**B.Sc. Biotechnology (Semester-I)**
**BT - 1**
**Zoology–A**

**Theory: 32**
**Practical: 16**
**Internal Assessment: 12**
**Total Marks: 60**

**Theory**

**Time: 3 Hrs** **Maximum Marks: 32**
**Periods/week: 3**

**Note for the paper setters/examiners:**
Each question paper will consist of three sections as follows:
**Section-A:** 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.
**Section-B:** This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 3 marks, total weightage being 15 marks.
**Section-C:** This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 4.5 marks, total weightage being 9 marks.

**Unit – I**

**Digestive System:**
- The alimentary canal and associated glands of man
- Teeth: types, dental formula and function
- Glands: Pancreas, Liver, Gastric glands
- Digestion of dietary constituents, regulation of digestive processes and absorption
- Types of nutrition, feeding mechanisms, extra and intracellular digestion, enzymatic digestion
- Symbiotic digestion

**Unit – II**

**Circulatory System**:
- General plan of circulation in Man
- Evolution of heart
- Origin and regulation of heart beat, cardiac cycle, electrocardiogram
- Cardiac output and fluid pressure
- Composition and functions of blood and lymph, Molecular structure and function of haemoglobin, Blood clotting, blood groups including Rh-factor, Homeostasis, Haemopoiesis

**Unit – III**

**Respiratory System**:
- Respiratory System of Man

- Different kinds of respiratory mechanisms
- Transport of $O_2$ and $CO_2$
- Oxygen dissociation of haemoglobin
- Bohr Effect, Chloride shift and Haldane effect
- Control of breathing

**Unit – IV**

**Integumentary System:**

- Comparative account of integument and its derivatives in mammals

**Books:**


1. Goyal, J.P. (2013). Life Sciences-1. Trueman Book Company, Jalandhar.
2. Kaur, T. et. al., (2007). A textbook of biotechnology, Life Sciences-1. Lakhanpal Publ., Asr.
3. Sobti, R.C. (2005). Introduction to Biotechnology, Part-2, Concepts Tools and Application, Vishal Publishers
4. Sobti, R.C. & Nigam, S.K. (2002). Structural & function biology of chordates, Vishal Publishers, Jalandhar.
5. Sobti, R.C. & Sharma, V.L. (2005). Basics of Biotechnology: Introduction of Life Sciences. Vishal Publishers, Jalandhar.

**B.Sc. Biotechnology (Semester-I)**
**BT-1**

**Zoology–A (Practical)**

**Time: 3 Hrs.** **Max. Marks: 16**
**Periods/week: 4**

**Note. The question paper will be set by the examiner based on the syllabus.**

1. Demonstration of osmosis and diffusion.
2. Demonstrate the presence of amylase in saliva, effect of pH and temperature on denaturation.
3. Determination of blood groups of human blood samples.
4. Recording of blood pressure of man.
5. Estimation of hemoglobin content.
6. **Study of the following prepared slides:** histology of rat/rabbit (compound tissues)

**B.Sc. Biotechnology (Semester-II)**
**BT – 1**
**Zoology–B**

**Theory: 32**
**Practical: 16**
**Internal Assessment: 12**
**Total Marks: 60**

## Theory

**Time: 3 Hrs** **Maximum Marks: 32**
**Periods/week: 3**
**Note for the paper setters/examiners:**
**Each question paper will consist of three sections as follows:**
**Section-A:** 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.
**Section-B:** This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 3 marks, total weightage being 15 marks.
**Section-C:** This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 4.5 marks, total weightage being 9 marks.

### Unit – I

**Urinogenital System:**

- Structure of kidney and nephron
- Strcuture of gonads and urinogenital ducts
- Urine formation
- Water balance in mammals.

### Unit –II

**Endocrine System:**

- Structure and physiology of:
  Thyroid, parathyroid, adrenal, hypothalamus, pituitary, pancreas and gonads of mammals

### Unit –III

**Nervous System:**

- Anatomy of brain and cranial nerves of man
- Nature, origin and propagation of impulse along the axon, synapse and myoneural junctions
- Sense Organs

### Unit –IV

**Skeletal System:**

- Jaw suspension & visceral arches in man
- Muscles (striped, un-striped and cardiac) in man
- Ultrastructure, chemical and physiological basis of skeletal muscle contraction

**Books:**


1. Goyal, J.P. (2013). Life Sciences-1. Trueman Book Company, Jalandhar.
2. Kaur, T. et. al., (2007). A textbook of biotechnology, Life Sciences-1. Lakhanpal Publ., Asr.
3. Sobti, R.C. (2005). Introduction to Biotechnology, Part-2, Concepts Tools and Application, Vishal Publishers
4. Sobti, R.C. & Nigam, S.K. (2002). Structural & function biology of chordates, Vishal Publishers, Jalandhar.
5. Sobti, R.C. & Sharma, V.L. (2005). Basics of Biotechnology: Introduction of Life Sciences. Vishal Publishers, Jalandhar.

