

University of Kota (Rajasthan)

Syllabus: M. Sc. (Microbiology) I& II Semester

Course Structure with Distribution of Marks:

Year / Semester	Serial Number, Code & Nomenclature of Paper			Duration of Exam	Teaching Hrs/Week & Credit			Distribution of Marks			Min. Pass Marks	
	Number	Code	Nomenclature		L	P	C	Conti. Assess.	Sem. Assess.	Total Marks	Conti. Assess.	Sem. Assess.
I Year/ I Semester	1.1	MIC101	General Microbiology	3 Hrs	4	--	4	30	70	100	12	28
	1.2	MIC102	Microbial Physiology and Biochemistry	3 Hrs	4	--	4	30	70	100	12	28
	1.3	MIC103	Microbial Genetics	3 Hrs	4	--	4	30	70	100	12	28
	1.4	MIC104	Biostatistics and Computer Applications	3 Hrs	4	--	4	30	70	100	12	28
	1.5	MIC111	Microbiology Laboratory-I	5 Hrs	--	16	8	--	100	100	--	50
	Total				16	16	24	120	380	500	--	
I Year/ II Semester	2.1	MIC201	Microbial Diversity	3 Hrs	4	--	4	30	70	100	12	28
	2.2	MIC202	Cell Biology and Enzymology	3 Hrs	4	--	4	30	70	100	12	28
	2.3	MIC203	Molecular Biology	3 Hrs	4	--	4	30	70	100	12	28
	2.4	MIC204	Immunology and Immunotechnology	3 Hrs	4	--	4	30	70	100	12	28
	2.5	MIC211	Microbiology Laboratory-II	5 Hrs	--	16	8	--	100	100	--	50
Total					16	16	24	120	380	500	--	
II Year / III Semester	Serial Number, Code & Nomenclature of Paper			Duration of Exam	Teaching Hrs/Week & Credit			Distribution of Marks			Min. Pass Marks	
	Number	Code	Nomenclature		L	P	C	Conti. Assess.	Sem. Assess.	Total Marks	Conti. Assess.	Sem. Assess.
	3.1	MIC301	Microbial Technology	3 Hrs	4	--	4	30	70	100	12	28
	3.2	MIC302	Microbial Ecology	3 Hrs	4	--	4	30	70	100	12	28
	3.3	MIC303	Medical Microbiology	3 Hrs	4	--	4	30	70	100	12	28
	3.4	MIC304	Elective –I 1) Computational Biology 2) Biofuel and Bioenergy 3) Recent trends in RNA Biology 4) Microbiology of waste and Waste remediation	3 Hrs	4	--	4	30	70	100	12	28
	3.5	MIC311	Microbiology Laboratory –III	5 Hrs	--	16	8	--	100	100	--	50
	Total				16	16	24	120	380	500	--	
II Year/ IV Semester	4.1	MIC401	Food and Dairy Microbiology	3 Hrs	4	--	4	30	70	100	12	28
	4.2	MIC402	Environmental Microbiology	3 Hrs	4	--	4	30	70	100	12	28
	4.3	MIC403	Soil and Agriculture Microbiology	3 Hrs	4	--	4	30	70	100	12	28
	4.4	MIC404	Dissertation	--	--	--	--	--	--	100	--	--
	4.5	MIC411	Microbiology Laboratory-IV	5Hrs	--	16	8	--	100	100	--	50
Total					16	16	24	120	380	500	--	

Note:

The allotment of an elective shall reserve with the department, which depends upon the availability of faculty members, infrastructure and laboratory facility available to run the elective and an elective cannot be offered by the department if the number of students is less than the 25% of the total sanctioned strength of the programme.

The syllabus for each theory paper is divided into five independent units and each theory question paper will be divided into three sections as mentioned below:

✂ **Section-A** shall have 01 compulsory question comprising 10 questions (maximum 20 words answer) taking two questions from each unit. Each question shall be of one mark and total marks of this section will be 10. This section will be compulsory in the paper.

