

FACULTY OF LIFE SCIENCES
SYLLABI
FOR
CBCS SYSTEM
M.Sc. (Hons.) Biotechnology First Year
(1st and 2nd Semester)
(Session: 2018-2019)



MATA GUJRI COLLEGE
FATEHGARH SAHIB-140406, PUNJAB



Mata Gujri College
Sri Fatehgarh Sahib
Ordinances and Syllabi
For

M.Sc. (Hons.) Biotechnology

The course for the degree of Master of Science shall be spread over two academic years (M.Sc. Part-I and M.Sc. Part-II). Each part shall consist of two semesters. The examination for the first and third semester shall be held in the month of November/December and the examination for the second and fourth semester shall be held in the month of April/ May.

1. Eligibility criteria for the admission in first year (first semester) M. Sc (Hons) Biotechnology

- a. The candidates who have passed the Bachelor's degree in Science with subjects in the Faculty of Life Sciences/Biological/Medical/Engineering/Food/Agriculture/home Science are eligible. Besides the candidates who has passed bachelor's degree in sciences in any three of the following subjects are also eligible: Mathematics/Statistics/Physics/ Chemistry.
- b. Minimum eligibility requirement for the admission in First semester is 50% marks in the graduation.

2. Last date for the Admission:

For the admission candidate has to fill the admission form and deposit the fees (as per rules) before the prescribed dates.

3. Distribution of Marks and passing criteria

- a. Each paper shall have 30% Internal Assessment and 70% external evaluation. Internal assessment of all subjects will be entered in detailed mark sheet as a separate identity.

*Internal assessment (30): Seminar (5 Marks) MST (15 Marks), Assignment (5), Attendance/report for the seminar/symposium/industrial/Educational visit (5 marks)

*Internal assessment (25): Seminar (5 Marks) MST (10 Marks), Assignment (5), Attendance/report for the seminar/symposium/industrial/Educational visit (5 marks)

The teacher/teachers concerned/Incharge of each paper/practical class will be responsible for the evaluation & submission of the internal assessment. Later this will be clubbed up with all other papers and sent to Examination branch, Mata Gujri College, Fatehgarh Sahib by the head of the department before the start of semester examination (theory).

- b. **To pass in a paper the candidate must score 40% marks in the external and internal examination separately.**
- d. For a candidate who fails in a paper (s) his/her internal assessment for that paper will be carried over and supplementary examination will therefore

consists of only external examination.

- e. **For a candidate who fails (score less than 40% marks) in internal assessment he/she has to fulfill all the requirements in the next semester, with the payment of fees to the college (as per rule).**

4. Admission to 2nd Year (third semester)

- a. To qualify the admission to 2nd Year (3rd semester) the candidate must have passed 50 % of the total theory papers of first and second semester. Candidate has to fill the admission form for the admission in third semester before prescribed dates.

4. Reappear cases

- a. A candidate placed under re appear in any paper will be allowed two chances to clear the reappear which will be available within two consecutive years/chances.
- b. The examination of reappear of odd semester will be held with regular examination of odd semester and re appear of even semester will be held with regular examination of even semester.
- c. Re-appear candidates will take semester-I papers along with semester-III examinations and semester-II paper along with semester IV examination
- d. But if the candidate is placed under re appear in the last semester of the course he/she will be provided chance to pass the re appear with the examination of next semester. Provided that he/she has not any reappear in earlier semester (1st, 2nd and 3rd). For the award of M.Sc degree he/she have to qualify in all paper prescribed for the M. Sc course within the period of four years from the date he/she joined the course.
- e. After completion of two academic years of studies(i.e. four semester) he/she shall not be admitted to any semester of the same course and will not have any privileges of a regular student.

5. Attendance

- a. Teaching/Seminars/Tutorial/Guided Library reading:
- | | |
|------------------------------|-------------------|
| Period of one hour duration | 1 attendance |
| Period of 2-3 hours duration | 2 or 3 attendance |

6. Eligibility criteria for fill up of examination forms

- a. **For First and second semester**
75% Attendance required in each course of syllabi.
- b. **For Third semester**
- i. To qualify the fill up of examination form for 3rd semester, the candidate must have passed 50 % of the total theory papers of first and second semester.
- ii. 75% Attendance required in each course of syllabi
- c. **For fourth semester**

- i. To qualify the fill up of examination form 4th semester, candidate must have passed 50 % of the total theory papers for the first, second and third semester.
- ii. 75% Attendance required in each course of syllabi.

7. Grace marks

The grace marks shall be allowed according to the general ordinances relating to “ Award of Grace marks”

8. Divisions in marks and award of Hons Degree

Successful candidate who obtain 60% or more of the aggregate marks in Part-I and Part-II examination (aggregate) taken together shall be placed in the first division. Those who obtained 50% or more but less than 60% shall be placed in the second division and all below 50% shall be placed in the third division.

9. Improvement of marks in Degree

- a. A candidate who has passed M.Sc. examination shall have two chances within a period of two years after passing the examination to improve division. Improvement shall be allowed in 50% of total theory paper/s offered in Part-I and part-II examination. However previous marks of the internals/practicals /project will be carried forward in the paper(s) in which he appears for improvement.

10. Evaluation training seminar and Research project

- a. In-plant training seminars shall be evaluated by a board of three teachers and the result would be communicated by Head of the Department to controller examination before commencement of semester examination.
- b. Research Project work** (RP1 and RP2) would be evaluated by one external examiner, Guide or nominee of guide and head of the department. Result would be communicated to examination controller by Head of the Department after the evaluation of project work.

