



**SHRI JAGDISHPRASAD JHABARMAL TIBREWALA UNIVERSITY**

**DEPARTMENT OF BIOSCIENCE**

**Syllabus B.Sc. Part-1<sup>st</sup>**

Semester 1st Zoology

**Paper-I**

**Paper Code-CMZ-107**

**Animal Taxonomy and evolution-I (Zoology Paper-I)**

**Maximum Mark=35**

**Unit-I**

- Zoogeographical distribution: principal zoogeographical regions of the World with special reference to their mammalian fauna.
- Biodiversity of Fauna of India and World.

**Unit-II**

- Adaptation to their modes of life **and** environment.
- Conservation measures of biodiversity where required.

**Unit-III**

- Continental drift.
- General principles of taxonomy; concepts of the five kingdom scheme.

**Unit-IV**

- Concept of Protozoa, Metazoa and levels of organization.
- Taxonomy and basis of classification of Non-chordata and Chordata: symmetry, coelom, segmentation and embryogeny.



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**Syllabus B.Sc. Part-1<sup>st</sup>**  
**Semester 1st Zoology**

**Paper-III**

**Developmental Biology-I**

**Paper Code-CMZ-109**

**Maximum Mark=50**

**Unit-I**

- Historical review and types and scope of embryology
- Gametogenesis:
  - I. Formation of egg and sperm.
  - II. Vitellogenesis

**Unit-II**

- Fertilization: Activation of ovum, essence of activation: changes in the organization of the egg cytoplasm.

**Unit-III**

- Parthenogenesis
- Cleavage: Definition, planes and patterns among non-chordates and chordates, significance of cleavage.

**Unit-IV**

- blastulation and morulation.
- Fate maps, morphogenetic cell movements, significance of gastrulation.



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**Syllabus B.Sc. Part-1<sup>st</sup>**

Semester 1st Zoology

**Paper-II**

**Paper Code-CMZ-108**

**Cell Biology-I (Zoology Paper-II)**

**Maximum Mark=35**

**Unit-I**

Introduction to cell: Morphology, size, shape and characteristics of Prokaryotic, Eukaryotic and Animal cells; basic idea of virus and cell-theory.

Cytoplasmic organelles:

- i. Structure and biogenesis of mitochondria; electron trans-*port* chain and generation of ATP molecules.
- ii. Structure and function of endoplasmic reticulum, ribosome (Prokaryotic and Eukaryotic) and Golgi complex.
- iii. Structure and function of lysosome, microbodies and centrioles.
- iv. Structure and functions of cilia, flagella, microvilli and cytoskeletal elements.

**Unit-II**

**1. Nucleus:**

- i. Structure and function of nuclear envelope, nuclear matrix and nucleolus.
- ii. Chromosomes: Morphology, chromonema, chromomeres, telomeres, primary and secondary constrictions, chromatids; prokaryotic chromosome.
- iii. Giant chromosome types : Polytene and Lampbrush.
- iv. Chromosomal organization: Euchromatin, heterochromatin and folded fibre model and nucleosome concept.

**Unit-III**

**3. Cell Division:**

- i. Interphase nucleus and cell cycle : S, G<sub>1</sub>, G<sub>2</sub> and M-phase.
- ii. Mitosis: Phases and process of mitosis, structure and function of spindle apparatus; anaphasic movement.
- iii. Meiosis: Phases and process of meiosis, synapses and synaptonemal complex, formation and fate of chiasmata and significance of the crossing over.

## Unit-IV

### 2. Nucleic Acids:

- I. DNA structure, polymorphism (A, B and Z type) and replication (semi conservative mechanism), experiments of Messelson and Stahl: elementary idea about polymerases, topoisomerase, single strand binding protein, replication forks (both unidirectional and bidirectional), leading and lagging strands, RNA primers and Okazaki fragments; elementary idea about DNA repairs.
- II. RNA structure and type (mRNA, rRNA and tRNA) and Transcription (brief idea about polymerase, exon and introns)
- III. Genetic code and translation,: triplet code, characteristics of triplet code; protein synthesis (translation)

**B.Sc. Semester I<sup>st</sup>**  
Practical –Zoology

Time : 4 hrs.  
Marks:50

Max.

Min. Marks:17

**I Microscopic Technique:**

1. Organization and working of optical microscopes: dissecting and compound microscope.

**2. Microscopic slides and specimens:**

**Protozoa:** Euglena, Trypanosoma, Giardia, Entamoeba, Elphidium (Polystomella), Foraminiferous shell, monocystis, plasmodium, paramecium, Paramecium showing binary fission and conjugation, Opalina, Nyctotherus, Balantidium, Vorticella.

**Porifera:** Leucosolenia, T. S. Sycon, Spicules, Spongin Fibres, Gemmules.

**II. Anatomy**

**Earthworm:** External features and nervous system.

**Cockroach :** External features and nervous system.

**III. Permanent Preparation and Study of the following:**

Sponge spicules, spongin fibers, gemmule, Obelia colony and medusa

**IV Exercises in Cell Biology:**

Squash preparation for the study of mitosis in onion root tip.

**V Exercise in Genetics:**

1. Identification of wild and mutants drosophila
2. Identification of male and female drosophila

**VI Developmental Biology**

Histological slides: cleaves, blastula, gastrula, neurula and tail bud stage.

## **Scheme of Practical Examination and Distribution of Marks**

Time 4:hrs

Min pass marks  $12 + 5 = 17$

Max Marks :50

1. Dissection	8
2. Permanent preparation	4
3. Identification and comments on spots	18
4. Viva- voce	5

### **Internal Assessment**

**(Total Marks – 15 Marks)**

1. Project	(10 Marks)
2. Record	(5 Marks)

**Total: 50**



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**SEMESTER-II**

**Paper – I- DIVERSITY OF ANIMALS AND EVOLUTION(CMZ-207)**

**Unit 1**

Detailed classification of Non-chordata Phylums protozoa, porifera , coelentrata habits, habitat and external features only of the following prescribed types, viz, Amoeba, Paramecium, Euglena, Sycon, Obelia

**Unit 2**

Detailed classification of Non-chordata Phylums platyhelminthes, nematoda, annelida habits, habitat and external features only of the following prescribed types, viz, Fasciola, Taenia, Nereis, Hirudinaria.

**Unit 3**

Detailed classification of Non-chordata Phylums arthropoda, Mollusca Echinodermata, Hemichordata habits, habitat and external features only of the following prescribed types, viz, Palaemon, Pila, Lameilidens and Asterias, Blanoglossus

**Unit 4**

Detailed classification of Phylum Urochordates & cephalochordates habits, habitat and external features only of the following prescribed types, viz, , Herdmania, Amphioxus.

**Unit 5**

1. History of evolutionary thoughts (Lamarckism and Darwinism)
2. Natural Selection, Genetic basis of evolution
3. Variations, Isolation
4. Study of extinct forms: Dinosaurs, Archeopteryx.

