

Paper XXIII

Microbial Biotechnology VI (Immunology II)

Unit I

Immunoglobulins: Type of bonds in them, structure of Antibody; Light chain, heavy chain, Type of Antibody and their properties, Diversity and specificity of antibody; mechanism of diversity.

Unit II

Hybridoma- monoclonal antibody and its applications;

Unit III

Antigen-antibody interactions: agglutination, Precipitation, complement fixation, opsonization, Neutralization;

Unit IV

Hypersensitivity: Anaphylaxis, cytotoxicity, Immuno-complex disorders; Delayed cell mediated hypersensitivity;

Unit V

Immunodeficiency; immune tolerance, Autoimmunity, immunosuppressive therapy, receptors associated diseases, Cancer and immunology.

Paper VI

Project and Seminar

As given by the teachers of the department.

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MJP Rohilkhand University, Bareilly

Ordinance

M.Sc. in Microbiology

Main and general ordinance shall be the same as for other M.Sc. course of the University and also following provisions which are based on the ordinance of the Agra University (the parental University) for this course except the detailed syllabus.

I. Aim & Objectives:

1. To impart education and knowledge in the above field to the students.
2. To impart research activities and contribute in the development process of the country.
3. To train the students for self sufficiency and providing the technology for the industrial & Agricultural development.

II. Duration of Course:

M.Sc. course shall be of two years duration i.e., M.Sc. previous and M.Sc. final year, each of one academic year. Each year shall have two semesters.

III. Admission:

Admission to the above M.Sc. course shall be govern by the Admission committee of the University and shall generally through the entrance exam. The entrance exam shall be conducted as per University rules, normally each year in the month of June.

Selected candidates, before being permitted to attend any class, shall have to fill in the prescribed admission form and submit to the department with prescribed fee and required to complete all formalities indicated therein, failing which he/she shall not be allowed to attend the classes.

IV. Eligibility:

The candidate passed B.Sc. having 45% marks with Microbiology, industrial microbiology, Biotechnology ^{or B.Sc. with Microbiology or Biotechnology combination} are eligible to apply. Other criteria shall be the same as prescribed by the Admission committee for other M.Sc. programmes of the University.

V. Enrolment:

Admitted candidates shall be required to get him/her enrolled with the University if he/she is not already enrolled as a student of this University. They will be required to submit their migration certificate along with enrolment form and prescribed fee.

VI. Seats and Fee Structure:

Intake in M.Sc. previous shall be of 45 students.

Tuition Fee to be paid by the student **in each semester** shall be Rs 20,000=00 (Twenty thousand only)

Intake 45 students

Fee 20,000=00/ semester

Development fee 3000=00/annum

Security fee 2000=00 one time, refundable

Sports fee 150=00/annum

VII. Faculty/employee required:

Professor 01 (on In-charge basis with fixed honorarium)

Lecturer (Guest) 02+ 02 (In previous + final year)

Guest Lectures 176 in one year by the staff of the specialized topics

DEO cum clerk one

Lab assistant one

Peon one

Sweeper one

Gardener one

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Gai. Pooja
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Teaching and non-teaching positions in the department may also be obtained from UGC/DST/DBT/other funding agencies.

VIII. Emoluments to Faculty/employee:

Professor/ Professor In-charge	Rs 5000/- per month honorarium
Lecturer (Guest)	Rs 18000/pm
Guest lecturers	Rs 400/lecture
DEO cum clerk	Rs 8000/pm
Lab assistant	Rs 10000/pm
Peon/sweeper/Gardener	Rs 6000/pm

If the posts are obtained from any funding agency, the pay scale shall be the same which shall be defined by the funding agency and university.

Note: It is recommended to exempt the deduction of 20% of the income of the department for first three years by the University in order to establish the department, and thereafter deduction shall be made regularly.