**B.Sc. Biotechnology (Semester-II)**
**BT – 1**
**Zoology–B (Practical)**

**Time: 3 Hrs.** **Max. Marks: 16**
**Periods/week: 4**

**Note. The question paper will be set by the examiner based on the syllabus.**

1. To study digestive, arterial, venous and urinogenital systems of rat / rabbit through charts/ models/videos: Digestive, arterial, venous and urinogenital systems.
2. Make a temporary preparation of the following: Blood smear of mammals.
3. Study of the skeleton of *Oryctolagus* (Rabbit) and human.
4. Analysis of urine for urea, chloride, glucose and uric acid

**As per UGC guidelines and instructions, the use of live materials is to be avoided and be replaced with models, simulated dissections and slides.**

**B.Sc. Biotechnology (Semester–III)**
**BT - 2**
**Zoology–C**

**Theory: 32**
**Practical: 16**
**Internal Assessment: 12**
**Total Marks: 60**

## Theory

**Time: 3 Hrs** **Maximum Marks: 32**
**Periods/week: 3**

**Note for the paper setters/examiners:**
Each question paper will consist of three sections as follows:
**Section-A:** 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.
**Section-B:** This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 3 marks, total weightage being 15 marks.
**Section-C:** This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 4.5 marks, total weightage being 9 marks.

### Unit-I

- Introduction to Parasitology (pertaining to various terminologies in use).
- Brief account of Life history, mode of infection and pathogenicity of the following pathogens with reference to man, prophylaxis and treatment:
    - *Entamaeba*
    - *Trypanosoma*
    - *Leishmania*
    - *Giardia*
    - *Trichomonas*
    - *Plasmodium*

### Unit-II

- Histopathological changes in organs in relation to following diseases:
    - liver cirrhosis
    - nephrosis
    - tumor
    - cancer
    - AIDS

### Unit-III

- **Arthropod vectors of human diseases:**
    - Malaria
    - Yellow fever
    - Dengue haemorragic fever
    - Filariasis

    - Plague
    - Epidemic typhus.
- Distribution and control of the above mentioned vectors.

Arthropod vectors of human diseases : Malaria, Yellow fever, Dengue haemorragic fever, Filariasis, Plague and Epidemic typhus. Distribution and control of the above mentioned vectors.

Unit-IV General account of diseases such as AIDS, Hepatitis, typhoid and cholera, their occurence and eradication programmes. General account of drug therapy and drug resistance.

**Unit-IV**

- General account, occurrence and eradication programmes of diseases such as:
    - AIDS
    - Hepatitis
    - Typhoid
    - Cholera
- General account of drug therapy and drug resistance.

**Books:**

1. Chatterjee, K.D Parasitology (Protozoology and Helminthology)
2. Harrison A. (2000). Principles of Medicine
3. Sobti, R.C. (1992) Medical Zoology, Shoban Lal Nagin Chand & Co

**B.Sc. Biotechnology (Semester–III)**

**BT-2**

**Zoology – C Practical**

**Time: 3 Hrs.** **Max. Marks: 16**
**Period/week: 4**

**Note. The question paper will be set by the examiner based on the syllabus.**

1. Preparation of blood smear showing different stages of plasmodium
2. **Study of permanent slides and specimens of parasitic protozoans, helminth and arthropods:**
   Entamoeba, Giardia, Plasmodium, Trypanosoma, Leishmania, Trichomonas, Anopheles, Culex (mouth parts), lice, rat flea, Aedes aegypti, Tapeworm, Ascaris, Wuchereria, Trichinella, Ancylostoma, Oxyuris.
3. Pathological examination of blood and urine.
4. Blood Tests:
   (a) Erythrocyte sedimentation rate
   (b) Bleeding time
   (c) Clotting time
   (d) Prothrombin time

## Cell Biology – A

**Theory: 32**
**Practical: 16**
**Internal Assessment: 12**
**Total Marks: 60**

### Theory

**Time: 3 Hrs** **Maximum Marks: 32**
**Periods/week: 3**
**Note for the paper setters/examiners:**
Each question paper will consist of three sections as follows:
**Section-A:** 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.
**Section-B:** This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 3 marks, total weightage being 15 marks.
**Section-C:** This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 4.5 marks, total weightage being 9 marks.

**Unit - I**

- Cell as a basic unit of living systems.
- The cell theory
- Broad Classification of Cell Types: PPLO's, bacteria, eukaryotic microbes, plant and animal cells.
- A detailed classification of cell types within an organism.
- Cell, tissue, organ and organism as different levels of organizations of otherwise genetically similar cells.

**Unit - II**

- Ecological amplitude of cells in various environments:
    - High altitude, sediments, arctic, hotspring, arid, brackish extremephytes and freshwater.

