

## **SYLLABUS FOR B.Sc. ZOOLOGY (SEMESTER PATTERN)**

### **(With effect from the academic year 2018-19)**

The semester pattern syllabus for B.Sc. Three Year Degree Course in the Subject - Zoology comprises of six semesters. Each semester is based on six theory periods and six practical periods per week. The examination of each semester shall comprise of one theory papers each of three hours duration and carries 100 marks and a practical of 4 hours duration carries 30 marks. Internal assessment for each semester based on one theory papers of 20 marks shall be conducted by departmental teaching staff. Candidates are expected to pass separately in theory and practical examination.

|                  | <b>Semester wise Theory Papers and Practicals</b>   | <b>Theory Marks</b> | <b>Internal Assessment</b> | <b>Practical Marks</b> | <b>Total Marks</b> |
|------------------|---|---------------------|----------------------------|------------------------|--------------------|
| <b>Sem - I</b>   | <b>Theory Paper - I :-</b><br>Life and Diversity of Animals-Nonchordates<br><br><b>Practical - I</b><br>(Based on Paper I)            | <b>100</b>          | <b>20</b>                  | <b>30</b>              | <b>150</b>         |
| <b>Sem - II</b>  | <b>Theory Paper - II :-</b><br>Life and Diversity of Animals- chordates<br><br><b>Practical - II</b><br>(Based on Paper II)           | <b>100</b>          | <b>20</b>                  | <b>30</b>              | <b>150</b>         |
| <b>Sem - III</b> | <b>Theory Paper - III :-</b><br>Cell Biology and environmental Biology<br><br><b>Practical - III</b><br>(Based on Paper III)          | <b>100</b>          | <b>20</b>                  | <b>30</b>              | <b>150</b>         |
| <b>Sem - IV</b>  | <b>Theory Paper - IV :-</b><br>Genetics and Molecular Biology<br><br><b>Practical - IV</b><br>(Based on Paper IV)                     | <b>100</b>          | <b>20</b>                  | <b>30</b>              | <b>150</b>         |
| <b>Sem - V</b>   | <b>Theory Paper - V :-</b><br>Developmental Biology<br><br><b>Practical - V</b><br>(Based on Paper V)                                 | <b>100</b>          | <b>20</b>                  | <b>30</b>              | <b>150</b>         |
| <b>Sem - VI</b>  | <b>Theory Paper - VI :-</b><br>Animal Physiology, Bioinformatics & Biostatistics.<br><br><b>Practical - VI</b><br>(Based on Paper VI) | <b>100</b>          | <b>20</b>                  | <b>30</b>              | <b>150</b>         |

**Shiksha Mandal's**  
**Jankidevi Bajaj College of Science, Wardha**  
**(An Autonomous College)**  
**Department of Zoology**  
**Syllabus for B.Sc. Zoology (Semester Pattern)**  
**Credit Based System**  
**Academic Session 2018-19**

**B.Sc. Semester I**

**Paper I: Life and Diversity of Animals – Non Chordates**

**UNIT - I** **(12 Periods)**

- 1.1 Animal Kingdom - Classification – Flow diagram of classification upto major phylum with few characters and examples
- 1.2 Protozoa - General Characters & Locomotion
- 1.3 Paramecium - Structure
- 1.4 Malaria - Causative organism & its Life cycle

**UNIT - II** **(12 Periods)**

- 2.1 Porifera - General Characters
- 2.2 Canal system in Sponges - Brief account
- 2.3 Coelenterata - General characters, Polymorphism in Coelenterata
- 2.4 Corals & Coral reef formation, Economic importance of corals

**UNIT - III** **(12 Periods )**

- 3.1 Helminthes - General characters, Platyhelminthes & Aschelminthes
- 3.2 Taenia - Morphology, Ascaris Morphology,
- 3.3 Annelida - General characters & Metamerism
- 3.4 Leech - Morphology, Genital system

**UNIT - IV** **(12 Periods )**

- 4.1 Arthropoda - General characters and vision in Arthropoda
- 4.2 Crustacean Larvae - Nauplius, Zoea, Megalopa
- 4.3 Mollusca - General characters & Torsion in Gastropoda
- 4.4 Pearl formation in Mollusc, Molluscan Larvae

**UNIT - V** **(12 Periods )**

- 5.1 Echinodermata - General characters, Echinoderm Larvae
- 5.2 Asterias - External features, Water vascular system & Locomotion
- 5.3 Hemichordata - General characters, Phylogeny
- 5.4 *Balanoglossus* - External features, Affinities of Balanoglossus

## Unit VI

(12 Periods )