✂ **Section-B** will carry 25 marks with equally divided into five long answer type questions (answer about in 250 words) and examiners are advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

✂ **Section-C** will contain five long answer type questions. One compulsory question of 15 marks and four questions of 10 marks each. Students are instructed to attempt total three questions with one compulsory question (answer about in 500 words) of and any two more questions (answer about in 400 words) out of remaining four questions. Paper setter shall be instructed to design question paper covering from all five units.

The pattern of question paper of internal and external shall be as follows:

(A) Continuous or Internal Assessment:

30% weightage of Maximum Marks (30 Marks out of 100 Maximum Marks)

First/Second Internal Test 20.....

Duration of Exam: 1.00 Hr Max. Marks: 15

Class: M.Sc. Semester:

Subject: Paper:

Note: The question paper contains three sections as under:

Section-A : One compulsory question with 04 parts. Please give short answers in 20 words for each part.

Section-B : 02 questions to be attempted having answers approximately in 250 words.

Section-C : 01 question to be attempted having answer in about 500 words.

SECTION A

Q.1(a) 1

(b) 1

(c) 1

(d) 1

SECTION B

Q.2 3

Q.3 3

Q.4 3

Q.5 3

SECTION C

Q.6 5

Q.7 5

(B) Semester or External Assessment:

70% weightage of Max. Marks (70 Marks out of 100 Max. Marks)

Duration of Examination: 3 Hours Max. Marks: 70

SECTION-A: 10x1=10

(Answer all questions)

(Two question from each unit with no internal choice)

Q. No. 1

- (i) **1 Mark**
- (ii) **1 Mark**
- (iii) **1 Mark**
- (iv) **1 Mark**
- (v) **1 Mark**
- (vi) **1 Mark**
- (vii) **1 Mark**
- (viii) **1 Mark**
- (ix) **1 Mark**
- (x) **1 Mark**

SECTION-B: 5x5=25

(Answer all questions)

(One question from each unit with internal choice)

(Maximum two sub-divisions only)

Q. No. 2.

Or

.....
5 Marks

Q. No. 3.

Or

.....
5 Marks

Q. No. 4.

Or

.....
5 Marks

Q. No. 5.

Or

.....
5 Marks

Q. No. 6.

Or

.....
5 Marks

SECTION-C: 1x15 + 2x10=35

(Answer any three questions including compulsory Q.No. 7)

(Maximum four sub-divisions only)

Q. No. 7. **15 Marks**

Q. No. 8. **10 Marks**

Q. No. 9. **10 Marks**

Q. No. 10. 10 Marks
Q. No. 11. 10 Marks

Distribution of Marks for Practical Examinations:

Time - 5 hrs	Max. Marks –100
	Min. Marks -50
Major Exercise	25
Minor Exercise	15
Preparation	05
Spotting	10
Seminar/Project	20
Record	10
Viva-voce	15
Total	100

SEMESTER-I
MIC 101-General Microbiology

Min. pass marks: 28

Duration: 3 hours

Max. Marks: 70

UNIT I

Overview of history of Microbiology: Contribution of Antonie Von Leeuwenhoek, Needham, Redi, Spallanzini, Tyndal, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Alexander Fleming, Scope of Microbiology.

Microbial World: Classification up to class level and distinctive characters of major groups: Viruses, Fungi, Algae and Protozoa.

Microbial Taxonomy: Taxonomy, Binomial Nomenclature, types of bacterial classification systems, new approaches to bacterial taxonomy. Bergey's manual of systematic bacteriology. Nutritional types [Definition and examples]. Classification on the basis of oxygen requirement.

UNIT II

Principles, Function & application of Microscopy: Light, Dark field, Phase Contrast, Fluorescence interference, Confocal and Electron (transmission and scanning) Microscopy. Hanging drop, Wet mounting Method.

