B.Sc. I

Semester-I

Paper-I

History And Microbial Morphology

Unit-I:History and scope of Microbiology.

i)Discovery of microbeii)Theory of biogenesis and a biogenesis.

iii)Contributions of Louis Pasteur, Robert Koch, Lister Winogradsky and Beijerink, John Tyndal iv)Branches of Microbiology: a] systemic microbiology including bacteriology, mycology, phycology, virology, b] biotechnology, c] geomicrobiology, d] exobiology,e]medical microbiology, f]environmental microbiology

Unit-II:Prokaryotic Cell structure I

i)A Typical Bacterial cell structure, ii)Structure of cell wall(-gram +ve, gram-ve)

iii) Cell membrane: Fluid mosaic model, mesosomes iv)Ribosomes, Nucleoid, plasmids, Storage granule

Unit- III

i)Capsules, slime layer, Pili, Flagella(including types and structure).

ii)Endospore structure, formation and germination iii) Exospores, Myxospores, Eukaryotic spores, iv) significance of dormancy

Unit IV—Bacterial Taxonomy

i)Significance of classification, ii)Intuitive classification, Whittaker five kingdom system, iii)Bergys manual ninth edition, numerical classification, iv) Approaches in modern classification: GC:AT Ratio, DNA Hybridization, 16SrRNA Cataloguining and phylogeny

Paper-II-Microbial Diversity.

Unit-I:Prokaryotic microbes

i)General characters of a)Proteobacteria, b)Mycoplasma, c)Rickettsia and chlamydia

ii)Cyanobacteria: Study of anabena and applications of cyanobacteria

iii)Actinomycetes: Streptomysis and their applications

iv)Archaebacteria: Methanogenic bacteria and their importance

Unit-II:Eukaryotic microbes

i)Fungi and yeast:General characters,Asexual and sexual mode of reproduction,slide culture techniques.

ii)Algae:-General characters and industrially important algal cells

iii)Protozoans: General characters and life cycle of trypanosome

iv)Differences between prokaryotes and eukaryotes

Unit-III:Acellular microbes:Viruses.

i)Discovery of viruses, General structure, symmetry and classification

ii)Cultivation,chick embryo,tissue culture

iii) Detection of viral growth iv)T4-Bacteriophages,lytic cycle, Lysogeny and Lambdaviruses.

Unit-IV:Microbial interaction.

i)Positive and negative interaction:Commensalism, synergism, syntropism, mutualism, parasitism, predation, antagonism, competetion

ii)Protist-Protist Interaction:Bdellovibrio

iii)Protist-Plant interaction: Root nodule bacteria

iv)Protist-Animal interaction: Rumen bacteria, insect midgut bacteria, luminescent bacteria

Semester-II

Paper-I-Microbial Physiology

Unit-I:Microbial Nutrition.

i)Nutritional types of bacteria.ii)Basic nutritional requirements.

iii)Types of culture media, growth, selective, enriched, enrichment, synthetic non synthetic.

iv)Axenic cultures. Diauxic cultures.

Unit-II:Microbial growth and cell cycle.

i)Bacterial cell cycle ii)Principle of growth curve and mathematical expression.

iii)Continuous culture: Turbidostat and chemostat.

iv) Factors influencing microbial growth.

Unit-III:Microbial control.

i)Concept of microbial death ii)General terms: microbiostatic, cidal disinfectant, sanitizer.

iii)Ideal antimicrobial agents.

iv)Physical methods;a)Heat and moist sterilization.b)Dry sterilization, c)Low temperature.

d)Filtration, e)radiation, f)osmotic pressure.