## **SEMESTER-II**

### **Paper – II- CELL BIOLOGY AND GENETICS(CMZ-208)**

#### **Unit 1**

Genetic code and translation,; triplet code, characteristics of triplet code; protein synthesis(translation)

1. Cell in Reproduction:

- I. Interphase nucleus and cell cycle: S, G-1, G-2 and M-phase.
- II. Mitosis: Phases and process of mitosis, structure and function of spindle apparatus; anaphasic movement.
- III. Meiosis: Phases and process of meiosis, synapses and synaptonemal complex, formation and fate of chiasmata and significance of the crossing over.

#### **Unit 2**

Mendelism: Brief history of genetics and mendel's work; Mendelian laws, their significance and current status; chromosomal theory of inheritance.

#### **Unit 3**

Chomosomal mutations: Classification of chromosomal mutation, translocation, inversion, deletion and duplication. Variations in chromosome numbers; haploidy, diploidy, polyploidy,aneuploidy and polysome.

#### **Unit 4**

1. Linkage and crossing over, elementary idea of chromosome mapping.
2. Genetic interaction: Supplementary genes, complementary genes.

#### **Unit 5**

- 1.Duplicate genes, epistasis, inhibitory and polymorphic genes multiple; ABO blood group and Rh factor and their singnificancs.
- 2.Cytoplasmic inheritance.



## **SEMESTER-II**

### **Paper –III- Developmental Biology-II(CMZ-209)**

#### **Unit 1**

Embryonic adaptations;

- I. Placentation in Mammals: Definition, types, classification on the basis of morphology and histology; functions of placenta.
- II. Extra-embryonic membranes in chick, their development and functions.

#### **Unit 2**

1. Embryonic induction; primary organizer, differentiation and competence;
2. Development of chick up to 96 hours Stage.

#### **Unit 3**

1. Regeneration
2. Various types of stem cells and their applications

#### **Unit 4**

3. Cloning of animals:
  - I. Nuclear transfer technique.
  - II. Embryo transfer technique.

#### **Unit 5**

1. Teratology –( elementary idea)
2. Biology of aging

## **Practical Syllabus**

### **Semester II- Practical Zoology (CMZ-212)**

#### **1. Microscopic Slides & Specimens**

**Porifera:** Leucosolenia, TS of Sycon, Spicules, Spongin Fibers, Gemmules

**Coelentrata:** Millepora, Physalia, Vellela, Auralia, Alcynium, Gorgonia, Penatula, Sea anemone, Stone Corals, Obelia colony and Medusa.

**Ctenophora:** Any ctenophore

#### **2. Anatomy**

**Earthworm:** General viscera and alimentary canal, Reproductive system

**Cockroach:** Appendages (wing and leg), mouth part, alimentary cana;, reproductive system and salivary gland.

#### **3. Permanent preparation and study of the following:**

Hydra, Obelia colony and medusa, Parapodium of Nereis and Heteronereis, Ovary of Earthworm, Nepridia of Earthworm, Setae of Earthworm.

#### **4. Exercise in Genetics:**

a. Study of Drosophila:

b. Study of Permanent prepared slides: sex comb, salivary glands chromosomes

c. Identification of Blood groups (A, B, O and Rh Factor)

#### **5. Development Biology**

Study the development of chick with the help of whole mounts: 18 hrs, 21 hrs, 24 hrs, 33 hrs, 72 hrs and 96 hrs of incubation.



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## SEMESTER-III

### **Paper – I- Structure and Functions of Invertebrate Types (CMZ-307)**

#### **Unit I**

Structure and functional organization of vital system of nonchordates as exemplified by Amoeba, Paramecium, Euglena, Obelia, Sycon, Fasciola, Nereis, Hirudinaria, Palaemon, Lamellidans, Pila and Aseterias:

1. Locomotion: Pseudopodia (Amoeba), ciliary (Paramecium) and flagellar (Euglena); Parapodial (Nereis); Pedal-Muscular foot (Pila) and tube-feet (Asterias).
2. Nervous System : Sensory cells (Obelia); brain ring and longitudinal nerves (Fasciola and Taenia); brain and ventral nerve cord (Nereis, Palaemon); Nervous system of Pila and Lamellidans.

#### **Unit II**

3. Sense-organs: Statocyst and osphradium (Lamellidans and Pila), compound eye (Palaemon) and simple eye (Nereis, Pila); tactile and olfactory organs (Palaemon); Nuchal organs (Nereis).

Food, Feeding, Digestive Structures and Digestion: Autotrophic (Euglena):

Heterotrophic: through food Vacuole (Paramecium) and in hydroid and medusoid zooids (Obelia); Parasitic (Fasciola, Taenia, Hirudinaria); Predatory (Nereis, Palaemon, Asterias); Filter-Feeding (Lamellidans).

#### **Unit III**

1. Respiration: Aquatic : general body surface (Euglena, Nereis, Hirudinaria); dermal bronchioles (Asterias), parapodia (Nereis), gills (Palaemon, Lamellidans, Pila); Aerial: pulmonary sac (Pila), trachea (insect): anaerobic (Fasciola, Taenia).
2. Excretion : General body surface (Protozoa, Sycon, Obelia); protonephridial system and flame cells (Fasciola, Taenia); nephridia (Nereis, Hirudinaria); malpighian tubules (insect); organ of Bojanus (Lamellidans, Pila.)

## **Unit IV**

### Invertebrate Adaptation

1. Salient features of Hemichordata.
2. Evolution of canal system of sponges.

## **Unit V**

3. Parasitic adaptations in Heminths.
4. Social organization in termites and bees.
5. Water vascular system of starfish.

## **SEMESTER-III**

### **Paper – II- Animal Physiology (CMZ-308)**

#### **Unit I**

1. Physiology of Digestion: Nature of food –stuff, various types of digestive enzyme and their digestive action in the alimentary canal.
2. Physiology of Circulation: Composition and function of blood: mechanism of blood clotting; heart beat; cardiac cycle; blood pressure; body temperature regulation.

#### **Unit II**

3. Physiology of respiration: Mechanism of breathing : exchange of gases: transportation of oxygen and carbon dioxide in blood; regulation of respiration.
4. Physiology of Excretion : kinds of nitrogenous excretory endoproducts (ammonotelic, uricotelic and ureotelic); role of liver in the formation of these end products. Functional architecture of mammalian kidney tubule and formation of urine; hormonal regulation of water and electrolyte balance.

#### **Unit III**

5. Physiology of Nerve impulse and reflex action : Functional architecture of a neuron, origin and propagation of nerve impulse, synaptic transmission; spinal reflex arc; central control of reflex action.

#### **Unit IV**

Physiology of Muscle Contraction : Functional architecture of skeletal muscles; chemical and biophysical events during contraction and relaxation of muscle fibers.

## **Unit V**

6. Type of Endocrine Glands, their secretion and function : pituitary, adrenal, thyroid, islets of Langerhans, testis and ovary.
7. Preliminary idea of Neurosecretion : Hypothalamic control of pituitary function neuroendocrine and endocrine mechanism of Insects.