IX. Examination:

Examination shall be conducted each year with the annual (main) exam of the University. There shall be five theory papers, one project/seminar and practical based on theory papers in each semester. 50% of the evaluation shall be external and rest 50% internal. Project/seminar and internal assessment with regard to discipline, performance throughout the semester shall be of 50 marks each semester by the internal teachers. Detail of the papers, and marks distribution shall be as follows:

X. M.Sc. I, Semester I

S.N.	code	Paper	Marks Theory		
			External	Internal	Total
01	22501	Introductory Microbiology & Virus (MIC 101)	70	30	100
02	22502	Microbial Diversity (Bacteria, Fungi, Algae, Protozoa) (MIC 102)	70	30	100
03	22503	Instrumentation (MIC 103)	70	30	100
04	22504	Bio-molecules (MIC 104)	70	30	100
05	22505	Microbial Biotechnology –I (Agriculture Microbiology) (MIC 105)	70	30	100
06	71541	Project and Seminar	---	50	50
			350	200	550
L01	71542	Practical Lab course I (Paper 1, 2, 3)		150	150
L02	71543	Practical/Lab Course II (Paper 4, 5, 6)		150	150
			Total =		850

M.Sc. –I, Semester II

07	22506	General Pathology (MIC 106)	70	30	100
08	22507	Microbial Molecular Techniques (MIC 107)	70	30	100
09	22508	Biophysics (MIC 108)	70	30	100
10	22509	Microbial Biotechnology –II (Water Microbiology) (MIC 109)	70	30	100
11	22510	Microbial Biotechnology –III (Food Microbiology) (MIC 110)	70	30	100

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12 71544 Project/ Training & Seminar

--- 50 50

350 250 550

L03 71545 Practical Lab course I (Paper 7, 8, 9)

150

150

L04 71546 Practical/Lab Course II (Paper 10, 11, 12)

150

150

Total 850

Grand Total = 1700

1- 60% & above

I Division

2- 45% & below 60%

II Division

3- 40% & below 45%

Pass

4 - Below 40%

Fail

Person has to pass separately in each paper of theory and Practical

Two grace mark for improving division or getting pass.

M.Sc. II, Semester III

S.N.	code	Paper	Marks Theory		Total
			External	Internal	
13	22511	Microbial Metabolism I (MIC 111)	70	30	100
14	22512	Microbial genetics (MIC 112)	70	30	100
15	22513	Bioinformatics (MIC 113)	70	30	100
16	22514	Pharmaceutical Microbiology (MIC 114)	70	30	100
17	22515	Microbial Biotechnology –IV (Industrial Microbiology) (MIC 115)	70	30	100
18	71547	Project/Seminar	---	50	50
			350	200	550
	L03 71548	Practical Lab course I (Paper 13, 14, 15)	150		150
	L04 71549	Practical/Lab Course II (Paper 16, 17, 18)	150		150
				Total	850

M.Sc. –II, Semester IV

19	22516	Microbial Metabolism II (MIC 116)	70	30	100
20	22517	Microbial Recombinant Genetics (MIC 117)	70	30	100
21	22518	Genomics & Proteomics (MIC 118)	70	30	100
22	22519	Microbial Biotechnology –V (Immunology I)(MIC 119)	70	30	100
23	22520	Microbial Biotechnology -VI (Immunology II)(MIC 120)	70	30	100
24	71550	Project/ Training & Seminar	---	50	50

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		350	200	550
L03	71551	Practical Lab course I (Paper 19, 20, 21)	150	150
L04	71552	Practical/Lab Course II (Paper 22, 23, 24)	150	150
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			Total	850
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			Grand Total =1700	

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|----|-----------------|-------------|
| 1- | 60% & above | I Division |
| 2- | 45% & below 60% | II Division |
| 3- | 40% & below 45% | Pass |
| 4- | Below 40% | Fail |

Person has to pass separately in each paper of theory and Practical
Two grace mark for improving division or getting pass.

XI. Division and passing marks:

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|----|-----------------|-------------|
| 1- | 60% & above | I Division |
| 2- | 45% & below 60% | II Division |
| 3- | 40% & below 45% | Pass |
| 4- | Below 40% | Fail |
- One grace mark for improving division or getting pass.
 - Student has to pass in each paper of theory and practical separately
 - Students shall have chance of improvement only in one paper.

XII. General rules:

These will be the same as applicable for the other M.Sc. courses of the University.