Stains and Staining Techniques: Definition of Auxochrome, Chromophores, dyes, Classification of Stains, Mechanism of Gram's, Capsule, Endospore, Flagella, Acid fast staining.

UNIT III

Concept of asepsis: Definition of Sterilization, disinfection, Sanitization, Antisepsis, Sterilants and Fumigation.

Physical methods: Moist and Dry heat, Pasteurization, Tyndalization, Radiation, Filtration.

Chemical Methods: Phenol and its Derivatives, Aldehyde, Heavy metal, Halogens, Gas Sterilant.

Culture Media and Isolation Techniques: Natural and Synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media.

Serial Dilution, Streak, Pour and Spread plate method. Maintenance and Preservation of pure cultures.

UNIT IV

Methods of reproduction in bacteria and new cell formation. Microbial Growth curve and its kinetics and growth yield. Determination of Cell mass and cell number. Environmental factors affecting growth - temperature, pH, osmotic pressure and nutrient Concentration.

Antimicrobial Therapy: Antibiotics their classification and Mechanism, Antibiotic sensitivity test- disk diffusion, Minimum Inhibitory Concentration, Minimum Lethal Concentration.

Unit V

Bacterial Morphology: Organization and structure: size, shape and arrangement, glycocalyx, capsule, flagella, fimbriae and pili. Composition and detailed structure of gram positive and gram negative cell walls, spheroplasts, protoplasts, and L-forms. Ribosomes, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids. Endospore: structure, formation, stages of sporulation. Economic importance of Bacteria.

Text/Reference books:

1. Prescott, L.M., J.P Harley and D.A Klein, 2007. Microbiology VII Ed. Mc Grow Hill,
2. Davis R.Y. E.A. Adeberg and J.L. Ingram, 1991 General Microbiology
3. Stainer .General Microbiology, V Ed., Printice Hall of India Pvt,Ltd. New Delhi
4. Ronald M. Atlas 1997. Principles of Microbiology. II Ed. Mc Graw Hill Pub.
5. Alexopoulos CJ et al, Introductory Mycology 4th Edition
6. Woese, C, R 1981 Archeabacteria , *Sci. Am.* 244:98-122
7. Salle A.J., Fundamental Principles of Bacteriology.

SEMESTER-I

MIC 102 - Microbial Physiology and Biochemistry

Min. pass marks: 28

Duration: 3 hours

Max. Marks: 70

UNIT I

Biomolecules: Chemical structure, properties, classification and biological significance of carbohydrates, proteins, lipids and nucleic acids. Introduction to metabolism: Anabolism, catabolism, primary and secondary metabolism, Role of reducing power, precursor metabolites and energy rich compounds in cell metabolism

Water, acid, base and buffers, pH and pH indicators, Solutions, Redox, potential, Hydrogen bonding; Hydrophobic, Electrostatic and Vander Waal forces. Scope and importance of biochemistry.

Unit II

Amino acids; classification, chemical reactions and physical properties; biosynthesis and catabolism.

Metabolism of nucleotides: Purine and pyrimidine biosynthesis, regulation of purine and pyrimidine biosynthesis, inhibitors of nucleotide synthesis.

Carbohydrate and glycobiology: Glycolysis and Gluconeogenesis, Citric acid cycle, Glyoxalate Cycle, Amphibolic and Anapleurotic reaction, Oxidative phosphorylation, light reaction of photosynthesis: Light and Dark reaction.

UNIT III

Metabolism of lipids and hydrocarbons, Lipid composition of microorganisms, biosynthesis and degradation of lipids, lipid accumulation in yeasts, hydrocarbon utilization, PHA synthesis and degradation.

Biological Nitrogen Fixation: Nitrogen fixing organisms, difference in symbiotic and non symbiotic fixation. Oxygen Protection mechanisms. nif gene organization and regulation.