Unit-IV: Chemical agents

i) Phenolics, Alcohols, Halogens, Heavy metals, Quaternary ammonium compounds, Bignamides-Chlorohexidines, Surface active agents, Aldehydes

b)Gaseous sterilization

c)Chemotherapeutic agents

i)Mechanism of cell injury.

ii)Factors influencing antibiotic activity

d)Phenol coefficient

Semester-II

Paper-II-Microbial Techniques

Unit-I:Microscopy-I Principle and application

i)Bright field microscopy, ii) Dark field microscopy, iii)Electron Microscopy(TEM, SEM),

iv)Confocal microscopy.

Unit-II: Microscopy- II-Principle and applications

i)Atomic Force Microscopy ii)Phase contrast microscopy.iii)Fluorescent microscopy.

Unit-III- Staining techniques

i) Stains and dyes, chromophore, auxochrome, chromogens, types of stains.

ii) Staining techniques :simple, differential, gram staining, acid fast staining.

iii) Staining of specific structure: flagella, spores, capsule (negative)

iv) Theory of staining

Unit-IV:Nutritional and growth techniques.

i)Isolation of pure culture:various techniques.

ii)Determination of C N P etc. by auxeno graphic and replica plate technique

iii)Synchronous culture techniques.iv)Measurement of growth.

Practicals SemI

1.General concept of basic equipments and apparatus

2.Preparation of media and stains

3.Isolation of microbes from air, water, soil

4. Performance of simple Grams, acidfast and spores staining

5. Isolation of pure culture

6. Performance of slide culture technique and fungal staining

7. Performance of antibiosis

8. Performance of motility

Practicals Sem II

1. Enumeration of microbes by SPC method
2. Performance of oligo dyanamic action
3. Determination of phenol coefficient
4. Study the effect of salt on growth
5. To perform membrane filtration
6. To demonstrate the effect of radiation
7. To cultivate anaerobic bacteria
8. Demonstration of Micrometry

B.Sc. II Semester III
Paper I
Chemistry of Organic Constituents And Enzymology

Unit I—Carbohydrates And Lipids
Classification of carbohydrates ,Structure of glucose, fructose, maltose, lactose, sucrose, raffinose, starch, hyaluronic acid, glycogen, cellulose, osazone formation
Classification of lipids, structure of triglyceride, compound lipids, derived lipids

Unit II---Amino acids and proteins
Classification of amino acids, titration curve, acidic, basic and neutral amino acids, peptide bond theory, organizational levels of proteins, concept of oligomeric protein

UnitIII--- Enzymology
Definitions and nature of enzymes, classification, nomenclature, primary concept of enzyme kinetics, MM equation, modifications of MM equations, activation energy, transition state, ES complex, enzyme activity, katal,specific activity, turn over number
Enzyme inhibition and their types, enzyme regulation, their types, allosteric sites, allosteric modulaters, functional diversity such as holoenzyme, apoenzyme, coenzyme, cofactor, prosthetic group, isoenzymes, membrane bound enzymes, multienzyme complex, zymogens

Unit IV---Nucleic acid and Vitamins
Structure of purines, pyrimidines, nucleosides, nucleotides, DNA, RNA, and various forms of DNA
Types of vitamins, Classification on the basis of solubility, functions of vitamins, Hyper and hypovitaminosis

B.Sc. II Semester III

Paper II

Industrial Microbiology

Unit I---Fundamentals of industrial microbiology

Definition and scope of industrial microbiology, general concept, primary screening,secondary screening, strain development, sterilization of fermentors, production of media and air

Unit II---Fermentor design

Types of fermentation processes, design of typical fermentor, parts of fermentor, factors effecting fermentor design, control of agitation,aeration, pH anddissolved oxygen, types of fermentors

Unit III ---scale up and DSP

Inoculum development, scale up of fermentor process, raw media for media preparation, Harvesting and product recovery

Unit IV ---Industrial Production

Production, biochemistry, recovery and uses of: SCP, Bakers yeast, ethanol, penicillin, semisynthetic penicillin, citric acid, Vit B12 and beer and wine