****75% and above A Grade , 65 % and above B Grade, 55% and above C Grade , Below 55 % Grade D**

S. No.	Assessment Parameters	Weightage(%)
1.	Topic analysis	10
2.	Literature review	20
3.	Language and writing of thesis	10
4.	Quantitative data analysis	20
5.	Significance of work	10
6.	Presentation and defense	30

M.Sc. (Hons.) Biotechnology First Year

(1st and 2nd Semester)

Subjects and Distribution of Marks

(Academic Session 2018-2019)

Semester 1

Paper No.	code	Paper No.	C/E	Name of paper	Credit per week	Marks		Total Marks
						Internal Marks *	External Marks	
MBT(C1)-101		Paper I	C1	Biochemistry	4	30	70	100
MBT(C2)-102		Paper II	C2	Microbiology	4	30	70	100
MBT(C3)-103		Paper III	C3	Molecular Genetics	4	30	70	100
MBT(E1)-104		Paper IV	EI	Technical Writing And Communication Skills	3	25	50	75
MBT(EII)-105		Paper V	EII (Any one)	opt.I Environmental Biotechnology opt II Cellular organization	3	25	50	75
MBT(Lab)106		LC 1		Lab Course1; Pertaining to theory paper I & Paper II	3		100	100
MBT(Lab)107		LC 2		Lab Course 2; Pertaining to theory paper III	1.5		50	50
MBT(Lab)108		LC 3		Lab Course 3; Pertaining to theory paper V	1		35	35
MBT(S1)109				Seminar	1.5	25		25
Total					25	165	495	660

Semester – II

Paper No.	code	Paper No.	C/E	Name of paper	Credit per week	Marks		Total Marks
						Internal Marks *	External Marks	
MBT(C4)-201		Paper V I	C4	Bioanalytical techniques	4	30	70	100
MBT(C5)-202		Paper VII	C5	Immunology & Immunotechnology	4	30	70	100
MBT(C6)-203		Paper VIII	C6	Food Bio-technology	4	30	70	100
MBT(E3)-204		Paper IX	EIII	OptI Biostatistics	3	25	50	75
MBT(E4)-205		Paper X	EIV	OptI Biosafety and Bioethics Opt II System biology	3	25	50	75
MBT-(lab)206		LC 4		Lab Course 4; Pertaining to theory paper VI &VII	3	--	100	100
MBT-(lab)207		LC 5		Lab Course 5;Pertaining to theory paper VIII	1.5	--	50	50
MBT-(lab)208		LC 6		Lab Course 6;Pertaining to theory paper IX & X	2	--	70	70
MBT(S2)209				Seminar	1.5	--	25(25 Grade A,B ,C)
Total					26	140	555	695

Paper I- MBT(C1) -101 Biochemistry

Course Objectives:

1. This course covers the structure and function of protein and small molecules in living system.
2. This also focuses on metabolic pathways and how the stoichiometry of metabolites influences the production of biotech products.

Lectures to be Delivered 60

M. Marks : 70

Time allowed: 3 Hrs

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 12 marks. Section C will consist of 11 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 2 marks

Unit-I

Biomolecules: Origin of biomolecules, types of biomolecules, composition and properties, macromolecules and their monomeric subunits.

Amino acids and Proteins: Classification of amino acids, Protein classification (Primary, secondary, tertiary, quaternary).

Nitrogen metabolism :Transamination, oxidative deamination, Urea cycle

Carbohydrates: Structure and function of Monosaccharides , disaccharides (sucrose, lactose and maltose), polysaccharides, homopolysaccharides (starch, cellulose, chitin), heteropolysaccharides , mucopolysaccharides.

Carbohydrate metabolism: Glycolysis, citric acid cycle, pentose phosphate pathway, glycogenesis, glycogenolysis, gluconeogenesis

Unit-II

Oxidative phosphorylation/respiration: Electron transport chain, Chemiosmotic model.

Lipids: Structure and function of Fatty acids, Neutral lipids (triglycerides), phospholipids (Cephalin, phosphatidyl inositol and Lecithin) .

Lipid metabolism: Biosynthesis and catabolism of fatty acids, Triglycerides, and Phospholipids.

Biological membrane: Structure of Biological membrane, fluid mosaic model, membrane proteins and their function, membrane mediated transport (passive,

active, facilitated).

Vitamins : Introduction, Structure and function of Water soluble (B complex and Vitamin C) and fat soluble (K, E, D and A) vitamins

Books Recommended:

1. Biochemistry, by Voet, D. and J.G. Voet, John Wiley and Co, 4th Edition, 2011.
2. Lehninger Principles of Biochemistry: by Nelson, D.L. and Cox, M.M.. CBS publishers, New Delhi., Sixth Edition, 2012
3. Biochemistry, by Stryer, L., W.H. Freeman Publishers and Distribution, New Delhi.
4. Harper's Illustrated Biochemistry, by Murray, R. 29th Edition, 2012
5. Biochemistry-an introduction, by Gurrand, M.L.A.I. James, Lipid., Chapman and Hall Ltd., London, 1980.
6. Outlines of Biochemistry, by Conn E.E. and P.K. Stump, Wiley Eastern Ltd. New Delhi, 1989.
7. Physical Chemistry with application to Biological system, by Chang. R. Macmillan Publishers, 1981.
8. Text Book of Biophysical chemistry (Vol. 2 and 3) by Cantor, A.W.H. Greeman and Co., 1980.
9. Principles of Biochemistry, Harter, H.R. 2002.

Lab Course LC1- MBT (lab)106 Pertaining to Biochemistry

Practical Time 3 Hrs/Week

M. Marks : 50

Time allowed for Examination: 5

Pass Marks : 40%

Hrs.

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (12.5 Marks).

List of Practical:

1. Qualitative test for proteins.
 2. Determination of pK_a value of amino acid.
 3. Determination of protein by Biuret and Lowry's method.
 4. Qualitative test for carbohydrates.
 5. Determination of total sugars by anthrone method.
 6. Determination of reducing sugars by Dinitrosalicylic Acid (DNSA)
 7. Determination of cholesterol-total, free and esterified.
 8. Determine vitamin C content in a citrus fruit by titration method.
 9. Isolation of casein protein from milk.
- Determination of starch content from wheat flour.