Unit IV

Optical methods: Colorimetry, Photometry, Nephelometry, VIS, UV VIS and infra red spectrophotometry. Flame photometry, Photo spectrofluorimetry, Mossebauer spectroscopy, ESR and NMR. Isotopic tracer techniques- stable and radioactive isotopes and neutron activation.

UNIT V

Basic principles and applications of Chromatography (paper, thin layer, column, gel filtration, ion-exchange and affinity chromatography); GLC, HPLC. Centrifugation techniques- principle, types and applications. Principles and applications of electrophoresis for protein and DNA; Iso-electric focusing and 2D gel electrophoresis.

Text/Reference books:

1. Wilson K. and Walker J. (2008). Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.
2. Nelson D and Cox MM. (2009). Principles of Biochemistry. W.H. Freeman and Company, New York.
3. Voet D and Voet JG. (2003). Biochemistry. John Wiley and sons New York.
4. Zubay G (2000). Biochemistry. W. C. Brown, New York.
5. Berg J, Tymoczko J, Stryer L (2001). Biochemistry. W. H. Freeman, New York.
6. Moat AG and Foster J W (2003). Microbial Physiology. John Wiley and Sons, New York.
7. Robert K., Murray M.D., Granner D.K., Mayes P.A. and Rodwell V.I. Harper's Biochemistry. McGraw-Hill/Appleton and Lange.
8. Biochemistry U, SatyaNarayan.
9. Biochemistry: Lehninger
10. Microbial Physiology: Moat, Foster and Spector
11. Fundamental of biochemistry by A.C.Dev.
12. J.L. Jain, Biochemistry.
13. Elements of biochemistry by H.R. Shrivastava.
14. Stainer .General Microbiology, V Ed., Printice Hall of India Pvt,Ltd. New Delhi

SEMESTER-I

MIC 103- Microbial Genetics

Min. pass marks: 28

Duration: 3 hours

Max. Marks: 70

UNIT-I

Introduction to Molecular Genetics. DNA structure and types. Superhelicity in DNA. Law of DNA constancy, Cot curve and C value paradox, DNA renaturation kinetics and T_m value determination and interpretation, Repetitive DNA, Satellite DNA, Selfish DNA.

UNIT-II

Recombination: Types of recombination, Models for Homologous recombination, Molecular mechanism of homologous recombination, Homologous recombination in eukaryotes, Molecular mechanism and biological role of site specific recombination. Transposable elements in prokaryotes.

UNIT-III

Conjugation: Conjugation by *E. coli* F factor. (Structure of F factor and regulation of F-factor fertility), F- prime conjugation, Conjugation of fertility inhibited F-like plasmids, Hfr and Lfr conjugation and chromosomal transfer, Non-conjugative, establishment of cell contact.

UNIT-IV

Transformation: Mechanism of natural competence and transformation in *Bacillus subtilis*, *Streptococcus pneumoniae* and *Haemophilus influenzae*. Transformation by artificial competence. Gene linkage and mapping by transformation. Transduction- specialized and generalized transduction and its applications.

UNIT-V

Regulation of gene expression: Operon concept, catabolite repression, instability of bacterial RNA, positive and negative regulation: inducers and co-repressors. Negative regulation in *E. coli* lac operon. Positive regulation in *E. coli* arg operon; regulation by attenuation of his and trp operons.

Text/Reference books:

1. Concepts of genetics by klug and cummings
2. Genetics: From Genes to Genomes by Leland Hartwell, Leroy E. Hood, Michael L. Goldberg
3. Genetics: Analysis and Principles (3rd Edition) by Brooker
4. Gene cloning by T.A.Brown
5. Cell and molecular Biology by P.K. Gupta.

SEMESTER-I
MIC 104- Biostatistics & Computer Applications

Min. pass marks: 28

Duration: 3 hour

Max. Marks: 70

UNIT-I

Introduction to Biostatistics: Basic definitions, scope of statistics in bioresearch, notations and applications.

Sampling: Representative sample, sample size, sampling techniques (Random and Non Random) and their merits and demerits.