XIII. Syllabus (Paper wise)

See appendix I

XIV. Up-gradation and Modification of Syllabus

Up-gradation and Modification of the syllabus shall be proposed by the BOS and shall be approved by the Academic Council through Faculty Board time-to-time, as and when required.

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M.Sc. I, Semester I

Paper I

Introductory Microbiology & Virus

Unit -I

Development and scope and future of Microbiology; Discovery of Microbes;

Origin & Evolution of microbes; Biodiversity, Speciation, Natural selection;

Nature of microbial world: Habitat and General feature of Eukaryotes, Prokaryotes (Eubacteria & Archebacteria) & Mesokaryotes.

Unit II

Board classification of Bacteria, fungi, and virus.

Modern approach of classification (Numerical Taxonomy, 16s RNA analysis).

Identification of Microbes: important characters & structures

Unit III

Aseptic methods

Isolation of microbes; pure culture of Aerobic & Anaerobic Microbes; axenic culture.

Preservation of Microbial cultures; Nutritional requirement of Microbes;

Methods for Selective culture.

Unit IV

Microbial Growth: Definition, Generation time, Growth curves.

Diauxic Growth: Synchronous Growth, continuous culture.

Factors affecting Growth

Determination/ measurement of Growth in Unicellular organisms (Bacteria).

Unit V

Development of Virology, Distribution & general structure of virus; Envelope, Capsid, Viral Nucleic Acid; viral life cycle; Symptoms & its Transmission, Cultivation & enumeration of viruses Cryptogram, HIV, Prions & Viroids.

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Paper II

Microbial Diversity

(Bacteria, Fungi, Algae, Protozoa)

Unit -I

Structure & Function of Prokaryotic Cell (Procyte); Surface appendages (Flagella, Pili) Surface adherents (Capsule/slime layer), Surface layers (Cell wall, Cell membrane), Prokaryotic Cellular reserve material, Genetics material, Endospore; Mode of Nutrition, Reproduction in bacteria. structural differences from Eucyte

Unit II

Types of Archaea; Somatic structure of Archaea, Cell envelops, Application of Archaea. Cynobacteria: their structure and somatic variations. Reproduction of Cynobacteria. Application of Cynobacteria.

Unit III

Structure & Evolution of somatic structure in fungi; Modifications of Somatic structures; Tissue formed by fungal mycelium, General Comparative & Evolutionary asexual & sexual reproduction in fungi, Type of fruiting bodies in Ascomycotina

Unit IV

Structure & evolution of somatic structure of Algae; Specific cell structure of Algae, Pigment & their types; General comparative & evolutionary asexual & sexual reproduction in Algae, Algal blooms, Algal bio-fertilizers

Unit V

Character and Structure of Actinomycetes, Reproduction of Actinomycetes, Protozoa and their types, Protists of great importance

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Paper III
Instrumentation

Unit I

Microscopy: Different type of microscope (Light, Phase contrast and Fluorescence; Electron microscopy: Transmission and Screening Electron microscopy, Confocal Microscopy)

Unit II

Centrifugation: Introduction and Principles of centrifugation; differential centrifugation; Ultra centrifugation, Density gradient centrifugation.

Unit III

Chromatography: Principles and applications, Gel filtration; Osmotic pressure (dialysis); Ion exchange and affinity chromatography; High-pressure liquid chromatography, Gas chromatography; Partition chromatography

Unit IV

Electrophoresis: Principles, PAGE, Agrose gel electrophoresis, Isoelectric focussing
Colorimetry; Spectrophotometry: Visible, UV; ESR, NMR, AAS, pH metery

Unit V

Fluorometry; Polarimetry, Biosensors; Mass spectrometry
Tracer techniques: Auto radiography- preparation, labelling, detection, and measurement; Geiger Muller count, X-ray crystallography;

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Paper IV
Bio-molecules

Unit I

Water: Structure, Physical and chemical properties; Dissociation of water and its ionic product. Dielectric constant; pH and buffers; Non-covalent interactions: Vander wall forces, ionic bonds, hydrogen bonds and hydrophobic interactions

Unit II

Carbohydrates: Chemical structure, nomenclature, classification, properties and biological significance,