Paper II- MBT (C2)102 Microbiology

Course Objectives:

1. The major objective of this course is to familiarize the students to microbes & microbial processes.
2. To optimize them with all areas of industrial microbiology

Lectures to be 60

M. Marks : 70

Delivered

Time allowed: 3 Hrs

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 12 marks. Section C will consist of 11 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 2 marks

Unit-I

Introduction to Microbiology: Historical developments of microbiology, scope of microbiology, brief account of organization and classification of microorganisms, Hackle's three kingdom concept, Whittaker's five kingdom concept, three domain concept and recent developments.

General account of microorganism: Brief characteristics and staining of prokaryotes (bacteria, archaebacteria, cyanobacteria,) eukaryotes (molds, slime molds, yeast, algae, fungi, protozoa) & viruses (bacterial, plant and animal). Characterisation of microorganisms: On basis of morphology, chemical, culture, metabolic, antigenic and Genetic.

Microbial nutrition and culturing techniques: Macro and microelements, growth factors, nutritional categories among micro-organisms preparation of culture media (conventional and non-conventional substrates), types of media, starter cultures, techniques for cultivation of anaerobes, maintenance and preservation of culture.

Microbial growth: Definition, mathematical nature and expression of growth, measurement of growth, efficiency of growth, synchronous and diauxic growth, effect of nutrient concentration on growth rate. Batch and Continuous culture of microorganism.

Strain Improvement: Its Need and importance. Methods of strain improvement: By means of radiations, chemicals and genetic engineering. Mutation and selection.

Unit-II

Control of microorganisms: Pattern of microbial death, Use of physical (heat, low temperature, radiation, filter); chemical (phenolics, alcohols, halogens,

heavy metals, gases)

Microbial genetics: Modes of bacterial recombination (conjugation, transformation and transduction in bacteria).

Microorganisms as geochemical agents: Fitness of micro organisms as agent of geochemical change; cycles of matter and microbial interactions (phosphorus, oxygen and nitrogen).

Human Microflora: Mode of infection ,pathogenesis and control of microbial flora(Clostridium , Salmonella, E.coli) of human, distribution and occurrence of normal flora, effect of antimicrobial agents on microflora (antibiotics).

Microbial adaptations: Influence of environmental factors on growth: solutes and water activity, temperature, oxygen concentration, pressure, radiation. Microbial growth in natural environment; growth limitation in environmental factors (Liebig's law of the minimum, Shelford's law of tolerance), quorum sensing and microbial population.

Books Recommended:

1. Biology of micro organisms by M.T. Madigan by M.T. Madigan, J.M. Martinlzo, J. Parker, Prentice Hall, New Jersey,.
2. General Microbiology by R.Y.Stanier, J.L. Ingraham, M.L. Wheelis and P.R. Painter, Mac Millan, Hong Kong,
3. General Microbiology by H.G. Schegel, Cambridge University Press, UK .
4. Introductory Microbiology by J. Heritage, E.G.V. Evans and R.A. Killington, Cambridge University Press, UK,
5. Microbiology by L.M. Prescott. J.P. Harleyu, D.A. Klein, WCB Pbls, England,
6. Microbiology: by A Human Perspective by E.W. Newster, C.E. Roberts. M.T. Nester, WCB Phis, London.

Lab Course LC2- MBT (lab)106 Pertaining to Microbiology

Practical 3 Hrs/Week

M. Marks : 50

Time

Time allowed for Examination: 5

Pass Marks :

Hrs.

40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (12.5 Marks).

List of Practicals:

1. Medium preparation(universal, differential, selective and enrichment) and sterilization
2. Isolation and enumeration of microorganism from soil, water and air (fungi and bacteria) by spreading , streaking (types) and pour plating

3. Staining of microorganism to study the morphology (size, shape, elevation, pigments, margin)
4. Determination of cell size with ocular micrometer
5. Determination of viability of microorganisms.
6. Determination of Coliforms bacteria in water.
7. Determination of microbial load on the surface with swab test.
8. Determine (a) Lag, log and exponential phase (b) Generation time and doubling time from growth curve of bacteria.
9. Effect of temperature, pH and radiations on the growth of bacteria.

Paper III - MBT (C3)103 Molecular Genetics

Course Objectives:

1. The course is to expose the students to the structure of Nucleic acids & gene expression in both prokaryotes and eukaryotes.
2. At the end of the course the student is expected to gain an understanding of nucleic acids their role in gene expression & technologies for control of gene expression. They also gain an understanding of Functional genomics .

Lectures to be Delivered

60

M. Marks : 70

Time allowed: 3 Hrs

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 12 marks. Section C will consist of 11 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 2 marks

Unit-I

Introduction to genetic materials: Genetic material (DNA & RNA: structure and types).

DNA replication, repair and recombination: Unit of replication, enzymes involved, DNA damage and repair mechanisms. Mechanism of transposition.

RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, elongation and termination

RNA processing: Post transcriptional modifications, RNA editing, splicing, polyadenylation.

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

Unit-II

Control of gene expression at transcription and translation level: Regulation of viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

Functional and Comparative genomics: Gene homology analysis.

Comparative genomics: Gene evolution, exon shuffling;

Genome annotation: Functional domain, Molecular phylogenetics .

Genetic mapping: Principle procedure and applications: Fluorescence in situ hybridization (FISH) Sequence-tagged site mapping (STS), expressed sequence tag (EST), sequencing and Serial analysis of gene expression (SAGE).

Application of genomics : Industry (protein engineering)) Health (gene therapy), Agriculture (N₂ fixation)

Books Recommended:

1. Genes IX by Benjamin Lewin, Jones Bartlett Publ.
2. Microbial Genetics; by D. Friefelder, Narosa Publishing House, New Delhi, 1989.
3. Molecular Biology: by D. Friefelder, Narosa Publishing House, New Delhi, 1998.
4. Molecular Biology of Gene: By J.D. Watson, N.H. Hopkin, J.W. Roberts, J.A. Steing and A.M. Weings, Benamin Cummings Publication Co., Amsterdan, 2008
5. Genomes 3 by T.A.Brown. Garland Science Publ; 2007.
6. Proteome Research: New Frontiers in Functional Genomics. Eds. MR Wilkins, RD Appeal and DF Haochshauser, Springer Publ. 1997.
7. Molecular Genetics of Bacteria, J.W. Dale, Wiley and Sons Ltd. 3rd Edn. 1998.