Data collection and presentation: Types of data, methods of collection of primary and secondary data, Data presentation (Histogram, Frequency curve, Frequency polygon, ogive curves, Bar diagrams and Pie diagram).

UNIT-II

Statistical Measures:

Measures of Central Tendency: Mean, Mode, Median their Merits and Demerits.

Measures of Variability/ Dispersion: Mean deviation, Standard deviation, Range, Variance and Coefficient of variation.

UNIT III

Correlation: Definition, Types of correlation, calculation of correlation coefficient (Karl Pearson's, Rank Correlation)

Regression Analysis: Definition, Two regression lines, Regression equation and Coefficient.

Difference between Correlation and Regression. The Analysis of Variance(ANOVA). F distributions, One way and nested ANOVA.

UNIT-III

Probability: Types of event, sample space, definition, conditional probability, addition and multiplication rules of probability and some simple problems.

Probability distributions-Binomial, Poisson and Normal distributions, Distribution Curve.

Statistical Inference-Estimation, standard error, confidence interval for means and proportion.

Testing of hypothesis: basic concepts and definitions, types of errors. Tests based on Normal, student's t, chi-square.

UNIT-V

Introduction of computer and its types. Hardware and software, operating system, Basic concept of MS- Office, MS- Word, Power Point, MS- Excel, DOS, I/O, Number system, memory, computer peripherals. LIMS and Computer Applications.

Text/Reference books:

1. Biostatistics-A foundation for Health Science, Daniel WW, John Wiley (1983).
2. Statistical Methods, Medhi J, Willey Eastern Limited, (1992).
3. Computer fundamentals by P.K. Sinha.

M.Sc. Microbiology (P) Exam 2017-18
Practical List

MIC-111 (MICROBIOLOGY LABORATORY –I)

1. Techniques of pure culture isolation-pour plate, spread plate, streaking.
2. Triple Sugar Iron Test.
3. Antibiotics Sensitivity test
4. IMVIC Test
5. H₂S Production
6. Preparation of Basic Liquid Medium (Broth)
7. Preparation of Basic Potato Dextrose Agar
8. Preparation of Basic Nutrient Agar.
9. Simple staining of bacteria.
10. Negative staining of bacteria.
11. Differential staining of bacteria.
12. Endospore Staining.
13. Litmus Milk Test
14. Catalase Milk Test
15. Isolation of Microbial colony from Soil, Water, Air, Milk, food Samples.
16. Isolation of Microbial colony from Rhizosphere.
17. Isolation of Microbial colony from Phyloplanes.
18. Paper chromatography.
19. Qualitative estimation of lipid, carbohydrates & proteins.
20. Reducing sugar estimation by benedict's method.
21. Specification of fats
22. Creating charts in excel using different data.
23. Design a worksheet for numeric entries and perform required calculation.
24. Design a worksheet enters required data and perform aggregate function like sum, average, count etc.
25. Perform file operation like copy, save, rename, delete using window explore.
26. Calculate mean, mode and median
27. Calculate correlation & regression
28. Colorimetry: To determine the association constant of a. given indicator colorimetrically and to prepare the buffer solutions in pH range of 2.2 to 8.0
29. Spectrophotometry: To find out absorption spectrum of given chromophore and /or oxidised and reduced forms (sodium nitrate and borohydrate).
30. Thin layer chromatography: lipids, mixture of dyes.
31. Chlorophyll estimation: spectrum and turbidity correction in chloroplasts.
32. Polyacrylamide gel electrophoresis of proteins.
33. Study of sex linked gene inheritance.
34. Estimating gene frequencies in human population,
35. Estimation of heterozygotes frequencies.
36. Isolation / identification of auxotroph mutants in bacteria,
37. Recombination in Bacteria.
38. Pedigree analysis, analysis of human karyotes,
39. Chromosomal aberrations

40. Study of conjugation in bacteria.
41. Isolation of genomic DNA(microbes), purification of DNA,
42. Separation of DNA by gel electrophoresis.
43. Isolation of cytoplasmic RNA.
44. Electrophoresis of RNA on denaturing gels.
45. Immobilization of enzyme

SEMESTER-II
MIC 201- Microbial Diversity

Min. pass marks: 28
Marks: 70

Duration: 3 hours

Max.