B.Sc. II Semester IV

Paper I

Metabolism

Unit I---Carbohydrate

General strategy of metabolism, EMP pathway and its regulation, TCA cycle and its regulation, Outline of ED pathway, Pentose Phosphate pathway, PK pathway

Unit II---Lipid and Nucleic Acid

Betaoxidation, Omegaoxidation, Replication of DNA, modes of replication, general features, enzymes involved, rolling circle and knife and fork model, Prokaryotic transcription including general features, enzymes involved and reverse transcription

Unit III---Amino acids and Proteins

Amino acid breakdown, deamination,(alanine, tyrosine, metionone) urea cycle, metabolic breakdown of individual amino acids, glucogenic and ketogenic amino acids
Genetic code and Prokaryotic translation

Unit IV---Energy Generation

High energy molecules, substrate level phosphorylation, Cyclic and noncyclic photophosphorylation, Oxidative phosphorylation and ATP generation

B.Sc. II Semester IV

Paper II

Applied Microbiology

Unit I ---Water microbiology

Significance of bacteriological analysis of water, collection and handling of water samples, indicators of excretal pollution, bacteriological analysis of water for coliforms and faecal streptococci (MTFT, MFT), water treatment using SSF and RSF,methods of chlorination, differences between fecal and non fecal organisms

Unit II---Waste water treatment

Sewage types, composition, physical, chemical and biological characteristics, BOD, COD, ThOD, trickling filter,activated sludge, RBC, sludg digester, oxidation pond, septic tank, imhoff tank

Unit III--- Air and Soil microbiology

Microbial analysis of air , settling plate and Anderson technique, bacteria and fungi as biopesticides, biofertilizers, PSB, mycorrhiza, microbial leaching of copper and uranium

Unit IV --- Food microbiology

Food spoilage organisms, canning process, pasteurization, low temperature preservation, chemical preservation

Food borne diseases and food intoxication

Practicals
Semester III

1. Identification of carbohydrates and lipids
2. Detection of enzymes: amylase, catalase, gelatinase, lipase
3. Estimation of proteins
4. Estimation of DNA
5. Estimation of RNA
6. Production and estimation of alcohol
7. Isolation of amylase producer from soil

8. Leavening capacity of yeast
9. Immobilization of yeast and demonstration of invertase activity

Practicals Sem IV

1Isolation of organisms from water and sewage

2Determination of MPN

3IMViC Test

4Determination of DO, alcalinity

5MBRT, Phosphatase test

6,BOD and COD

7 Detection of arsenic by bioassay

8 determination of Chlorine demand

B.Sc. Final Semester V

Paper-I

Medical microbiology

Unit-I

Epidemiology and host –parasite relationship.

a) Definitions:

i)Signs,symptoms and syndrome of disease,stages of infectious diseases-incubation period,prodromal phase,Invasive phase,decline phase and the period of convalescene,primary infection,secondary infection,acute infection,chronic infection local and systemic infection.

ii)Bacteremia,septicaemia,pyamia,toxemia,Viremia.

iii)Epidemic,Endemic,Pandemic,Zoonotic,Exotic.

b)Dynamics of disease transmission:

i)Causative or etiological agents[list]

ii)sources of reservoir of infection.

.Exogenous Human (case and carrier) Non-living reservoir.

Endogenous infections.

iii)Portal of exit

iv)Mode of transmission-Contact, Vehicle,Vector,Air-borne,transplacental and laboratory/hospital infections.

v)Portal of entry.

vi)Susceptibility of host.

c)control of communicable diseases: Control of sources, blocking the channels of transmission,protecting the susceptible host.

Unit-II

a)Microbial mechanism of Pathogenicity: pathogenicity and virulence,exaltation and attenuation,MID,MLD,ID 50,LD50.

i)Invasiveness:-adherence,capsule,enzymes.

ii)Toxigenicity:-Exotoxins and Endotoxins.

b)Normal flora of healthy human host:

Definition,origin significance,Germ free and Gnotobiotic life.

