURSE: BMB4 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
Fourth (End) Semester M.Sc. Biotechnology/Microbiology Examination – September 2017

COURSE: BMB4 E08- 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
Fourth (End) Semester M.Sc. Biotechnology/Microbiology Examination – September 2017

COURSE: BMB4 E09 - 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

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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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)		CE TOTAL (40)	THEORY (45 MARKS)				PRACTICAL (15 MARKS)	ESE TOTAL (60)			
			ASSIGNMENT (6 MARKS)	CLASS TEST (12 MARKS)	SEMINAR / DISCUSSION ETC(12MARKS)	LAB TEST (7 MARKS)	RECORD (3 MARKS)		1 VALUATION$_{ST}$	2 VALUATION$_{ND}$	3 VALUATION$_{RD}$	AVERAGE (45 MARKS)	LAB TEST (15 MARKS				
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)**

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(16MARKS)	CE TOTAL (40)	1 VALUATION ST	2 VALUATION ND	3 VALUATION RD	AVERAGE (60 MARKS)			
1													
2													
3													

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

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