Unit I

Introduction-Biodiversity. Origin of life, Evolution and Origin of Biodiversity, Species Concept, Evolutionary tree of microorganisms.

Classification of microorganisms – Haeckel's three kingdom concept, Whittaker's five kingdom concept, Three domain concept of Carl Woese, Classification systems-artificial or phonetic, natural and phylogenetic, Classification and salient features of bacteria according to the Bergey's manual of determinative bacteriology.

UNIT II

Fungi: Recent Trends in fungal systematics (Alexopoulos & Mims), General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultrastructure, thallus organization and aggregation, fungal wall structure and synthesis, asexual reproduction, sexual reproduction, Life cycle (major group of Fungi), heterokaryosis Parasexuality and Heterothallism. Economic Importance (Agriculture, Environment, Industry, Medicine, Food, Biodeterioration, Mycotoxins).

UNIT III

Algae: Definition, occurrence, Classification upto class level, Ultra-structure, Reproduction and Life cycle. Economic importance (Agriculture, Industry, Environment and Food)

Protozoa: General Characteristics – Definition, Occurrence, Ultrastructure, Reproduction, Economic importance.

Virus: General characteristics – Definition, Structure, Reproduction and Ultrastructure, Capsids. Virus related agents–Viroids, Prions.

Bacteriophages: Structure, Life cycle –Lytic & Lysogenic

UNIT IV

Characteristics of important genera and physiology of: Chemoautotrophic and Methophilic eubacteria, Gram negative aerobic eubacteria, Gram positive bacteria (Mycobacteria), Enteric group and related eubacteria, Gram negative anaerobic eubacteria, Gram negative eubacteria-Rickettsia, Chlamydia and Spirochaetes.

Gram positive eubacteria- Unicellular endospore forming eubacteria, Actinomycetes.

UNIT V

General Characters, Classification, Adaptations and Physiology of Archaeobacteria: methanogens, Acidophiles, Halophiles, Thermoacidophiles.

Cyanobacteria: General characters , Ultra structure, Reproduction and Economic importance.
Photosynthetic eubacteria : Anoxygenic and oxygenic photosynthesis, Sulfur or NonSulfur
Bacteria (purple and green), Mollicutes. Gram positive fermentative eubacteria.
Bdellovibrio and its interperiplasmic growth cycle.

Text/Reference books:

1. Michael T. Madigan, John M. Martinko, Paul V. Dunlap and David P. Clark, Brock Biology of Microorganisms, 13th Edition, Pearson Education, Limited, 2011.
2. Pelczar, M.J., Chan E.C.S. and Krieg, N.R., Microbiology –Application based approach, 5th edition, Mc Graw Hill, 2009.
3. Tortora, G. Microbiology: An Introduction-Benjamin Cummings, 10th Edition, 2009.
4. Willey J, Sherwood and Woolwerton C, Prescott, Harley and Klein's, Microbiology, 8th Edition, McGraw Hill International, 2010.
5. Singh, Pandey, Jain. A text Book of Botany, 2016

SEMESTER-II

MIC 202- Cell Biology and Enzymology

Min. pass marks: 28

Duration: 3 hours

Max. Marks: 70

Unit I

Evolution of cell; Cell as a unit of living organism and structure of prokaryotic cell, Structural and functional features of eukaryotic cell: cell organelles; endoplasmic reticulum, golgi complex, lysosomes, vacuoles, peroxisomes, mitochondria, chloroplast, cytoskeleton, microtubules, nucleus, extracellular matrix etc.