Characteristics of normal flora..

c)Infectious microbiology: Microbial diseases of skin, eye,digestive, respiratory,cardiovascular,lymphatic,urinary,reproductive and nervous systems.

(outline of structure of each system and lists of infectious diseases affecting the particular system).

Unit-III

Study of pathogenic organisms: Morphology, cultural characteristics, biochemical characteristics, serology, lab diagnosis

1.Bacteria:

.Salmonella typhi and paratyphi A & B.

.Mycobacterium tuberculosis.

.Spirochetes-treponemma pallidum

2.Viruses:

.HIV

.Hepatitis A & B

3.Protozoa:

.Plasmodium

Unit-IV

Disease control:

Basic principle of drug designing.

Development of modern drug delivery system.

Basic mechanism of action of drugs.

Bacterial cell wall synthesis inhibitor; Penicillin

Bacterial protein synthesis inhibitor: chloramphenicol

Bacterial DNA synthesis inhibitor: Nalidixic acid, Floxacin antibiotics.

Antimetabolites:Trimethoprime,sulfamethoxazole.

Non automated and automated in vitro drug susceptibility testing-kirby-Bauer disc diffusion method and e-strip method.

Reasons for development of resistance

Semester V

Paper-II

Molecular biology and bioinstrumentation

Unit-I

Gene mutation and regulation.

a)Concept of gene,muton,recon,cistron,monocistronic and polycistronic gene,gene within gene,spit gene.

b)Gene regulation:lac operon(detail)

c)mutation:Definition,random vs directed mutation,type of mutation,base pair substitution,frame shift,point,nonsense,missense,and silent mutation.

d)Genetic suppression:Intergenic and Intragenic.

e)Molecular basis of mutation:Mechanism of spontaneous and induced mutation.

Unit-II

Genetic recombination:

a)Definition,Basic concept of recombination

b)General types of recombination.

c)Transformation.

d)Conjugation

e)Transductions

f)Transposable genetic elements(Prokaryotic)

Unit-III

Bioinstrumentation-I(Principles and applications)

a)Spectroscopy:Laws of absorption,limitations of beer law,UV-Visible spectroscopy and its applications.

b)Centrifugation:Type of centrifuge,analytical and ultra centrifugation,density gradient centrifugation.

c)Electrophoresis:Principle,types of electrophoresis,agarose gel electrophoresis and SDS-PAGE.

Unit-IV

Bioinstrumentation-II(Principles and applications)

a)Chromatography:Thin layer chromatography, ion exchange, gel filtration, HPLC

b)Isotope tracer technique: Method and applications.

Detection and measurement of stable isotope: Mass spectrometry.

Detection and measurement of radioactive isotope: GM counter, scintillation counter.

B.Sc. Final Semester VI

Paper-I

Immunology

Unit-I: Defensive mechanism of host:

a)Nonspecific defences of the host:

i)species,race and Individual resistance.

ii)age,sex,hormonal and nutritional influences.

iii)Mechanism of non-specific defences:

I.First line of defence:Skin,mucus membrane,Mechanical chemical and microbial defences.

II.Second line of defence:Phagocytosis,inflammation,fever,interferon,complement system.

b)Acquired immunity: Active and Passive immunity.

c)Organs involved in immune function:

1.Primary lymphoid organs:Bursa,bone marrow,thymus.

2.Secondary lymphoid organs:Lymph nodes, Spleen,MALT,GALT,CALT.

Unit-II:

a)Diagram of Haematopoiesis.

b)Cells of immune system: general characters of

1)B and T cells,

2)Monocytes and macrophages,

3)Neutrophils,Eosinophils and basophiles.