## **SEMESTER-III**

### **1. Paper – III- Biotechnology (CMZ-309)**

#### **Unit-1**

Definition, history, scope and application of biotechnology, major areas of biotechnology (microbial, and animal biotechnology).

#### **Unit-2**

Vectors for gene transfer (plasmids and phages). Basic concepts of animal cell, tissue, organ and embryo culture. Protoplast fusion in prokaryotes and eukaryotes.

#### **Unit-3**

Recombinant DNA technology and hybridomas and their applications. Monoclonal antibodies and their application. Genetic Engineering (outline idea only) application of genetic engineering, hazards and regulations. Transgenic animals, their uses in biotechnology. Brief account of cloning, its advantages and disadvantages.

#### **Unit-4**

Biotechnology in Medicine (outline idea only): P.C.R., antibiotics. Vaccines, enzymes, vitamins, hormones, artificial blood. Environmental biotechnology (outline idea only): Metal and petroleum recovery, pest control, waste-water treatment.

#### **Unit-5**

Food, Drink and Dairy Biotechnology (outline idea only): Fermented food Production; dairy products, alcoholic beverages and vinegar microbial spoilage and food Preservation. Scope of biotechnology based industries and entrepreneurship with particular reference to Rajasthan.

## Practical Syllabus

### Semester III- Practical Zoology(CMZ-312)

#### **1.Study of Museum Specimens :**

Platyhelminthes : Taenia

Aschelminthes : Ascaris

Annelida : Nereis, Heteronereis, Aphrodite, Chaetopterus, Arnicola, Glossiphonia, Pontobdella,  
Polygordius

Onychophora: Peripatus

#### **2. Study of Microscopic slides:**

Platyhelminthes: Planaria, Fasciola, T.S. body of Fasciola, Miracidium, Sporocyst, Redia and  
Cercaria larva of Fasciola, Scolex, T.S. Mature Proglottid of Taenia, Cysticercus.

Aschelminthes: Wuchereria, Dracunculus

Annelida: T.S. Body of Nereis

#### **3. Dissection:**

Prawn : External Features appendages, Alimentary canal and nervous system

#### **4. Animal Physiology:**

- a. Counting of red blood cells in blood sample
- b. Counting of White blood cells in blood sample

#### **5. Biotechnology**

- a. Detection of proteins in animal tissue food sample
- b. identification of different kinds of mono, Di and poly saccharides in the given samples



## **Reference Books:**

1. David R Hyde (2010). Genetics and Molecular biology. Special Indian edition, Tata Mc Graw Hill P.Ltd., New Delhi.
2. Ramawat and Shaily goyal (2010). Molecular biology and Biotechnology. First edition S.Chand & Co.Ltd., New Delhi.
3. Peter Paoella (2010). Introduction to Molecular Biology. First edition, Tata Mc Graw-Hill P. Ltd., New Delhi.
4. Mahabal Ram (2010). Fundamentals of Cytogenetics and Genetics. First edition, PHI Learning P.Ltd., New Delhi.
5. Ajoy Paul (2007). Text Book of Cell and Molecular Biology. First edition, Books Allied (P) Ltd., Kolkata.
6. Peter Snustad D and Michael J Simmons (2003). Principles of Genetics. Third edition, John Wiley and Sons, Inc. publication, New Delhi.
7. Peter J Russel (2002). Genetics. Benjamin Cummings.
8. Robert H Tamarin (2002). Principles of Genetics. Seventh edition, Tata Mc Graw-Hill P. Ltd., New Delhi.
9. David Friefelder (1995). Molecular biology. Narosa publishing house, New Delhi.



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**SEMESTER-IV**

**Paper – I- Structure and functions of chordate types CMZ-407**

**UNIT-I**

Detailed classification of chordata Phylums habits, habitat and external features only of the following prescribed types, viz, Scoliodon Labeo any lung fish, Ichthyophis, Salamander, Frog, Hemidactylus, Naja, Python, Crocodile, Pigeon, Great Indian Bustard, Hare, Camel and Chinkara

**UNIT-II**

1. Comparison of habit, external features and anatomy of Herdmania and Branchiostoma (excluding development).

**UNIT-III**

Ascidian tadpole larva and its metamorphosis. .

**Unit IV**

Affinities of Hemichorata, Urochordata and Cephalochordata.

**Unit V**

Habit, habitat and salient features of Petromyzon; Ammocoete larva.

## **SEMESTER-IV**

### **Paper –II- Biochemistry CMZ-408**

#### **Unit 1**

Carbohydrates: Structure, function and significance, oxidation of glucose through glycolysis, Krebs's cycle and oxidative phosphorylation; elementary knowledge of interconversion of glycogen and glucose in liver, role of insulin.

#### **Unit 2**

Proteins : Structure, function and significance, Essential and nonessential amino acids, transformation of acids, deamination, transamination, decarboxylation, synthesis of protein and urea, fate of ammonia (Ornithine cycle) : fate of carbon skeleton.

#### **Unit 3**

Lipids: Structure, function and significance, Beta-oxidative pathway of fatty acids; brief account of biosynthesis of triglycerides. Cholesterol and its metabolism.

#### **Unit 4**

Catabolism and biosynthesis of nucleotides.

#### **Unit 5**

Mineral Metabolism: Iodine, Iron, Calcium and Zinc.

## SEMESTER-IV

### **Paper – III- Ecology and environmental Biology CMZ-409**

#### **Unit-1**

1. Basic concepts in ecology, its meaning and history.
2. Concepts of limiting factors.
3. Ecosystem: Biotic and abiotic factors.
4. Ecosystem: Production, consumption and decomposition in an ecosystem; concepts of food – chain, food-web, trophic structure, ecological pyramids.

#### **Unit-2**

5. Biogeochemical cycles of O<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O, N, P, and role of microbes.
6. Ecosystem: Its homeostasis, Functional aspects, productivity concepts and its determination, ecotone, edge effects, niche.
7. Population Ecology: density and methods of its measurement, natality, mortality, age ratio and distribution, pyramids, fluctuations, biotic potential, dispersal growth forms, population interaction and propagation, brief idea of demography.

#### **Unit-3**

8. Community Ecology: Characteristics of natural communities, structure, composition, stratification.
9. Ecological Succession: Types and patterns, concept of climax, details of xerosere and hydrosere successions.
10. Habitat Ecology: Brief account of fresh water, marine, terrestrial and estuarine water ecosystems.
11. Major biomes of the world.

#### **Unit-4**

12. Ecology and Human future: Growth rate, role of human kind in modifying natural communities in term of public health and welfare with respect to use of pesticides, conservation and pollution.
1. Environment and its concepts, global environment, hydrosphere, lithosphere and atmosphere.
2. Natural Resources: Present status and future needs.
3. Conservation and management of Natural Resources: Renewable (Forest, wildlife, water) and non-renewable (soil, minerals and energy).