Unit II

Biological membranes: Membrane structure and transport mechanisms- passive diffusion, active and co-transport, secondary active transport, membrane selectivity, electrolyte selectivity, non electrolyte selectivity, stimuli, receptors, second messengers and cellular response, membrane channels and pumps.

Cell signaling and signal transduction pathways- MAPK/ERK pathway, cAMP dependent pathway, IP₃/DAG Pathway.

UNIT III

Classification, nomenclature and general properties of enzymes, mechanism of enzyme action, enzyme inhibition, enzyme kinetics, Coenzyme, Allosteric and other regulations of enzyme activity

Enzyme Kinetics: Bioenergetics and Catalysis, Single substrate kinetics: Equilibrium and Steady state kinetics, significance of K_m, V_{max} & K_{cat}.

UNIT IV

Enzyme inhibition and its kinetics: Reversible and irreversible inhibition, competitive, non competitive and uncompetitive, mixed, partial, substrate and allosteric inhibition. Mechanism of Enzyme Action, Enzyme activators, co-enzymes and co-factors in enzyme catalysis, Enzyme and substrate specificity.

UNIT V

Isoenzymes and its physiological significance, Ribozymes and Abzymes.

Enzyme engineering: Chemical modification of enzymes: methods of modification of primary structure, catalytic and allosteric properties, use of group specific reagents. Enzyme Immobilization Enzymes in non conventional media, Enzymes sensors, Enzymes as analytical reagents.

Text/Reference books:

1. Biochemistry: Lubert Stryer
2. Biochemistry: Lehninger

3. Microbial Physiology: Moat, Foster and Spector
4. Molecular biology of the cell: Bruce Alberts et al.
5. Cell and molecular biology: Gerald Karp.
6. Cell and molecular biology: DeRobertis and DeRobertis.
7. Molecular cell biology: By Lodish et al.
8. Genetic Engineering by Nicoll

SEMESTER-II
MIC 203- Molecular Biology

Min. pass marks: 28

Duration: 3 hours

Max. Marks: 70

UNIT I

The nature of Genetic material: The structure of DNA and RNA. Organization of Microbial Genomes, Organization of Eukaryotic Genomes, Chromatin arrangement, nucleosome and solenoid structure of DNA. Mutations : Types of Mutations and mutagens. Molecular mechanisms of induced mutation : DNA damages and its repair pathways.

UNIT II

DNA Replication: Central dogma. DNA replication in prokaryotes and eukaryotes- Initiation , elongation and termination. Enzymology of replication. Proofreading of DNA with reference to specific enzymes and co-factors. Regulation of replication. Genetic code.

UNIT III

Transcription: Transcription machinery of prokaryotes and eukaryotes -initiation, elongation and termination, various transcription enzymes and cofactors. Transcription eukaryotes -initiation, elongation and termination Types of RNA polymerase. Promoters, enhancers, silencers, activators. Regulation of transcription

UNIT IV

Translation: Mechanisms of translation in prokaryotes and eukaryotes- initiation, elongation and termination. RNA processing: splicing, capping and polyadenylation, rRNA and tRNA, processing, RNA Editing, RNAi : miRNAs and siRNA, Post-transcriptional gene regulation. Ribozymes.

UNIT V

Genetic Engineering: Principle and basic tools. Gene cloning vectors: Plasmids, phage vector- Ti and Ri plasmid, Phagemids, Cosmids, shuttle vectors, Artificial chromosomes (BAC, YAC, HAC), Application of genetic engineering. DNA sequencing methods, Gene amplification - PCR and its applications,

Text/Reference books:

1. Concepts of genetics by klug and cummings
2. Genetics: From Genes to Genomes by Leland Hartwell, Leroy E. Hood, Michael L. Goldberg
3. Genetics: Analysis and Principles (3rd Edition) by Brooker
4. Gene cloning by T.A.Brown
5. Genetic Engineering by Nicoll

SEMESTER-II
MIC 204- Immunology

Min. pass marks: 28

Duration: 3 hours

Max. Marks: 70

UNIT-I

Structure, composition and types of cells and organs involved in immune system, Innate and acquired immunity. Immunization – Modern methods of producing vaccines. Humoral and cell mediated immune responses.