Unit III

Lipids: Function and properties of saturated and unsaturated fatty acids; Biological properties; Fatty acid metabolism; Glycolipids,

Unit IV

Nucleic acids: components of nucleic acids, structure and properties; Factors affecting structure of nucleic acid (melting curve, non-covalent interactions) Biosynthesis of nucleotides
Supramolecular Assembly

Unit V

Amino acids: Structure, properties, reaction of amino acids; amino acids synthesis and degradation.
Protein: Structure: Primary, secondary (Ramachandran plot), tertiary and quaternary structure;
Protein designing, sequencing, targeting. Properties and biological significance; Protein engineering (structure-function relationship); Glycoproteins

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Microbial Biotechnology-I

(Agricultural Microbiology)

Physio-chemical Properties of Soil: Organic Matter, Soil Water & Air, Soil microbes.

Bio-fertilizers: Bacterial Fertilizers, Siderophores in relation to rhizobacteria, Plant growth promoting Rhizobacteria (PGPR). Steps preparing bio-fertilizers, Green manuring. Algae as fertilizer, Mycorrhizal bio-fertilizers (Ecto- & endo- mycorrhiza)

Biogeochemical Cycles: Carbon, Nitrogen, Phosphorous & Sulphur Cycle and their importance in Agriculture.

Humus formation & Microbiology of composting.

Degradation of lignin; Aromatic hydrocarbons,.

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Paper VI
Project and Seminar

As given by the teachers of the department

M.Sc. I, Semester II

Paper VII

Plant Pathology

Unit I

What is Pathology? Terminology in Pathology:, Nature and classification of plant diseases, symptoms, Host-parasite relationship, Pathogen, role of environment in disease, Causal organism, Causal complex, Pathogenicity, Pathogenesis, identification of pathogenic microbe, heterocious, autoecious, epidemic, endemic, sporadic.

Unit II

Disease resistance in plants

Control of plant diseases: structural defence (morphological defence), defence in response to infection, cellular defence, biochemical defence, Avoiding contact between host and parasite, strengthening of host and modification of Environment (Biological, chemical and physiological).

Plant quarantine: certification and notification

Unit III

Fungicides and their types, mechanism of action, Phytoalexins, Antibiosis, Antagonism, Chemotherapy, Hypersensitivity, Toxins and Toxoids and their effect.

Unit IV

Study of following bacterial diseases: Citrus canker, potato scab, crown gall, Fire blight, bacterial wilt

Study of viral diseases: Mosaic (Cauliflower, cucumber, sugarcane, Maise), peanut stunt, bud blight

Unit V

Black wart of potato, Late blight of potato

Peach leaf curl, Stem gall of Coriander, Ergot of rye, leaf blotch disease of wheat

Loose smut of Wheat, Rust of gram, Rust of linseed, Early blight of Potato, Red rot of Sugarcane.

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Paper VIII

Microbial Molecular Techniques

Unit I

Fermentation: Basis and development of industrial fermentation processes, screening for new metabolites, strains used in screening, stock cultures, substrates for industrial fermentation-substrates used as carbon and nitrogen sources, fermentation media components and inoculum preparation. Fermenter design and its types.

Unit II

Immobilization of enzymes and cells (Methods, effect and applications);
Protoplast fusion (Methods, mechanism and applications)

Unit III

Molecular techniques: DNA Sequencing, Chemical synthesis of DNA

Unit IV

Blotting techniques: Southern, Northern, Western blotting, Polymerase chain Reaction (PCR) RFLP, RAPD, Micro-array, Gene library; Gene transfer; Probes; DNA finger printing; Molecular farming

Unit V

Introduction to statistics: mean, median, mode, standard deviation, probability distribution, Chi-square test, T-test, F-test

Patenting (Intellectual property right)

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Biophysics

Unit I

Enzymes: Introduction, basic properties and classification, Kinetics of enzyme; Enzyme activity and inhibition, active sites; Coenzymes, Isozymes, Ribozymes, abzymes and artificial enzymes

Lineweaver-Burk, Eddie-Hofstee plot, Woolf plot. Effect of pH, temperature, metal ions on enzyme activity. Enzymes turn over mechanisms of multisubstrate enzyme reactions (conceptual approach), kinetics of reversible enzyme inhibition, Mechanisms of action of Chymotrypsin and Ribonuclease.