Lab Course LC2- MBT(lab) 107 Pertaining to Molecular Genetics

Practical Time: 3 Hrs/Week

M. Marks : 50

Time allowed for Examination: 5 Hrs.

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (12.5 Marks).

List of Practical:

1. Isolation and quantification of DNA from *E. coli*/leaves.
2. Isolation and quantification of RNA from yeast.
3. Determination of molecular weight of DNA with agarose gel electrophoresis.
4. Determination of T_m of DNA.
5. Determination of phosphate content of DNA and RNA.
6. Analysis of GC content in DNA.
7. Determine nucleic acid content (DNA & RNA) by photofluorimeter.

Q3.

- a) **CV (Curriculum vitae) writing.** Students shall be asked to write a CV containing a brief account of one's qualification, personal experience, hobbies and expertise for a particular jobs etc.

(6 Marks)

- b) **Report Writing:** A report of about 100 words to be written on some issue, an event/ incident, some topics of current affairs. **(6 Marks)**

Q4 Precise Writing: Students shall be asked to make a precise of the given passage.

- a) **Words commonly misspell** (from choices of short stories).

Paper V (MBT (EII)105) Option-1 Environmental Biotechnology

Course Objectives:

1. The main objective of this course is to impart students an understanding of pollution of environment by air, water and soil responsible for degradation of natural resources and degradation of biodiversity.
2. It also familiarizes them with various remediation techniques, nonpolluting technologies viz. bioenergy and biomining.

Lectures to be Delivered 35

M. Marks : 50

Time allowed:

3 Hrs

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 10 marks. Section C will consist of 10 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 1 mark .

Unit I

Introduction: Environment pollution, types of pollutants, biochemical and physiological effects of pollutants on environment.

Aerobic treatment technology I: Activated sludge (AS), Completely mixed conventional activated sludge (CCAS), contact stabilization (CSAS), step aeration (SAAS), completely mixed (CMAS), extended aeration (EAAS), pure oxygen or high purity oxygen (POAS), tapered aeration (TAAS) systems.

Aerobic treatment technology II: Aerated lagoons, trickling filters and rotating biological contactors, composting and vermicomposting.

Anaerobic Treatment technology: Anaerobic decomposition, anaerobic filter reactor, anaerobic contact reactor, fluidized bed reactor, up-flow anaerobic sludge blanket (UASB), anaerobic baffled reactor.

Unit II

Bio-energy production from waste: Fermentative production of ethanol and butanol, hydrogen gas production, biogas technology (raw materials, biochemistry, microbiology, biogas plant, factors affecting biogas production.

Metal Microbe interaction: Bioleaching, Types and Processes, bio-mining-microbiology, biochemistry and applications.

Bioremediation approaches to waste treatment: Bioremediation, Types of Bioremediation, Development of Bioremediation technology for Heavy metals, pesticides.

Biosensors: Definition, Types of biosensors, Applications of biosensor, BOD biosensor

Books Recommended:

1. Industrial water pollution Control, W. Wesley Elbenfields-jr. Mcgraw Hill international Editions (1998).
2. Biotechnology-Applications to environmental protection. First Edition 1993, Published by Mo Mera Pandey, for Himalaya Publishing House.
3. Advances in Industrial waste water treatment edited by P. K. Goel, Techno science publications, First Editions, 1999.
4. Commercial Biotechnology- An by Elsevier Science publishers B. V., Amsterden, The Newdesk.
5. Environmental Engineering Howard and Pevy, Donald R. Rowe and George Technologies, McGraw Hill International Edition.
6. Basic Environmental Science by G. S. P. Iyer, Educational Publishers and Distributers, New Delhi, 1997.

Lab Course LC3- MBT(lab) 108 Environmental Biotechnology

Practical Time: 2 Hrs/Week M. Marks : 35

Time allowed for Examination: 5 Hrs. Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (7.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (20 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (7.5 Marks).

List of Practical:

1. Characterization of industrial effluents for pH, TS, TDS, TSS, alkalinity and hardness parameters.
2. Evaluation of population potential of waste materials as Biochemical Oxygen Demand (BOD).
3. Determination of chemical oxygen demand (COD) in various effluents.
4. Isolation of phage from sewage.
5. Determination of pesticides in food and soil.
6. Determination of heavy metal ions in industrial effluents.
7. Development of biosensor (enzyme based/ microbe based) for monitoring heavy metal ion/pesticides in the environment.
8. Development of a small scale vermicomposting unit for waste utilization.
9. Isolation of Metal tolerant bacterial strains from waste water.
10. Construction of a biogas plant for methane production.

Paper V (MBT (EII)105- Option II CELLULAR ORGANIZATION

Course Objectives:

1. The major objective of this course is to study about the structure and functions of cells and cell organelles.
2. To impart information about microbial physiology , cell differentiation and cell death.

Lectures to be Delivered 35

M. Marks : 50

Time allowed: 3 Hrs

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 10 marks. Section C will consist of 10 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 1 mark.

Unit-I

Cell as a basic unit of life: Introduction to cell biology: Cell as a basic unit of living systems, level of organization, cell theory, Structure of PPLO, prokaryotic cell, eukaryotic cell, Plant cell, animal cell

Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

Structural organization and function of intracellular organelles I: Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes,

Structural organization and function of intracellular organelles II: plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle, and control of cell cycle.

Unit-I

Organization of genes and chromosomes: Operon, interrupted genes, gene families, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin, transposons.

Microbial Physiology: Growth, yield and characteristics, strategies of cell

division, stress response.

Cell differentiation in plants and animals: general characteristics of cell differentiation in plants and animals.

Cell Senescence and death: Apoptosis and necrosis.

Ecological Amplitude of cells in Different Environment: Organisms in Extreme environment (thermophiles, acidophiles, halophiles, barophiles).