## Unit 5

4. Environmental pollution I: General outline and various types of pollution of water, air and soil.
5. Environmental pollution II: Sources and remedies for noise radiation, industrial chemicals. Agrovbchemicals insecticide pesticides and household pollutants.
6. Green House effect, Ozone layer depletion, El-Nino and La- Nino effects.
7. Radiation and Environment: Types of radiation, fallout, effects of radiation, nuclear accidents.
8. Basic concepts of bioaccumulation, biomagnifications, biodegradation of pollutants.
9. Wildlife Conservation: Vanishing and threatened animals and plants with special reference to Rajasthan.

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### Practical Syllabus

#### Semester IV- Practical Zoology CMZ-412

##### **1. Study of Museum Specimens :**

**Arthropoda:** Limulus, Spider, Scorpion, Centipede, Millipede, Lepas, Balanus, Squilla, Eupagurus, Crab, Mantis, Honey- Bee, Locust, Silk- worm, Moth, Beetle, White grub

**Mollusca :** Chiton, Aplysia, Cypraea, Mytilus, Pearloyster, Dentalium, Loligo, Nautilus

**Echinodermata:** Pentaceros, Echinus, Ophiothrix, Cucumaria, Antedon

**Hemichordata:** Balanoglossus

##### **2. Study of Microscopic slides:**

**Arthropoda:** VS of integument (cuticle) : Pediculus, Bedbug, Termite and its various types, Cyclops, Daphnia, Crustacean Larvae

**Mollusca:** VS shell, TS gill of Pila, Glochidium,

##### **3. Permanent Preparation**

**Hastate Plate and statocyst, of Prawn:** gill- lamella, radula and TS osphradium of Pila.

##### **4. Dissection:**

Pila : External anatomy, pallial organs and nervous system

##### **5. Animal Physiology:**

a. estimation of hemoglobin in blood sample

b. estimation of himatocrite value (PCV) in blood sample

##### **6. Biochemistry:**

a. Detection of carbohydrates and lipids in animal tissue food sample

b. Demonstration of principle of paper chromatography



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**SEMESTER-V**

**Paper – I- Structure and Function of Chordate Types-II (CMZ-507)**

**UNIT-I**

**Comparative Anatomy**

1. Alimentary Canal.
2. Heart and aortic arches.

**UNIT-I I**

**Comparative Anatomy**

1. Respiratory System.
2. Urinogenital system.

**UNIT-III**

1. Pisces: Scales and fins, migration, and parental care.
2. Reptilia : Poisonous and non-poisonous snakes, poison apparatus.

**UNIT-IV**

1. Amphibia : Parental care.
2. Aves: flight adaptations, bird migration.

**UNIT-V**

1. Mammals: Adaptive radiation, dentition.

## **SEMESTER-V**

### **Paper – II- Applied Zoology (CMZ-508)**

#### **Unit I**

Principles and Practices of the following:

1. Vermiculture
2. Sericulture(including Ericulture)
3. Lac culture
4. Apiculture

#### **Unit II**

5. Prawn culture
6. Poultry keeping
7. Pisciculture

#### **Unit III**

Economic Importance of the following

1. Protozoa
2. Corals and coral reefs
3. Helminthes
4. Arthropods
  - I. Crustacean larvae
  - II. Insects and their management.

#### **Unit IV**

1. Introduction and history of Ethology.
2. Concepts of Ethology: Fixed action pattern, sign stimulus, innate releasing mechanism, acton specific, motivation, imprinting and learning.

#### **Unit V**

3. Methods of studying brain behavior: neuranatomical, neurophysiological and neurochemical techniques.
4. Elementary idea of role of pheromones.
5. Societies: Characteristics and advantages with special reference to honey-bee, deer and monkey.

## SEMESTER-V

### **Paper – III Biostatistics (CMZ-509)**

#### **Unit-1**

Introduction scope and application of Biostatistics.

Understanding the concepts of descriptive and inferential statistics.

#### **Unit-2**

Frequency distribution.

#### **Unit-3**

Graphical and tabular presentation of data.

#### **Unit-4**

Mean mode, median and their Significance.

#### **Unit-5**

Standard deviation, Standard error and their Significance.



## Practical Syllabus

### Semester V- Practical Zoology (CMZ-512)

#### **1. Study of Museum Specimens :**

Ascidia, ciona, Botrllus, Ammocoete, Larvae, Petromyzon, Myxine, Zygaena, Torpedo, Chimaeria, Acipenser, Amia, LAbeo, Clarias, Anguilla, Hippocampus, Exocoetus, Echeneis, protopterus, Ichthyophis, Proteus, Ambystoma, Axolotal, Siren, Hyla, Testudo, Chelone, Sphenodon, Hemidatylus, Phrynosoma, Draco, Chameleon, Eryx, Hydrophys, Naja, Viper, Bungarus, Crorodilus, Alligator, Archaeopteryx, Pavocristatus, Chroriotis, Ornithorrhynchus, Tachyglossus, Didelphys, Macropus, Bat, Loris, Scaly Ant-Eater.

#### **2. Study of Microscopic slides:**

Whole Mounts of oral hood, vellum and pharyngeal wall of Amphioxus, TS of Amphioxus through various regions, Tadpole Larvae of Ascidia, Whole mount of Pyrosoma, Salpa, Doliolum, Oikopleura, VS of skin of fish, TS body of fish through various regions, VS skin of birds, VS Mammalian skin, TS mammalian liver, Kidney, Stomach, Intestine, Boon, Spinal cord, Lung, Duodenum, Pancreas, Testis and ovary

#### **3. Permanent Preparation**

Spicules and pharyngeal wall of Herdmania, Placoid Scales and ampulla of Lorenzini of Scoliodon, Striped Muscle fibers

#### **4. Dissection:**

General Viscera, Afferent and Efferent Branchial blood vessels, eye muscles and their innervations, brain, Cranial Nerves and internal ear of **Scoliodon** (In this exercise CAL (computer assisted learning ) may be used with a software compurat)

#### **5. Environmental Biology:**

Analysis of environment :

- a. soil pH
- b. water analysis, pH, Alkalinity, Acidity, Dissolved Oxygen and fee CO<sub>2</sub>
- c. Salinity

#### **6. Ethology:**

- a. study of any stored insect pest
- b. A visit to a Zoo, Museum of natural history and wild life century



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**SEMESTER-I**

**Paper – I- General Microbiology (CMZ-104)**

**Unit-1**

Definition and scope of microbiology- history and recent developments- spontaneous generation- biogenesis contributions of Leeuwenhoek, Louis Pasteur.

**Unit-2**

Microscopy - simple, compound, dark field, phase contrast, Florescence & Electron microscopy.

**Unit-3**

Microbial Evolution and Diversity - Endosymbiotic theory. Binomial nomenclature of Microbes. Classification – Whittaker's five kingdom concept. Difference between prokaryotes and eukaryotes microorganism.

**Unit-4**

Anatomy of prokaryotes - cell wall, cytoplasmic membrane, cilia, flagella, capsule, cytoplasmic inclusions, sporulation.

**Unit-5**

Sterilization - methods of sterilization and Disinfection. Antimicrobial chemotherapy - tests for sensitivity to antimicrobial agents.