Unit II

Enzyme Technology. Enzyme Immobilization techniques, use of isolated enzymes in industrial processes, Enzymes in clinical diagnosis, Structure and biochemical functions of vitamins, and hormones.

Unit III

Biochemical energetics: Law of thermodynamics; concept of energy; Hydrolysis of energy rich intermediates; Respiratory Electron transport system and inhibition of electron transport

Unit IV

Cell communication & Signal transduction: Receptors and G protein, Phospholipid signalling; Kinase and phosphatase; Signalling mechanism in Bacteria; Sucrose sensing mechanism, Amoeboid movement, flagella movement

Unit V

Redox potential :Oxidation –Reduction , Equivalence of electrical & chemical energy, Electrochemical cell, contact potentials, galvanic cell, potential of half-cell, redox potentials & its calculations by Nernst equation, standard electrode potentials & its determination , its relationship with emf, Types of electrodes, pH electrodes, ion selective electrodes, oxygen electrodes.

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Paper X

Microbial Biotechnology-II

(Water and Air Microbiology)

Unit I

Type of water, Ground Water, Domestic water, Safe & Potable Water.

Water contaminants & their effects, Purification of H₂O.

Marine Microbiology

Unit II

Sewage Systems, Sewage treatment: Primary, Secondary & Tertiary.

Examples of Petroleum industrial waste treatment.

Wenodeskey column and distribution of microbes in water profile

Unit III

Bacteriological standards of potable water, Bureau of Indian standards (BIS) and World health organization (W.H.O.),

Water borne diseases, Indicators of faecal pollution

Methods of water analysis

Unit IV

Microbiology of Air: Enumeration of Micro-organism in air, Significance of Micro-organisms in air, Control of air borne Micro-organisms.

Unit V

Microbial Adaptations to environmental stress. Bio-magnification & Bio-remediation.

Effect of radiation & Green house effect on microbe

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Paper XI
Microbial Biotechnology-III
(Food Microbiology)

Unit I

Microbes as food; Single Cell Protein (SCP)

Source of microorganisms in food: perishable and semi-perishable food

Factors affecting microbial growth in food: Intrinsic: pH, water activity level, nutrient, Antimicrobial constituents of food, Extrinsic: Temperature of storage, relative humidity of environment, Gaseous atmosphere.

Unit II

Food spoilage (by bacterial and fungal agents)

Microbes of raw milk, spoilage of fresh meat, fish, and Plant product: Cereals, pulses, nuts, oilseeds, fruit and fruit products, vegetable and vegetable products

Unit III

Food infection; Microbes of alimentary canal and their role

Food intoxication: Association of microbe and toxins produced in food, LD50, LD70 etc

Food sanitation; food quality system: ISO (International standards organisation) equivalence.

Unit IV

Food fermentation: desirable and undesirable fermentation, role of starter in food fermentation
Starter spoilage.

Microbiology of fermented milk, cheese, yoghurt, Vegetables, Fish, & meat

Therapeutic use of fermented foods

Unit V

Principal of food preservation, Removal of microbes, Preservation by physical methods: Temperature, radiation, drying, high pressure processing- Pasteurization, Canning; Preservation by chemical methods: Organic acids, sulphur-dioxide and sulphides, nitrite, lactic antagonism, lectoperoxidase system and additives, osmoregulatory substances.

Paper XII
Project and Training

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M.Sc. II, Semester III

Paper XIII

Microbial Metabolism I

Unit I

Biosynthesis of cell wall peptidoglycan; Metabolism of Volutin, glycogen,

Unit II

Respiration: Glycolysis, Pentose-phosphate pathway, Entner-Doudoroff pathway; Krebs cycle; Glyoxylate shunt, Glyconeogenesis, Pyruvate as central hub to various metabolic pathways, SO_4 respiration, Halorespiration

Unit III

Anaerobic respiration: Nitrate respiration, denitrification, and nitrate-ammonification