Books Recommended:

- 1 Molecular Biology and the Cell, Albert Watson, 2003, Gerland Pub. USA.
- 2 Molecular Cell Biology, Dornall and Baltimore, 2003, Scientific Publishers, USA.
- 3 Mol. Cell Biology by Lodish et al. 2004. Freeman & Co.
- 4 The World of the Cell by Becker, Klein Smith & Hardin (2007) Pearson education Inc.
- 5 Cell Biology by Powar, Himalaya Publishing House, Mumbai. 511

Lab Course LC3- MBT(lab) 108 Cellular Organization

Practical Time: 2 Hrs/Week

M. Marks : 35

Time allowed for Examination: 5 Hrs.

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (7.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (20 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (7.5 Marks).

List of Practical:

1. Study of cells:
 - a. Prokaryotic cells- *Lactobacillus*, *Escherichia. coli*, *blue green algae*.
 - b. Eukaryotic cells- amoeba, paramecium, Testicular material for spermatogenesis.
2. Microtomy: Instruments introduction, use, care & section cutting.
3. Preparation of permanent slides: section cutting of plant tissue and staining with Eosin method.
4. Study of permanent slides.
5. Study of electron micrographs of various cell organelles: Plasma membrane, nucleus, mitochondria, Golgi apparatus, Lysosomes, Endoplasmic reticulum, Cilia, centriole, inclusion like glycogen, lipids etc.
6. Study and preparation of Mitosis and Meiosis slides.
7. Determine the effect of salt concentration on osmosis.
8. Determine the effect of salt concentration on the shapes of animal and plant cells.

**M.Sc. (Hons.) Biotechnology First Year
(Semester II)**

Paper VI – MBT (C4)201 Bio-analytical Techniques

Course Objectives:

1. To make the students conversant with basics of biotechniques.
2. To acquaint the students with concepts of important fundamental principles and applied application of bioanalytical techniques

Lectures to be Delivered 60

M. Marks : 70

Time allowed:

3 Hrs

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 12 marks. Section C will consist of 11 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 2 marks.

Unit-I

Centrifugation: Principles of sedimentation, types and safety aspects of centrifuge, preparative (differential centrifugation, density gradient) and analytic centrifugation.

Microscopy: Introduction to microscopy, principles, instrumentation and application of Phase contrast, confocal, Fluorescent Microscopy and Electron Microscopy: Transmission electron microscopy (TEM) Scanning electron microscope (SEM), Atomic force microscopy,

Chromatography: Introduction to chromatography, distribution coefficients, modes of chromatography (column and planer), selection criteria of stationary and mobile phase. Chromatographic performance parameters (retention time & elution volume, capacity factor, plate height), qualitative and quantitative analysis. Principles, procedure and application of Paper, thin layer (TLC), ion exchange, gas liquid (GLC), high performance liquid (HPLC) and affinity chromatography.

Radioisotopic techniques: Types of radioactive decay, units of radioactivity, Use of radioisotopes in life sciences in life sciences, radioactive labeling, principle and application of tracer techniques, detection and measurement of radioactivity using ionization chamber, proportional chamber, Geiger- Muller and Scintillation counters, autoradiography and its applications.

Unit-II

Diffraction Technique: Crystal geometry and structure; Introduction to lattice and lattice systems, Bragg's plane, miller indices, point groups and space groups Principle of diffraction and X-ray diffraction: X-rays production, X- ray spectra, Bragg's law and intensity of X- rays, Mosley's law, powdered XRD, percentage crystallinity, single crystal XRD, macromolecular XRD (protein crystallization, data collection and structure solution).

Spectroscopy: Introduction, properties of electromagnetic (EM) radiation, interaction of electromagnetic radiation with matter. Types of spectra, Beer's Lambert law, molar extinction coefficient. Principle, instrumentation and applications of: UV-VIS.

Mass spectrometry: Electron impact, Chemical ionization, Fast atom bombardment, Matrix assisted laser desorption and ionization, Electrospray ionization, Circular Dichroism, Isothermal titration calorimetry, Differential scanning calorimetry, Infrared spectroscopy, Nuclear magnetic resonance spectroscopy.

Electrophoresis techniques: Principle and application of Two-Dimensional Gel Electrophoresis (2-DGE), Denaturing gradient gel electrophoresis (DGGE), isoelectric focusing.

Books Recommended:

1. Essentials of molecular biology by George M. Malacinski , David Freifelder (Jones & Bartlett Publishers).
2. Freifelder D. Physical Biochemistry – Application to Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman and Company, San Fransisco
3. Physical chemistry of macromolecules by Charles Tanford (John Wiley and Sons).
4. Richard E. Venn, Principal and Practice of Bioanalysis. Taylor and Francis.
5. Sawhney, S.K. and Singh R, Introductory Practical Biochemistry, Narosa Publishing House, New Delhi
6. Slater R.J. , Radioisotopes in Biology-A Practical Approach, Oxford University Press, New York
7. Switzer R.L. and Garrity L.F. , Experimental Biochemistry, W.H. Freeman and Company, New York
8. Walker J. and Wilson K , Principles and Techniques-Practical Biochemistry, 5th Edition, Cambridge University Press, London.

Lab Course LC4- MBT (lab)206 Pertaining to Bio-analytical Techniques

Practical Time: 3 Hrs/Week

M. Marks : 50

Time allowed for Examination: 5 Hrs.

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (12.5 Marks).

List of Practical:

1. Determine the pH of a buffer solution using pH meter, prepared by mixing 0.075 M sodium acetate and 0.025 acetic acid in different proportion.
2. Calibration of pH meter, spectrophotometer, laminar air flow bench , autoclave.
3. Verification of Beers Lamberts law with UV-VIS spectrophotometer.
4. Determination of λ_{\max} of protein and nucleic acid from UV-VIS spectrum.
5. Determination of molar extinction coefficient.
6. Determination of R_f (Relative front) of amino acid/sugar with paper and Thin layer chromatography.
7. Determine the molecular weight of protein with polyacrylamide gel electrophoresis (PAGE)
8. Determination of packed cell volume (PCV) of bacteria and fungus with high speed centrifuge.
9. Performance and description of microscopes (simple, compound, phase contrast etc).