## **Reference Books:**

1. Pelczar Jr. M.J. Chan. E.C.S and Kreig. N.R (2006). "Microbiology"- 5th Edition Mc Graw Hill Inc. New York.
2. David, B.D., Delbecco,. R., Eisen, H.N and Ginsburg, H.S (1990) "Microbiology" 5th Edition. Harper & Row, New York.
3. Lansing M. Prescott., John. P. Harley., Donald A, Klein, "Microbiology"-Mc Graw Hill Inc. New York.
4. Robert F.Boyd., "General Microbiology" 2nd Edition., Times MIRROR/Moshy College Publishing Virginia.

# SEMESTER-I

## Paper – II- Bacteriology (CMZ-105)

### Unit 1

#### **Cell organization**

Cell size, shape and arrangement, capsule, flagella, endoflagella, fimbriae and pili.

**Cell-wall:** Composition and detailed structure of gram positive and gram-negative cell walls, Archaeobacterial cell wall, Gram and acid fast staining mechanisms, lipopolysaccharide (LPS).

**Cell Membrane:** Structure, function and chemical composition of bacterial and archaeal cell membranes.

**Cytoplasm:** Ribosomes, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids

**Endospore:** Structure, formation, stages of sporulation.

### Unit 2

#### **Bacteriological techniques**

Pure culture isolation: Streaking, serial dilution and plating methods; cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria.

### Unit 3

#### **Growth and nutrition**

Bacterial growth curve , phases of growth.

Nutritional requirements in bacteria and nutritional categories;

**Culture media:** components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media

### Unit 4

Characteristics of important genera and salient features of the physiology of Archaeobacteria, Parasitic associations of bacteria. *Bdellovibrio* and its interperiplasmic growth cycle. Spirochaetes, Rickettsia and unicellular endospore forming eubacteria.

### Unit 5

Characteristics of important genera and salient aspects of the physiology of

Gram positive fermentative eubacteria. Actinomycetes and related eubacteria, Photosynthetic eubacteria, Chemoautotrophs. Methophilic eubacteria. Gram negative eubacteria. Mycobacteria and other gliding bacteria. Enteric group and related eubacteria. Gram negative anaerobic bacteria. Prosthecate and stalked eubacteria.

### **Text Books:**

1. Salle A.J. Principles of Bacteriology.
2. Brock T.D., Madigan M.T. Biology of microorganisms. Prentice Hall.
3. Pelczar M.J., Chan E.C.S., Kreig N.R. Microbiology. McGraw Hill.
4. Stanier RY, Ingraham J.L., Wheelis M.L., Painter P.R. 1999. General Microbiology. MacMillan Education Ltd., London.
5. Schlegel. General Microbiology. Cambridge University Press, Cambridge.
6. Prescott. Microbiology
4. Priest. Bacterial Taxonomy

# **SEMESTER-I**

## **Paper – III- Biochemistry (CMZ-106)**

### **Unit-1**

Carbohydrates: Definition, classification, and structural concepts of triose, tetraose, pentose and hexose sugars, disaccharides, (sucrose, lactose and maltose). Important derivatives and properties of mono-saccharides (glycosides, sugar acids, deoxysugars, aminosugars). Polysaccharides and glycol-proteins.

### **Unit-2**

Amino acids and peptides; Classification & properties of amino acids (neutral, acidic and basic amino acids), peptide linkage and polypeptides. Proteins: Classification (only function based), primary, secondary and tertiary and quarternary (only domain and subunit) structure; Protein turn over.

### **Unit-3**

Enzymes: general characteristics, nomenclature, classification, enzyme kinetics, Michaelis-Menten equation and Lineuaver Berck Plot, co-enzymes and their function. Competitive, non-competitive and uncompetitive inhibition of enzyme activity. Allosteric inhibition. Outline idea of isozyme, abzyme, ribozyme and zymogen.

### **Unit-4**

Lipids: Nomenclature, classification (only structure based) and properties of different types of lipids. General classification of fatty acids; chemical reactions of saturated and unsaturated fatty acids. Lipid micelles, lipoproteins, liposomes, bilayer formation.

### **Unit-5**

Nucleic acids: Purine, pyrimidine bases, nucleosides and nucleotides. Structure, properties and types of DNA and RNAs.

## **References:**

1. Lehninger principles of biochemistry-david l. Nelson, michael m. Cox, macmillan worth publishers.
2. Harper—s biochemistry-rober k. Murray, daryl k. Grammer, mcgraw hill, lange medical books. 25th edition.
3. Fundamentals of biochemistry-j.l. Jain, sunjay jain, nitin jain, s. Chand & company.
4. Biochemistry-dr. Amit krishna de, s. Chand & co., ltd.
5. Biochemistry-dr. Ambika shanmugam, published by author.
6. Biomolecules-c. Kannan , mjp publishers,chennai-5.

## **SEMESTER-I**

### **Microbiology Practical (CMZ-111)**

1. Sterilization
2. Preparation of Nutrient Agar Media
3. Isolation of microorganism from air
4. Isolation of microorganism from water
5. Pour plate method
6. Streaking plate method
7. Preparation of broth media
8. Spreading plate method
9. Gram staining

## **Reference Books:**

1. K.R. Aneja, Experiments In Microbiology, Plant Pathology And Biotechnology.
2. R.C. Dubey, D.K. Maheshwari , Practical Microbiology, S. Chand & Company Limited.





# SHRI JAGDISHPRASAD JHABARMAL TIBREWALA UNIVERSITY, CHUDELA, JHUNJHUNU (RAJ.)

## SEMESTER-II

### Paper – I- Microbial Physiology (CMZ-204)

#### UNIT-I

Basic concepts of metabolism - Nutritional types of microorganisms uptake of nutrient in to the cell. Transport of nutrients by active and passive ways.

#### UNIT-II .

Metabolism : ATP Cycle, Photophosphorylation, Oxidative phosphorylation, Substrate level phosphorylation. Major metabolic pathways – Glycolysis, Pentose phosphate pathway, EMP , TCA and Glyoxalate cycle.

#### Unit III

Effect of the environment on microbial growth- Temperature- temperature ranges for microbial growth, classification based on temperature ranges and adaptations, pH-classification based on pH ranges and adaptations, solutes and water activity, oxygen concentration, radiation and pressure.

#### Unit IV

Photosynthesis – characteristics and metabolism of autotrophs- photosynthetic bacteria and cyanobacteria - autotrophic CO<sub>2</sub> fixation and mechanism of photosynthesis.

#### Unit V

Methanogens and Methylotrophs. Sulphur utilizing bacteria. Sulphate reduction pathway, Economic importance of Methylotrophs.