Unit IV

Alcoholic fermentation by yeast and bacteria, Lactic acid, Propionic acid, formic acid, Butyrate and butanol-acetone fermentation, Acetate and methane fermentation

Unit V

Bacterial Photosynthesis: Photoautotrophs, Chemoautotrophs: nitrifying bacteria, sulphur oxidising bacteria, hydrogen oxidising bacteria, iron oxidising bacteria; Photosynthetic pigments; Photophosphorylation; Calvin cycle; Comparison with eukaryotic photosynthesis

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Unit I

Genome organisation: chromatin structure (coding and non-coding sequences; Repetitive DNA; Molecular structure of DNA; A, C, D and Z DNA; Circular DNA; Organelle genome
Nucleic acid as genetic material; Concept of Gene; Units of gene, Gene mapping;

Unit II

Molecular mechanism of DNA replication in Prokaryote and Eukaryote; Transcription; Mechanism of transcription; RNA splicing; Reverse transcription, regulation of transcription, role of antisense RNA-regulation in bacteriophages. Gene expression control in eukaryotes-role of specific DNA sequences, modifications in DNA transcripts and histone proteins.

Unit III

Genetic code: concept and properties; Central dogma, tRNA processing, Translation: initiation, elongation, and termination of polypeptide chain, Regulation at translational level, phosphorylation of translational machinery, masking of m-RNA, regulation by gene rearrangement.

Unit IV

Post translation modification, Inhibition of protein synthesis, Gene and Protein, Proteomics and their types.

Unit V

Mutation and repair: Type of mutation, molecular basis of mutagenesis, site detected mutagenesis, mutant reversion.

Methods for isolation of mutants. Physical mutagen, biochemical mechanism of repair, photo reactivation, excision repair, SOS repair.

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Paper XV

Bioinformatics

UNIT I

Basic of computer hardware and software & its application in Biological Sciences.

Type of operating systems, DOS, WINDOWS & LINUX.

Introduction to MS Office and basics of internet.

UNIT II

Introduction to Bioinformatics: History, Definition - Importance and uses of Bioinformatics.

Information network – Internet, web Browser and address (NCBI, EBI, DDBJ etc). Introduction to various open resources essential for Bioinformatics.

UNIT III

Database: Introduction, Concepts, Characteristics, categories and types.

Literature database (PubMed, LITDB), Disease data base (OMIM, Gene Cards, Med line Plus).

Information retrival system (Entrez, SRS).

UNIT IV

Database Search Techniques- Sequence Comparison and Alignment Techniques- Use of Biochemical Scoring Matrices- BLAST and FASTA- Pairwise and Multiple sequence alignment. Profiles, motifs and features identification – Phylogenetics analysis.

UNIT V

Basic Bioinformatics Software: Clustal X , Clustal W. Genetic Analysis Software- MEGA and Phylip, Primer desining, sequence submission using Sequin.

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Paper XVI

Pharmaceutical Microbiology

Unit I

Normal micro-flora of human body; medically important bacteria with respect of pathogenicity, epidemiology, disease by Staphylococcus, Streptococcus, Nisseria, clostridium, Enterobacteria, Pseudomonas, Mycobacterium, Chlamydiae

Unit II

Pathogenic fungal diseases by Trichophyton, Microsporum, Epidermophyton, Philophora, Mucor, Aspergillus, Histoplasma: Cryptococci, Candida

Unit III

Diseases by protozoans: Plasmodium, Entamoebia

Diseases by virus: adenovirus, influenza virus, herpes virus, polio, measles, mumps, rubella, hepatitis, rabies
Transmission of disease

Unit IV

General characteristics and diseases caused by Adeno-, Pox-, Influenza-, Herpes-, Hepatitis-, Polio-, rabies-, HIV-, MMR Viruses

Unit V

Chemotherapy; antimicrobial agents; Drug discovery and development, Drug resistance in bacteria; Drug sensitivity test

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Paper XVII

Microbial Biotechnology-IV

(Industrial Microbiology)

Unit I

Microbial deterioration of industrial products (leather, cotton, paint, wood) and their control.