Paper VII - MBT (C5)202 Immunology & Immunotechnology

Course Objectives:

1. This course aims to familiarize the students to mechanisms associated with immune system, any abnormalities which could lead to disease development.
2. Students will be able to distinguish between innate & acquired immunity, they should also be able to demonstrate and identify immune cells specific functions. They can correlate between immune/disease development

Lectures to be Delivered

60

M. Marks : 70

Time allowed:

3 Hrs

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 12 marks. Section C will consist of 11 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 2 marks

Unit-I

Introduction to Immunology: History, types of immunity, innate immunity, acquired immunity, active and passive immunity.

Antigens and MHC: Antigens-properties, haptens, epitopes, super antigens; MHC-structure and function of major histocompatibility complex I and II.

Cells and organs of immune system: Cells involved in immune system, organs of immune system, lymphocytes, macrophages.

Humoral & Cell mediated immune response: Immunoglobulins-types distribution, function, molecular biology of immunoglobulin synthesis, organization of immunoglobulin genes; B cells-development. T cells , mechanism of cell mediated immune response; Interferons, Cytokines & their interactions

Complement system: Classical and alternate pathway, lactic pathway, consequences and functions.

UNIT-II

Hypersensitivity: Mechanism of type I, II , III and IV immune reactions; Disorders related to hypersensitivity Type I ,Type II and Type III.

Autoimmunity: Mechanism of autoimmunity, diseases (Rheumatoid arthritis, Diabetes, SLE, Pernicious anaemia) and treatment.

Immunization and vaccines: Active and passive immunization; Vaccines-traditional and modern vaccines.

Immune response assays: Methods to assay humoral immune response (agglutination, immunodiffusion, immunoelectrophoresis, RIA, fluorescent assays, ELISA), immunoblot.

Hybridoma technology: Production and selection of monoclonal antibodies, applications of monoclonal antibodies in diagnosis and therapy and in biomedical research.

Books Recommended:

Cellular and Molecular Immunology by Abbas, A.K. Lichtman, A.H. Pober, J.S. W.B. Saunders Co., Philadelphia.

Immunology by A.I. Prentice Hall International London.

Essential Immunology: 7th Edn., Roitt I.M. Blackwell Scientific Pub.

Immunology: 11th Edn., Kuby Janis, W.H. Greenman and Co., New York.

Immunology, Tizard, I.R. Saunders College Publishing, Philadelphia.

The experimental Foundation of Modern Immunology, Clark, W.R. 3rd Ed. John Wiley and Sons. New York, 1986.

Benjamin E. Immunology: A short course 3rd Edition, John Wiley, New York

Lab Course- LC-4 MBT(Lab) 206 : Pertaining to Immunology & Immunotechnology

Practical Time 3 Hrs/Week

M. Marks : 50

Time allowed for Examination:

Pass Marks : 40%

5 Hrs.

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (12.5 Marks).

List of Practical:

1. Immunization of animals via different routes.
2. Determination of TLC and DLC.
3. Enumeration of T and B cells in human body.
4. Purification of IgG from serum by column chromatography.
5. Determination of antigen and antibody reaction by rocket immuno-electrophoresis.
6. Radial immuno-diffusion test.
7. Determination of titer of serum by indirect haemagglutination cell mediated immunity by leucocyte migration inhibition test and Antibodies by ELISA method.
8. Estimation of Hb content in blood.

Paper VIII- (MBT(C6) 203) Food Bio- Technology

Course Objectives:

1. The major objective of this course is to acquaint the students with fundamentals of food preservation, food poisoning and food fermentative products.
2. To impart knowledge about microbiological production of foods and vitamins.

Lectures to be Delivered **60**

M. Marks : 70

Time allowed: **3 Hrs**

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 12 marks. Section C will consist of 11 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 2 marks

Unit-I

Microorganisms for food and feed: Algal, bacterial, fungal and yeast biomass assingle cell protein; Solid-state fermentations and submerged fermentation technologies for the production of SCP.

Baker's yeast production and bread making: Morphology and physiology, production, handling and harvesting of baker's yeast; Production technology of bread.

Probiotic, prebiotic and functional foods: Concepts and applications in food; Functional foods (oat products, milk and dairy products, sea food products); Biopreservatives - A brief account.

Production of alcoholic beverages: Raw materials, culture, fermentation technology and post fermentation processing of beer, wine, whiskey, vodka, rum and brandy.

Production of vinegar and Organic acids: Raw materials, culture and fermentation conditions, post fermentation processing, recovery and applications. Fermentative production and applications of citric acid and lactic acid; Lactic acid fermented foods – A brief account.

Unit-II

Indian fermented foods and sugar syrups: Brief account of fermented foods (*Vada, Dosa, Warries, Marchu, Gundruk, Kimchi, Koji, Tempeh, Sauerkraut, Soya sauce*). Fermented dairy products: Production of cheese, cultured dairy milk, cultured cream, yoghurt and kefir.

Microbial colours & flavours: Current status and future perspectives; Sugar

syrups -glucose syrup, invert syrup, high fructose syrup, maltose syrup.

Immobilized whole cell technology in food industry: Brief account in wine, beer & dairy industry.

Waste utilization: Technology for the utilization of waste from dairy, fruit and vegetable processing industries.

Food regulations: Brief account on FSSA 2006, FAO, FDA, AGMARK, HACCP, CODEX ALIMENTARIUS.