## **Reference Books:**

5. Dubey RC and Maheswari DK (2012). A text of Microbiology. Revised edition, S. Chand and Company Ltd., New Delhi.
6. Geeta Sumbali and Mehrotra RS (2009). Principles of Microbiology. First edition, Tata McGraw Hill P.Ltd., New Delhi.
7. Pelczar TR M J Chan ECS and Kreig N R (2006). Microbiology. Tata Mc Graw-Hill INC., New York.
8. Robert F Boyd (1984). General Microbiology. Times mirror / Mosby college publishers.
9. Moat G, John W. Foster and Michael P. Spector (2002). Microbial physiology . Fourth edition, A John Wiley sons, Inc. publication. New Delhi.

## **SEMESTER-II**

### **Paper – II- Virology (CMZ-205)**

#### **Unit 1**

**General Virology:** Brief outline of the discovery of viruses. Virus, their nature, structure, diversity and mode of replication. Isolation, purification & cultivation of viruses. Viral genome. Acellular living entities Viroids and Prions

#### **Unit 2**

**General Methods of Diagnosis and Serology:** Cell cultures. Serological methods- Complement fixation, Immunofluorescence methods, ELISA and radioimmunoassays.

#### **Unit 3**

**Bacterial viruses:** Bacteriophage structure, organization and life cycles (Lysogenic and Lytic). One step growth curve. Eclipse phase. Phage production. Burst size. Bacteriophage typing.

#### **Unit 4**

**Animal Viruses:** Classification and structure of animal and human viruses. Life cycle of RNA viruses: HIV, Picorna and Oncogenic viruses. DNA viruses: Pox and Herpes viruses. Viral vaccines, Interferons and antiviral drugs.

#### **Unit 5**

**Plant viruses:** Classification and nomenclature. Effects of viruses on plants. Life cycle: TMV and Cauliflower Mosaic Virus. Transmission of plant viruses, diagnostic techniques in seeds, seed stocks and diseased plants. Prevention of crop loss due to virus infection. Virus-free planting material. Vector control. Physical and biochemical defense mechanisms in plants against viral pathogens.

## **Reference Books:**

1. Morag C. and Timbury M.C. 1994. Medical virology. X/e. Churchill Livingstone, London.
2. Dimmock N.J., Primrose S.B. 1994. Introduction to Modern Virology.IV/ e. Blackwell Scientific, Oxford.
3. Conrat H.F., Kimball P.C. and Levy J.A. 1994. Virology-III/e. Prentice Hall, New Jersey.
4. Mathews R.E. 1992. Fundamentals of Plant Virology. Academic Press, San Diego.
5. Topley and Wilson 1995. Text book on Principles of Bacteriology, Virology and Immunology. Edward Arnold, London.
6. Lenetter E.H. 1984. Diagnostic procedures for viral and Ricketssial diseases. American Public Health Asso., New York.
7. Hayes W. 1985. The genetics of Bacteria and their viruses. Blackwell Scientific Publishers, London.

## **SEMESTER-II**

### **Paper – III- Microbial Tools & Techniques (CMZ-206)**

#### **Unit-1**

Microscopy – Light, phase contrast, electron, scanning and transmission electron microscopy, staining techniques for light microscopy, sample preparation for electron microscopy.

#### **Unit-2**

Common equipments of microbiology lab and principle of their working – autoclave, oven, laminar air flow, centrifuge.

#### **Unit-3**

Calorimetry and spectrophotometry, Electrophoretic techniques – proteins and nucleic acids, PCR.

#### **Unit-4**

Chromatography techniques: adsorption, partition, ion exchange, gel filtration, TLC, HPLC.

#### **Unit-5**

Cultivation of extraordinary microorganisms, techniques used for identification of microorganisms – biotyping, serotyping, molecular techniques.

### **Reference Books:**

1. R M Atlas, A E Brown, K W Dobra and L Miller. Basic Experimental Microbiology. Prentice Hall.
2. Wilson K. and Walker J. (2008). Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.
3. Nelson D and Cox MM. (2009). Principles of Biochemistry. W.H. Freeman and Company, New York.
4. Talaro K. P. & Talaro A. (2006). Foundations in Microbiology. McGraw-Hill College Dimensi.

**SEMESTER-II**  
**Microbiology Practical (CMZ-211)**

1. Isolation of micro-organisms by serial dilution.
2. Striking, Spreading and staining of micro-organisms
3. Preparation of solutions: Normal, Molar, Molal and ppm
4. Estimation of Chlorophyll
5. Estimation of Phycobilins
6. Estimation of Carotenoids
7. Estimation of Carbohydrates
8. Estimation of Proteins
9. ELISA Test

**Reference Books:**

1. K.R. Aneja, Experiments In Microbiology, Plant Pathology And Biotechnology.
2. R.C. Dubey, D.K. Maheshwari , Practical Microbiology, S. Chand & Company Limited.



# SHRI JAGDISHPRASAD JHABARMAL TIBREWALA UNIVERSITY, CHUDELA, JHUNJHUNU (RAJ.)

## SEMESTER-III

### Paper – I- Environmental Microbiology (CMZ-304)

#### UNIT-I

Soil microorganisms: Types of microbial communities in air, water and soil, microbial diversity: Rhizosphere & phyllosphere. Microbial interaction between microbes – neutralism, commensalism, synergism, mutualism, ammensalism, competition, parasitism and predation. Biogeochemical cycling – Carbon, Nitrogen, Sulphur and Phosphorus.

#### UNIT-II .

Microbiology of air and water – Aeromicrobial pathways – Enumeration of bacteria from air. Nitrogen fixation by symbiotic and non-symbiotic microorganisms. Use of microorganisms as biofertilizers. Mass cultivation of *Rhizobium* and *Azotobacter*. Use of blue-green algae as biofertilizers..

#### Unit III

Liquid waste disposal. Nature of domestic and municipal waste and sewage. Sewage treatments, Solid waste disposal, Methods of disposal of Agricultural waste.

#### Unit IV

Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolve Oxygen (DO), Bioremediation, Environmental Protection Agency (EPA).

#### Unit V

Biodegradation of herbicide & pesticides. Microbial products & plant health: PGPR (plant growth promoting rhizobacteria).

## **Reference Books:**

1. Principles of Biochemistry, Author- A.L. Lehninger
2. Fundamentals of Biochemistry, Author- J. L. Jain
3. Biochemistry, Author- Voet and Voet.
4. Textbook of Biochemistry- S.P. Singh.
5. Biochemistry, Author- Stryer.
6. Introduction to protein structure, Authors- Branden and Tooze.
7. Fundamental Principles of Bacteriology, Author- A.J. Salle.
8. Principles of Biochemistry, Authors – Zubey, Parson and Vance.
9. Microbial Diversity, Author- D. Colwd.
10. Introductory Food Microbiology. Author – H.A. Modi
11. Environmental Microbiology, Author- P.D. Sharma.
12. Environmental Microbiology, Author- K.G. Vijaya.



## **SEMESTER-III**

### **Paper – II- Phycology, Mycology & Protozoology (CMZ-305)**

#### **Unit 1**

General features of fungi. Classification up to class level with their distinctive features. Life cycle of selected fungi (*Aspergillus*, *Penicillium*, Yeasts).