Fermentation: introduction, Type of fermenters, fermentation process, mode of operation of fermentation, Applications of fermentation; Strain development; Scaling up,

Unit II

Downstream Processing: Introduction, Cell disruption: Enzymatic, chemical, Physical; Initial purification; Precipitation, Chromatography: Scale-up and quality management, method selection, Selection of matrix, Maintenance of column packing materials, control and automation, Design of proteins for purification, future trends

Unit III

Microbial production of ethanol; Wine, beer; Organic acids; Amino acids; enzymes; Vitamins; antibiotics (natural and synthetic); Hormones

Unit IV

Microbial transformation of antibiotics and steroids; Microbial leaching of metal ores; Immobilization of microbial cell; Choice of support material; Immobilization procedure; Properties of immobilized biocatalysts; Applications of immobilization

Unit V

Synthesis of commercial products by recombinant micro-organisms;
Biopolymers, Human insulin,
Growth hormones by microbes, interferon and vaccines.

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M.Sc. II, Semester IV

Paper XIX

Microbial Metabolism II

Unit I

Nitrogen fixation: Symbiotic: root nodule formation, leg-haemoglobin, and metabolism of nitrogen fixation

Unit II

Genetics of nitrogen fixing organism: nod and nif genes regulation,

Unit III

Nitrogen fixation mechanisms: Nitrogenase and their types, mechanism of electron transfer, Nitrate and ammonia assimilatory enzymes: Glutamate synthetase, amino acid transferase

Unit IV

Incomplete oxidations and microbial biotechnology: Acetic acid formation and acetic acid bacteria, production of organic acid by fungi, chemistry of acid formation by fungi, Interconversions of products by micro organisms, Production of antibiotics, Mycotoxins

Unit V

Bacterial transport system, Uptake of solutes into the cell.

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Paper XX

Microbial Recombinant genetics

Unit I

Gene regulation in pro and eukaryotes; positive and negative control

Unit II

operon concept; induction, repression, attenuation

Unit III

Gene recombination: Type of recombination, Restriction enzymes and other enzymes involve in cloning; Restriction analysis;

Unit IV

Vectors: Features of vectors; Plasmids: Ti Plasmid; SV40; Bacteriophage; YAC vector, BAC vector, Cosmids,

Unit V

Gene cloning: cutting and joining; identification of recombinants

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Paper XXI

Genomics and proteomics:

UNIT I

Introduction to Microbial Genomics - sequencing genomes – first generation DNA sequencing – shot gun sequencing – second generation DNA sequencing – third and fourth generation DNA sequencing. Metagenomics: principles and applications as a tool to reveal the vast microbial diversity.

UNIT II

Gene prediction: Gene structure in Prokaryotes and Eukaryotes, Gene prediction methods: Neural Networks, Pattern Discrimination methods, Signal sites Predictions, Evaluation of Gene Prediction methods, Genome similarity and SNPs.

UNIT III

Functional genomics and Transcriptomics: Complete transcript cataloguing and gene discovery-sequencing based approach, Microarray based technologies and computation based technologies. RNA secondary structure prediction.

UNIT IV

Protein Computational Biology: Structural classification of proteins, Protein structure analysis, structure alignment and comparison, Secondary and tertiary structure prediction and evaluation, prediction of specialized structures, Active site prediction, Protein folding.

UNIT V

Proteomics: Types of proteomics, tools for proteomics-separation and isolation of proteins, acquisition of protein structure information, databases and applications Phylogenetic analysis: molecular basis of evolution, Phylogenetic trees & different methods for phylogenetic inference.

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Paper XXII

Microbial Biotechnology-V

(Immunology I)

Unit I

History of Immunology; Immune System: Introduction of immune system, immunity and their types, Specific and non-specific defence,

Unit II

Blood groups, Type of Leukocytes, Leukocyte activation and migration, Phagocytosis, Inflammation; Interferon;

Unit III

Antigens, their structure, genesis and differentiation; immunogen and tolerogen, Molecular basis of antigen recognition; Factors for immunogenicity.

Unit IV

Lymphoid organs: T-lymphocytes; B-lymphocytes;

Unit V

Histocompatibility; MHC; Human leukocyte antigen (HLA) system; Molecular structure of HLA class I and class II protein

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