Books Recommended:

1. Prescott and Dunn's industrial microbiology by B. Reed McMillan Publishers Ltd., Connecticut.
2. Principles of fermentation technology by P. F. Stanbury, A. Whitaker and Hall, Pergamon Press, NY.
3. Comprehensive Biotechnology by Moo Young (Vol. 3 and 4), Pergamon Press, NY, 1985.
4. Fundamentals of Biotechnology by P. Praive, B. Fraust, W. Sitting and D. A. Sukatesh WCH Weinheim.
5. Biotechnology, Principles and Applications by J. Higgins, D. J. Bestand j. Jones, Blackwell Scientific Publications, London.
6. Biotechnology by R. H. Rehm and G. Reed (Vol 4, 5, 6 and 7a), Verlag Press, NY, 1982 and 1987.
7. Essays in applied microbiology by J. R. Norris and M. H. Richmong: John Wiley and Sons, NY.
8. Yeast Biotechnology by D. R. Berry, I. Russel and G.G. Stewart: Allen and Unwin, Boston.
9. Microbial Biotechnology, Fundamentals of Applied Microbiology by A. N. Glazer and H. Nikaido, W. H. Freeman and Co., NY.
10. Biotechnology: Food Fermentation Technology by V. K. Joshi and A. Pandey, Educational Publishers and Distributors, New Delhi.

Lab Course- LC-5: MBT (Lab) 207 Pertaining to Food Biotechnology

Practical Time 3Hrs/Week

M. Marks : 50

Time allowed for Examination: 5 Hrs.

**Pass Marks :
40%**

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (12.5 Marks).

List of Practical:

1. Preparation of Indian fermented foods.
2. Production of lactic acid fermented food.
3. Preparation of fermented dairy products.
4. Biopreservation of food.
5. Extraction of microbial pigments.
6. Production of baker's yeast and evaluation of its leavening effect.
7. Production of fructooligosaccharides.
8. Production of organic acids.
9. Production of various types of wines using free and immobilized cells.
10. Production and evaluation of single cell protein-fungal and yeast biomass.

Paper IX MBT (EIII) 204 –Option-I Biostatistics

Course Objectives:

1. Its objective is to acquire and be able to apply knowledge of basic statistical methods.
2. To critically evaluate statistics to their validity, reliability and to the right information.

Lectures to be Delivered 45

M. Marks : 50

Time allowed: 3 Hrs

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 10 marks. Section C will consist of 10 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 1 mark.

Unit-I

Introduction to biostatistics: Basic definitions and applications, sampling (representative sample, sample size, sampling bias), sampling techniques

Data collection and presentation: Types of data, collection of primary and secondary data histogram, polygon and pie diagram

Measures of central tendency: Mean, median, mode

Measures of variability: Standard deviation, standard error, range, mean deviation and coefficient of variation

Correlation and regression: Positive and negative correlation, Karl- Pearsons co-efficient of correlation, Linear regression and regression equation and multiple linear regressions

Unit-II

Tests of significance: Small sample test (Chi-square test, t- test, F- test), large sample test (Z test)

Introduction to probability theory and distributions: concept of theory and distribution without derivation, binomial, Poisson and normal (only definitions and problems)

Analysis of variance-I: Analysis of variance with linear models

Analysis of variance-II: Analysis of variance for one-way classified data, analysis of variance for two-way classified data with one observation for cell

Analysis of variance-III: Analysis of variance for two-way classified data with multiple but equal number of observations per cell (data analysis only)

Books Recommended:

1. Bailey N T J. *Statistical Methods in Biology*, English University Press,

London

2. Banerjee PK. *Introduction to biostatistics*, S. Chand Publishers, New Delhi.
3. Bliss, C I.K. *Statistics in biology*, Mac-Graw Hill Publishers, NewYork
4. Singh S, Bansal ML, Singh TP and Kumar R. *Statistical Methods for Research Workers*, Kalyani Publishers, New Delhi.

Lab Course LC-6 MBT(lab) 208 Biostatistics

Practical Time: 3 Hrs/Week

M. Marks : 35

Time allowed for Examination: 5 Hrs.

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (7.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (20 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (7.5 Marks).

List of Practical:

1. Representation of Statistical data by
 - a) Histograms b) Ogive Curves c) Pie diagrams
2. Determination of Statistical averages/ central tendencies.
 - a) Arithmetic mean b) Median c) Mode
3. Determination of measures of Dispersion
 - a) Mean deviation b) Standard deviation and coefficient of variation c) Quartile deviation
4. Tests of Significance-Application of following
 - a) Chi- Square test b) t- test c) Standard error

Paper IX (EIII) MBT(EIII) 204–Option-II Biophysics

Course Objectives:

1. To aware the students about methods of physics to study biological systems like thermodynamics, bioenergetics, chemical kinetics, electrode potential and quantum mechanics.
2. Exposure of instrumental techniques like spectroscopy, diffraction, optical and various hydrodynamic techniques in the field of biotechnology.

Lectures to be Delivered	45	M. Marks : 50
Time allowed:	3 Hrs	Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 10 marks. Section C will consist of 10 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 1 mark.

Unit I

Thermodynamics : Laws of thermodynamics, concept of enthalpy, heat capacity at constant volume and pressure, isothermal expansion, differential scanning calorimetry, concept of entropy, statistical and thermodynamic definitions of entropy, entropy change due to mixing of ideal gases, entropy change due to heating, Gibb's free energy, dependence of free energy on temperature (Gibb's Helmholtz equation), dependence of free energy on pressure, Vant Hoff equation, bioenergetics, coupled reactions, high energy bonds.

Chemical kinetics: Reaction rate, order of reaction, renaturation of DNA – A case study, half life of a reaction, Determination of reaction order, molecularity of reaction, Complex reaction, consecutive kinetics, isotope effect.

Quantum mechanics : Wave theory of light, Planck's quantum theory, photoelectric effect, de Broglie's postulate, Bohr's theory of atomic spectra, Huckel theory; Schrodinger's wave equation, Heisenberg's Uncertainty principle, particles in one dimensional box, quantum mechanical tunneling .

Unit II

Spectroscopy: Principle, Instrument & Applications of UV-Visible Spectra, IR Spectra, NMR and ESR.

Optical Techniques: Principle, Instrument & Applications of Polarimetry, Refractometry, Flowcytometry.