#### **Unit 2**

Nutrition and cultivation of fungi. Structure of fungal cells and growth. Effect of environment on growth. Prevention of fungal growth. Dormancy and reproduction in fungi. Spore diversity. Importance of fungi.

#### **Unit 3**

Algae: General characteristics. Classification up to class level with their distinctive features. Thallus organization. Nutrition, cultivation and reproduction

#### **Unit 4**

Types of life histories. Blooms and toxic algae. Control of algal growth. Importance of algae. Lichens.

#### **Unit 5**

Protozoa: Classification up to class level with their distinctive features. Body coverings and skeletons. Locomotive organelles and locomotion. Nutrition, Reproduction, cultivation. Importance of protozoa.

## **Reference Books:**

1. Burnett J.H. Fundamentals of Mycology. Edwar Arnold, Crane Russak.
2. Charlie M. and Watkinson S.C. The Fungi. Academic Press. Moore E. Landeekeer. The Fundamentals of Fungi. Prentice Hall.
4. Venkataraman G.S., Goyal S.K., Kaushik, B.D. and Rouchoudhary, P. Algae-Form and Function
5. Alexopolous C.J. and Mims C.W. 1979. Introduction to Mycology (3/e). Wiley Eastern, New Delhi.
6. Kotpal R.L. Protozoa.

## **SEMESTER-III**

### **Paper – III- MICROBIAL GENETICS (CMZ-306)**

#### **Unit-1**

Introduction and history of microbial genetics. DNA as a genetic material. Physical structure and chemical composition of DNA -RNA and its types, RNA as a genetic material.

#### **Unit-2**

DNA replication- types and experimental proof of replication-enzymes involved in DNA replication.

#### **Unit-3**

Prokaryotic transcription, translation. Genetic code- regulation of gene expression in prokaryotes - Lac operon.

#### **Unit-4**

Gene transfer mechanisms- transformation, conjugation and transduction. Plasmid- characteristics and types.

#### **Unit-5**

Mutation- types of mutation- molecular basis of mutation- mutagenesis, detection of mutants- Ames test , DNA repair mechanisms .

## **Reference Books:**

1. David R Hyde (2010). Genetics and Molecular biology. Special Indian edition, Tata Mc Graw Hill P.Ltd., New Delhi.
2. Ramawat and Shaily goyal (2010). Molecular biology and Biotechnology. First edition S.Chand & Co.Ltd., New Delhi.
3. Peter Paoella (2010). Introduction to Molecular Biology. First edition, Tata Mc Graw-Hill P. Ltd., New Delhi.
4. Mahabal Ram (2010). Fundamentals of Cytogenetics and Genetics. First edition, PHI Learning P.Ltd., New Delhi.
5. Ajoy Paul (2007). Text Book of Cell and Molecular Biology. First edition, Books Allied (P) Ltd., Kolkata.
6. Peter Snustad D and Michael J Simmons (2003). Principles of Genetics. Third edition, John Wiley and Sons, Inc. publication, New Delhi.
7. Peter J Russel (2002). Genetics. Benjamin Cummings.
8. Robert H Tamarin (2002). Principles of Genetics. Seventh edition, Tata Mc Graw-Hill P. Ltd., New Delhi.
9. David Friefelder (1995). Molecular biology. Narosa publishing house, New Delhi.

## **SEMESTER-III**

### **Microbiology Practical (CMZ-311)**

1. General Microbiological techniques- Spreading, Striking, Spore Staining and Staining
2. Isolation of micro-organisms by serial dilution.
3. Estimating the TDT and TDP of cultures
4. Estimating the TDP of cultures
5. Estimation of BOD content of water sample
6. Estimation of DO Content of water sample
7. Isolation of DNA
8. Estimation of DNA by spectrophotometer
9. Isolation of Protein (SDS-PAGE)

### **Reference Books:**

3. K.R. Aneja, Experiments In Microbiology, Plant Pathology And Biotechnology.
4. R.C. Dubey, D.K. Maheshwari , Practical Microbiology, S. Chand & Company Limited.



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**SEMESTER-IV**

**Paper – I- Immunology (CMZ-404)**

**UNIT-I**

History of immunology- host-parasite relationship – normal flora of human body- host defense mechanism-1<sup>st</sup> , 2<sup>nd</sup> & 3<sup>rd</sup> line of defense. Primary & secondary responses. immunity-innate and acquired immunity , active & passive immunity.

**UNIT-II .**

Structures and functions of cells and organs involved in immune system- spleen, thymus, lymph nodes. Structure and functions of cells involved in immune system- T-cells & B-cells. Humoral and cell mediated immunity.

**Unit III**

Antigens- types, properties-Immunoglobulin's- structure, types and properties- generation of antibodies complement- classical and alternative pathways.

**Unit IV**

Antigen – antibody interactions – reactions – Agglutination – Precipitation - Complement fixation – Hem-agglutination and PHA Immunofluorescence – ELISA – RIA, COOMBS Test.

## Unit V

Hypersensitivity immediate & delayed type- antibody mediated-type 1, type 2 and type 3 - cell mediated- type 4 – Immunohaematology.

### **Reference Books:**

1. Madhavee Latha (2012). A Text book Immunology. First edition, S.Chand & Company Ltd, New Delhi.
2. Annadurai B (2008) . Immunology and Immunotechnology. First edition, S.Chand & Company Ltd., New Delhi.
3. Kannan I (2007). Immunology. First edition, MJP Publishers, Chennai.
4. Kuby Immunology - Richard A Goldsby, Thomas J Kindt. Barbara A Osborne, (2000). Fourth edition, W H Freeman and company. New York.
5. Tizard K (1983). Immunology. An Introduction. Saunders college publishing, Philadelphia.
6. Roitt, IM (1988). Essentials of Immunology. ELBS-Blackwell Scientific Publishers, London.
7. Bashir SF (2011). Text Book of Immunology. First edition, PHI Learning Private limited, New Delhi.

## **SEMESTER-IV**

### **Paper – II- Medical Microbiology (CMZ-405)**

#### **Unit 1**

Pathogen, Pathogenicity, Virulence, Disease, Determinants of infectious diseases-transmissibility, Attachment and colonization, Entry, growth and multiplication, Toxigenicity-Exotoxins and endotoxins.

#### **Unit 2**

Skin infections: Frunucle, Chicken pox, Measles and Herpes simplex.

#### **Unit 3**

Respiratory infections: Diphtheria, Pneumonia, Tuberculosis, Influenza and Rheumatic fever.

#### **Unit 4**

Alimentary infections: Dental plaque, Cholera, Typhoid fever, Giardiasis and Amoebiasis.

#### **Unit 5**

Nervous system infections: Leprosy, poliomyelitis, Rabies and meningitis.