**Unit - III**

- Extracellular Matrix:
    - Composition
    - Molecules that mediate cell adhesion
    - Membrane receptors for extra cellular matrix
    - Regulation of receptor expression and function.
- Signal transduction: General considerations of Cell-matrix and cell - cell interactions

**Unit-IV**

- Biological Membranes: Supramolecular architecture of membranes
- Solute transport across membranes
- Model membranes and Liposomes.

**Books Recommended:**

1. De-Robertis, F.D.P. and De-Robertis Jr. E.M.F. (1991) Cell and Molecular Biology, Saunders, Philadelphia.

2. Geoffrey, M. (2000). The Cell: A molecular approach 2nd Edition, ASM Press.
3. Lodish, H. Baltimore, D., Berk, A., Zipursky, S.L., Matsudaira, P. and Darnell, J. (1995). Molecular Cell Biology 3rd Edition, Scientific American Books Inc.

**B.Sc. Biotechnology (Semester–III)**

**BT-4**

**Cell Biology – A Practical**

**Time: 3 Hrs.** **Max. Marks: 16**
**Periods/week: 4**

**Note. The question paper will be set by the examiner based on the syllabus.**

**I. Microscopy:**

(a) Principles of compound, phase contrast, electron microscopy.

(b) Use and care of Light compound microscope.

**II. Study of Cells:**

(a) Prokaryotic cells: *Lactobacillus, E. coli*. Blue green algae.

(b) Eukaryotic cells: Testicular material (for studies of spermatogenesis)

**III. Study of electron micrographs of various cell organelles-**

Plasma membrane, Mitochondria, Golgi complex, Lysosomes, Endoplasmic Reticulum (smooth and granular), Cilia, Centrioles, inclusions like glycogen, lipids, etc.

**Books Recommended:**


1. Celis, J.E. (1998) Cell Biology: A Laboratory handbook. Vol. 1-3. Academic Press, UK.
2. Shah, V.C., Bhatavdekar, J., Chinoy, N.J. and Murthy, S.K. (1988). Essential techniques in Cell Biology. Anand Book Depot, Ahemadabad.

**B.Sc. Biotechnology (Semester–IV)**
**BT - 4**
**Cell Biology – B**

**Theory: 32**
**Practical: 16**
**Internal Assessment: 12**
**Total Marks: 60**

**Theory**

**Time: 3 Hrs** **Maximum Marks: 32**
**Periods/week: 3**

**Note for the paper setters/examiners:**
Each question paper will consist of three sections as follows:
**Section-A:** 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.
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**Section-C:** This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 4.5 marks, total weightage being 9 marks.

**Unit - I**

**Structure and function of cell organelles**:

- ultrastructure of Cell membrane
- Cytosol
- Golgi bodies
- Endoplasmic reticulum (rough and smooth)
- Ribosomes
- Cytoskeletal structures (actin, microtubules etc.)

**Unit-II**

**Structure and function of cell organelles:**

- Mitochondria
- Chloroplasts
- Lysosomes
- Peroxysomes
- Nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin).

**Unit - III**

**Cell Division and Cell Cycle:**

- Amitosis and its regulation
- Mitosis
- Meiosis
- Stages of cell cycle, binary fission
- Cell-cell interaction
- Cell locomotion (amoeboid, flagellar and ciliar).

## Unit – IV

**Cell Senescence and Death:** Apoptosis and necrosis
**Cell Differentiation in Plants and Animals:** Totipotent, multipotent, pleuripotent cells.
**Precellular Evolution:** artificial creation of "cells"

**Books Recommended:**


1. 1. De-Robertis, F.D.P. and De-Robertis Jr. E.M.F. (1991) Cell and Molecular Biology, Saunders, Philadelphia.
2. Geoffrey, M. (2000). The Cell: A molecular approach 2nd Edition, ASM Press.
3. Lodish, H. Baltimore, D., Berk, A., Zipursky, S.L., Matsudaira, P. and Darnell, J. (1995). Molecular Cell Biology 3rd Edition, Scientific American Books Inc.

**B.Sc. Biotechnology (Semester–IV)**

**BT-4**

**Cell Biology – B Practical**

**Time: 3 Hrs.** **Max. Marks: 16**
**Periods/week: 4**

1. **Microtomy:**

   Introduction of the instrument- its use, care, section cutting and stretching.

2. **Preparation of Permanent Slides:**

   Principles and procedures- Section cutting of tissues and staining of tissues with Haematoxylin/eosin method.

3. **Study of permanent slides of various tissues:**

   Gut region, liver, lung, spleen, kidney, pancreas, testis, ovary, tongue, skin etc.

**Books Recommended:**


1. Celis, J.E. (1998) Cell Biology: A Laboratory handbook. Vol. 1-3. Academic Press, UK.
2. Shah, V.C., Bhatavdekar, J., Chinoy, N.J. and Murthy, S.K. (1988). Essential techniques in Cell Biology. Anand Book Depot, Ahemadabad