Diffraction Techniques: Crystals, Molecular crystal symmetry, X ray diffraction by crystals, Bragg's Law, laue powder method and rotation methods.

Books Recommended:

1. Principle of Biochemistry by Lehninger, David L. Nelson and Michael M. Cox, Third Edition, 2000, Macmillan Worth Publisher, New York, USA.
2. Biochemistry by Lubert Stryer, W.H Freeman and Company, New York, Fourth Edition, 1995.
3. Instant Notes in Biochemistry by B.D. Hames, N.M. Hooper and J.D. Houghter, Bios Scientific Publishers Limited, Oxford U.K.
4. Biophysical Chemistry - Principles and Techniques by Upadhyay and Upadhyay Nath, Himalaya Publishing House, Third Revised Edition 2002, Reprint 2006.
6. Physical Chemistry for the Biosciences by Raymond Chang, University Science Books, Sausalito, California 2005.
7. Physical Biochemistry : Application to Biochemistry and Molecular Biology by David Freifelder W.H. Freeman & Company New York, Second Edition 1982, Eighteenth Printing.
9. Biophysical Chemistry : Techniques for the Study of Biological Structure & Function by Cantor & Schimmel 1980 W.H. Freeman & Company, New York.

Lab Course LC 6- MBT(lab) 208 Biophysics

Practical Time: 3 Hrs/Week

M. Marks : 35

Time allowed for Examination: 5 Hrs.

**Pass Marks :
40%**

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (7.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (20 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (7.5 Marks).

List of Practical:

1. Qualitative and Quantitative analysis of Proteins and Nucleic acids by U.V. Spectrophotometer.
2. Determination of protein in presence of nucleic acid by spectrophotometer method.
3. Determine the λ_{\max} of proteins and Nucleic acids from absorption spectrum.
4. Determine the quantity of Flavonoids/nucleic acids with fluorimetric.
5. Determination of sucrose in the presence of other sugars using polarimeter.
6. Determine the effect of environmental factors (pH ,temperature and NaCl) on absorption spectra of protein.

Paper X - MBT (E IV) 205 Option-I - Biosafety and Bioethics

Course Objectives:

1. This course creates awareness on the Biosafety, Bioethics and patenting of biotechnological processes and products.
2. To emphasize on ELSI issues regarding Human genome project, genetic engineering, patenting of human genes and Stem cell research.

Lectures to be Delivered 45

M. Marks : 50

Time allowed: 3 Hrs

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 10 marks. Section C will consist of 10 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 1 mark.

Unit-I

Biosafety: Introduction and Development of Biosafety Practices

Principles and need of Biosafety ,General lab requirements,GMPs

Biosafety levels: Biosafety levels 1,2,3,4 and their containment labs, risk assessment Biological safety cabinets, Shipment of biological specimens, Biosafety guidelines for transgenic organisms by DBT, Institutional Biosafety committee.

Biological waste management: Decontamination, Biosafety manuals, Medical surveillance, Emergency response

Unit-II

Bioethics: History and Introduction, Ethics and genetic engineering Genetic Privacy, Patent of genes, ELSI: Origin and goals

Human genome: ELSI of HGP and religious considerations, future of HGP in medicine and genetics, Ethics of human DNA cloning and clinical trials involving human participants

Stem Cell research: Stem cell research and its applications ,Ethical issues of stem cell research, stem cell biosafety.

Books Recommended:

1. Understanding Biotechnology by Borem
2. Intellectual Property Rights : Raju
3. Biosafety and Bioethics : Joshi
4. Introduction to Bioethics : Bryant

Lab Course LC6- MBT (lab) 208 Option-I Biosafety and Bioethics

Practical Time: 2 Hrs/Week

M. Marks : 35

Time allowed for Examination: 5 Hrs.

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (7.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (20 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (7.5 Marks).

List of Practical:

1. To study the case; Harward college vs Canada case
2. To study the case: myriad's case on gene patenting
3. To study the case : bt Bringal
4. To study the case: Bt cotton
5. To study the case: Golden rice

Paper X - MBT (EIV)205 Option II- System Biology

Course Objectives:

1. To give students an introduction to different biological systems of human being.
2. To acquaint them with the functions of various organs and their regulation.

Lectures to be Delivered 45

M. Marks : 50

Time allowed: 3 Hrs

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The question paper will consist of three sections. Section A and B (Consist of unit I and II of the syllabus, respectively) will have four questions each from respective units and candidates are required to attempt two questions each from section A and B. Each question in section A and B shall carry 10 marks. Section C will consist of 10 short answer type questions covering entire syllabus and the candidates are required to attempt all questions. Each question in section C will carry 1 mark.

Unit-I

Blood and circulation - Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.

Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.

Respiratory system - Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.

Nervous system - Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture.

Unit-II

Sense organs - Vision, hearing and tactile response.

Excretory system - Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.

Thermoregulation - Comfort zone, body temperature – physical, chemical, neural regulation, acclimatization.

Digestive system - Digestion, absorption, energy balance, BMR.

Endocrinology and reproduction - Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, gametogenesis, ovulation, neuroendocrine regulation.

Books Recommended:

1. Human Physiology: From Cells to Systems by Lauralee Sherwood, Christopher Ward
2. An Introduction to Systems Biology: Design Principles of Biological Circuits
By Uri Alon
3. Systems Biology By Edda Klipp, Wolfram Liebermeister, Christoph Wierling, Axel Kowald, Hans Lehrach, Ralf Herwig

Lab Course LC6 - MBT(lab) 208 System Biology

Practical Time: 2 Hrs/Week

M. Marks : 35

Time allowed for Examination: 5 Hrs.

Pass Marks : 40%

INSTRUCTIONS FOR THE PAPER SETTER/CANDIDATE

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (7.5 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (20 Marks) Section C will contain, practical note Book Evaluation and Viva Voce (7.5 Marks).

List of Practical:

1. Preparation of slide of cheek cells
2. To study different specimens of animal organs
3. To study skeletal system
4. To study permanent slides
5. To study ECG report.