### **Reference Books:**

1. Chakraborty P (2003). A Text book of Microbiology. Second edition, Published by New Central Agency (P) Ltd., Kolkata.



2. Ananthanarayan R and Jayaram Paniker CK (2005). Text Book of Microbiology. Seventh edition, Orient Longman Limited, Hyderabad.
3. Satish Gupte (2005). The Short Textbook of Medical Microbiology. Eighth edition, Jaypee Brothers, Medical publishers (P) Ltd., New Delhi.
4. Baron EJ, Peterson LR and Finegold SM (1994). Bailey and Scotts diagnostic microbiology. 9th edition, Mosby publications.
5. Rajan S (2009). Medical Microbiology. First edition, MJP Publishers, Chennai.
6. Rajesh Bhatia and Ratan Lal Ichhpujani (2004). Essentials of Medical Microbiology. Third edition, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi

## **SEMESTER-IV**

### **Paper – III- Genetic Engineering (CMZ-406)**

#### **Unit-1**

Historical perspectives - Synthetic DNA, DNA amplification technique - PCR.

#### **Unit-2**

Preparation of genomic library, DNA library, gene cloning system, vectors enzymes, expression system.

#### **Unit-3**

Application of genetic engineering in medical field - genetherapy, vaccines preparation, Hybridoma and monoclonal antibody techniques.

#### **Unit-4**

Application in agricultural field - Production of biotechnological products. Food - SCP (algae, yeast, mushrooms, Biopesticide) 'Nif— gene - transfer - development of resistant plant variety.

## **Unit-5**

Application in Pharmaceuticals - antigens, interferons, vaccines, insulin, Social impact of recombinant DNA technology.

### **Reference Books:**

1. Old, R.S. and Primrose, S.B. (1995) Principles of Gene manipulation. An introduction to genetic Engineering. 5th Edition. Blackwell Scientific Publication, London.
2. Click. B.R. and Pasternat J.J. (1994) Molecular Biotechnology. ASM press. Washington DC.
3. Benjamin Lewin (1997) Genes VI, Oxford University Press.

## **SEMESTER-IV**

### **Microbiology Practical (CMZ-411)**

1. General Microbiological techniques- Spreading, Striking and Staining
2. Isolation of micro-organisms by serial dilution.
3. Determining blood group ABO and Rh factor.
4. Immunodiffusion
5. Enzyme assays – amylase, gelatinase, catalase etc
6. Antibiotic sensitivity test by well and disc methods.
7. ELISA
8. Gel Electrophoresis
9. Polymerase Chain Reaction

### **Reference Books:**

5. K.R. Aneja, Experiments In Microbiology, Plant Pathology And Biotechnology.
6. R.C. Dubey, D.K. Maheshwari , Practical Microbiology, S. Chand & Company Limited.



**SHRI JAGDISHPRASAD JHABARMAL TIBREWALA  
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**SEMESTER-V**

**Paper – I- Food & Dairy Microbiology (CMZ-504)**

**UNIT-I**

Food Spoilage – Intrinsic factors and Extrinsic factors. Disease transmission by foods –Food poisoning, Aflatoxins, Botulinum toxin.

**UNIT-II .**

Food preservation –Asepsis, Pasteurization, Canning, Desiccation, Temperature effects.

**Unit III**

Chemical preservation of food-salt and sugar, Organic acids, use of SO<sub>2</sub>, ethylene and propylene. Preservation by radiation.

**Unit IV**

Microorganisms in milk and milk products - yoghurt, cumis - butter and cheese - Quality control of milk – MBRT, Litmus Milk - Phosphatase tests.

## **Unit V**

Fermented alcoholic beverages: Wine and Beer. Bread and Indian fermented foods.

### **Reference Books:**

1. Sivashankar B – Moss (2011). Food Processing and Preservation. Eighth edition, PHI Learning P.Ltd., New Delhi.
2. Vijaya Ramesh K (2007). Food Microbiology. First edition, MJP Publishers, Chennai.
3. Adams MR – Moss (2004). Food Microbiology. Second edition, Panima publishing house New Delhi.
4. Banwart GJ (2004). Basic Food Microbiology. Second edition, CBS Publishers and Distributors, New Delhi.
5. James M Jay (2003). Modern Food Microbiology. Fourth edition, CBS Publishers, New Delhi.
6. Frazier WC and West Hoff DC (1988). Food Microbiology. Fourth edition, Mc Graw Hill, New York.

## **SEMESTER-V**

### **Paper – II- Industrial Microbiology (CMZ-505)**

#### **Unit 1**

Exploitation of microorganisms and their products, screening, strain development strategies, immobilization methods, fermentation media, raw material used in media production, antifoaming agents, buffers, downstream processing.

#### **Unit 2**

Fermentation equipment and its uses, fermentor design, Types of fermentors and fermentations- single, batch, continuous. Balanced & unbalanced, synchronous growth, multiple, surface, submerged and solid state.

#### **Unit 3**

Industrial products from microorganisms- antibiotics: production of penicillin, streptomycin. Interferons, vaccines, hormones, vitamins.

#### **Unit 4**

Enzymes from microbes: amylase, protease. Organic acids: citric acid, acetic acid, amino acids: glutamic acid, lysine.

#### **Unit 5**

Production of alcoholic beverages: beer and wine, biofuels: ethanol, methane, biogas.

### **Reference Books:**

1. Whitaker and Stanbury. Principles of Fermentation Technology.
2. Casida. Industrial Microbiology. Tata McGraw Hill.

## **SEMESTER-V**

### **Paper – III- Computers, Bioinformatics and Biostatistics CMZ-506)**

#### **Unit-1**

Introduction to Computers – classification, computer generation, low, medium and high level languages, software and hardware, operating systems, compilers and interpreters, personal, mini, main frame and super computers, characteristics and application, computer memory and its types, data representation and storage.

#### **Unit-2**

Microsoft excel, data entry, graphs, aggregate functions, formulas and functions, number systems, conversion devices, secondary storage media.

#### **Unit-3**

Overview of bioinformatics, database types, computer tools for sequence analysis, finding and retrieving sequences, similarity searching.

#### **Unit-4**

Nature and scope of statistical methods, compilation, classification, tabulation and applications in life sciences, graphical representation, introduction to probability theory and distributions.

#### **Unit-5**

Correlation and regression – concepts of sampling and sampling distribution, tests of significance based on t, chi square and F for means, variances and correlations. Sampling methods – simple Random, stratified systematic and cluster sampling procedures, analysis of variance.

### **Reference Books:**

1. G W Snedecar and W G Cochran. Statistical Methods. Oxford.
2. R White. How Computers Work. Techmedia.
3. Higgins and Taylor. Bioinformatics. OUP.

## **SEMESTER-V**

### **Microbiology Practical (CMZ-511)**

1. Striking, Spreading and staining of micro-organisms
2. Isolation of micro-organisms by serial dilution.
3. Isolation of root nodulating bacteria.
4. Coliform test
5. MBRT test
6. Phosphatase tests
7. MRVP test
8. Ethanol Production
9. Lipid Estimation from Algae

### **Reference Books:**

7. K.R. Aneja, Experiments In Microbiology, Plant Pathology And Biotechnology.
8. R.C. Dubey, D.K. Maheshwari , Practical Microbiology, S. Chand & Company Limited.