UNIT-II

Antigens: Structure and properties, Types– Iso and allo – haptens, adjuvants, antigen specificity, vaccines and toxoids. Immunoglobulins- structure, heterogeneity, types and subtypes, physico-chemical and biological properties. Theories of antibody production. Generation of antibody diversity.

Complement –Complement pathways and biological consequences of complement activation.

UNIT-III

Antigen- Antibody interaction -In vitro methods - Agglutination, Precipitation, Complement fixation, Immunofluorescence, ELISA, Radioimmunoassays; Immuno blotting. In vivo methods: Skin tests and immune complex tissue demonstrations and their applications in diagnosis of microbial diseases. Hybridoma Technology: Monoclonal antibodies production and their applications.

UNIT-IV

Structure and functions of MHC and the HLA systems, HLA and tissue transplantation – Tissue typing methods for organ and tissue transplantations in humans, graft versus host reaction and rejection. Tumor immunology – tumor specific antigens, immune response to tumors, immunodiagnosis of tumors – detection of tumor markers – alpha foetal proteins.

UNIT-V

Antibody: Mediated – type I. Anaphylaxis; Type II. Antibody dependent cell cytotoxicity; Type III immune complex mediated reactions; Type IV Cell mediated hypersensitivity reactions. Autoimmunity – mechanism and diseases. Immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies

Text/Reference books:

1. Essentials of Immunology, Author- Roitt, I.M., ELBS. Blackwell Scientific Publishers, London.
2. Immunology II Edition, Author- Kuby, J. WH., Freeman and Company, New York.
3. Immunology. Author- Klaus D. Elger, Wiley-Liss. NY.
4. Text Book on Principles of Bacteriology, Virology and Immunology, IX Edition (5 volumes). Authors- Topley and Wilson's, Edward Arnold, London.
5. The Experimental Foundations of Modern Immunology. Authors- Clark, V.R., John Wiley and Sons, Incl.
6. Fundamental Immunology. Author – W.E. Paul, Raven Press, New York.
7. Fundamentals of Immunology. Authors – R.M. Coleman, M.F. Lombord and R.E. Sicard 2nd ed. C. Brown publishers.
8. Immunology. Authors – D.M. Weir and J. Steward 7th Ed. (1993).

M.Sc. Microbiology (P) Exam 2017-18 Practical List

MIC 211 (MICROBIOLOGY LABORATORY –II)

1. Determination of blood group.
2. Determination of Rh factor.
3. Estimation of haemoglobin content.
4. Isolation of chromosomal and plasmid DNA. from bacteria.
5. Gel electrophoresis of DNA and examination of Agarose gels
6. To perform total leucocyte count on the given blood sample.
7. To perform differential leucocyte count of the blood sample
8. To separate serum from the blood sample
9. To perform immunodiffusion by ouchterlony method
10. To perform immunoelectrophoresis with a given sample.
11. Rocket immunoelectrophoresis
12. Radial immunodiffusion
13. To perform DOT ELISA
14. Enzyme assays (LDH, beta galactosidase, acid phosphate, arginase, succinic dehydrogenase)
Time, Temperature, Protein concentration, cofactors. LDH: K_m and V_{max} various kinetic plots:
Use of computer packages for parametric and non-parametric methods and non-linear regression
15. Isolation of plasmid DNA - i) mini preparation ii) large scale isolation.
16. DNA ligation
17. Transformation of E.coli.
18. Blotting and hybridization with labeled- DNA probes (Southern Blot) Techniques.
19. DNA hybridization.
20. Northern blot techniques. In situ detection of RNA in embryos / tissue.
21. Fragment separation by restriction endonuclease enzyme.