4)Mast cells

5)Dendritic cells

6)Natural Killer cells.

c)B-cell biology:(Humoral immunity)

1.Primary and secondary immune response

2.Clonal selection and clonal deletion(immune tolerance)

3.T-cell dependent antibody response. outline

4.T-cell independent antibody response.outline

d)T-cell biology:(Cell mediated immunity)

1.Types of T-cells and Cluster of differentiation(CD)

2.T-cell receptor(TCR)

3.Cytotoxic T-cell response

4.MHC molecules and antigen presentation.(diagrammatic)

5.Cytokines-Definition,types(colony stimulating factor,Interleukins,Tumor necrosis factor alpha).

Unit-III:

a)Antigens:

I)Definition,Complete antigen,hapten,epitope,valence.

II)Factors determining antigenicity

III)Antigenic mosaic of bacteria

IV)Antigens in relation to human being:Species specific,isoantigen,autoantigen(RA),Organ specific antigens,Heterophile antigens.

b)Antibody:

I.Definition,General structure.

II. Classes of Immunoglobulins and their functions.

c)Ag-Ab reactions(Diagnostic immunology)

I. General features of antigen-antibody reactions.

II. Antibody titre,rising antibody titre,paired sera

III. Precipitation: Precipitation in liquids, Immunodiffusion, Immunoelectrophoresis.

IV. Agglutination: Slide agglutination,tube agglutination,haemagglutination,Haemagglutination inhibition test,coomb's test,passive agglutination.

UNIT IV

a) Tagged antibody test: ELISA direct and indirect
b) Immunofluroscence

c)Hypersensitivity reactions:Definition,Gel & Coomb's classification.

1.Type I (Anaphylaxis) Hypersensitivity:Mechanism of anaphylaxis,systemic and localized anaphylaxix,prevention of anaphylaxis.

2.Type II (Cytotoxic) Hypersensitivity:

.Blood transfusion reaction(Rh compatibility)

.Heamolytic diseases of the new borne

3.Type III (Immune complex)hypersensitive:

.Arthus reaction

.Serum sickness.

4.Type IV(delayed)Hypersensitivity: Mantaux test, allergic contact dermatitis.

Semester VI

Paper II

Biotechnology

Unit I:

Tools & techniques of genetic engineering:

a)Preparation of pure samples of DNA,range of enzymes used in DNA manipulation,analysis of DNA fragment size,Joining of DNA molecule,vectors and their types.

b)Introducing rDNA into host cell,transformation of cells,identification of transformed cells,selection of clones,direct and indirect method.

c)Expression of cloned genes,construction of gene library,cells for cloning,expression of prokaryotic genes.

d)PCR and its application,DNA fingerprinting.

Unit-II:Application of genetic engineering:

a)Health Biotechnology:

i)Production of hormones:insulin

ii)Production of interferon.

iii)Production of vaccines:Conventional vaccines:BCG,salk,Diphtheria toxoid,ATS,DNA vaccines,Edible vaccines.

iv)Hybridoma technology,monoclonal antibody formation

Unit-III

b)Agricultural biotechnology:

i)Protoplast fusion

ii)Biopesticides.

iii)Biofertilizers

c)Industrial biotechnology

i)Bio sensor and Nano biotechnology applications

ii)Biochips and concept of microarray.

d)Ethics and hazards of biotechnology.

Unit-IV Food

1) Genetically modified food. definition and one example

2)Oriental Fermented food:soya sauce,miso,sufu

3)Transgenic plants.BT Cotton

4)Transgenic animals and clones: Knockout mice, Dollyship, Milching animals

Practicals

Semester v

1) Isolation of bacterial DNA
2) Isolation of plasmid DNA
3) Demonstration of restriction digestion
4) Estimation of creatinine by spectrophotometric method
5) Perform gelfiltration
6) Perform paper chromatography
7) Perform TLC
8) Identification of bacteria: E coli, S aureus, Salmonella, Proteus

Practicals

Semester VI

1) Perform VDRL test
2) Perform Widal test
3) Perform immunodffusion
4) Perform Western blot
5) Perform PCR
6) Development of sphaeroplast
7) Production of biofertilizer
8) Production of soyasauce

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