- 6.1 Parasitism - Concept, Parasite Protozoa – Entamoeba, Leshmania
- 6.2 Parasitic Helminthes Adaptation
- 6.3 Taeniasis, Life cycle, Taenia, Ascariasis, Ascaris Life cycle
- 6.4 Vector - Biological & Mechanical, Insect vector, Housefly

### PRACTICAL – I Based on Life and Diversity of Animals – Nonchordates

#### 1. Study of museum specimens (Classification of animals up to orders)

- I. Protozoa (Slides) :- *Paramoecium*, *Euglena*, *Amoeba*, *Plasmodium vivax*
- II. Porifera :- *Sycon*, *Leucosolenia*, *Hyalonema*, *Euplectella*,
- III. Coelenterata :- *Obelia*, *Aurelia*, *Tubipora*, *Adamsia*
- IV. Platyhelminthes :- *Planaria*, *Fasciola*, *Taenia*
- V. Aschelminthes :- *Ascaris*, *Wuchereria*
- VI. Annelida :- *Aphrodite*, *Nereis*, *Hirudinaria*
- VII. Arthropoda :- *Peripatus*, *Daphnia*, *Limulus*, *Scolopendra*, Moth
- VIII. Mollusca :- *Chiton*, *Pila*, *Mytilus*, *Octopus*
- IX Echinodermata :- *Asterias*, *Holothuria*, *Echinus*
- X. Hemichordata :- *Balanoglossus*,

#### 2. Study of Permanent Slides

Sponge spicules, T.S. *Sycon*, Redia and Cercaria larvae of *Fasciola*, T.S. male and female *Ascaris*, Scolex of *Taenia*,

Nauplius, Zoea of Arthropoda, Glochidium larva of Mollusca, T.S. of arm of star fish, Bipinnaria larva, T.S. *Balanoglossus* through proboscis

#### 3. Anatomical observation / demonstration & detail explanation of Digestive and reproductive system of Cockroach through ICT tools / Models / Charts / Photography

#### 4. Whole mount preparation of or Study of permanent preparation of Pila Gill lamella *Obelia* colony, *Nereis* parapodia, with the help of already available permanent slides / ICT tools / Charts / Photographs

#### 5. Local Biodiversity in J.B. Campus (Invertebrates) field visit and diary or visit to National park & sanctuary & submission of tour report.

**Distribution of Marks –****Total Marks 30**

|   |    |
|---|----|
| 1. Identification and Comment on Spots<br>(7 Museum specimens + 3 slides) | 10 |
| 2. Anatomical observation through ICT tools (Dissection)                  | 04 |
| 3. Permanent stained preparation (through ICT tools)                      | 03 |
| 4. Submission of certified practical record                               | 05 |
| 5. Submission of Slides & tour diary                                      | 04 |
| 6. Viva voce  | 04 |

**B.Sc. Semester I ( List of Recommended Books )****Life and Diversity of Animals – Non Chordates**

1. Barnes – Invertebrate Zoology (Halt-Saunders international) Philadelphia, USA
2. Barradaile L.A. & Potts F.A. – The Invertebrate
3. Nigam – Biology of Nonchordates
4. Kotpal, Agrawal & Khetrapal – Modern Text Book of Zoology - Invertebrates, Rastogi Publication, Meerut
5. Puranik P.G. & Thakur R.S. – Invertebrate Zoology
6. Majupuria T.C. – Invertebrate Zoology
7. Dhami & Dhami – Invertebrate Zoology
8. Parker & Hashwell, Textbook of Zoology Vol. I (Invertebrates) A.Z.T.B.S. Publishers & Distributors, New Delhi
9. Dr. S.S. Lal Practical Zoology Invertebrates 9<sup>th</sup> edition, Rastogi Publication Meerut
10. EJW Barrington– Invertebrate Structure and Function ELBS III Edition
11. R.L. Kotpal – Phylum Protozoa to Echinodermata (series), Rastogi and Publication, Meerut
12. Parker J. and Haswell W. – Text Book of Zoology, ELBS Edition
13. Vidyarthi – Text Book of Zoology, Agrasia Publishers, Agra
14. Invertebrate Zoology – Jorden & Varma

15. Jordan E.L. and Verma P.S. – Chordate Zoology, S. Chand and Co., New Delhi
16. Ayer E. – Manual of Zoology
17. M.D. Bhatia – The Indian Zoological Memories – Leech
18. Beni Prasad – The Indian Zoological Memories – Pila
19. P. K. Gupta – Vermicomposting for Sustainable Agriculture, Agrobios India Ltd
20. A manual of Practical Zoology Invertebrates – P. S. Verma
21. Barnes – Invertebrate Zoology (Halt-Saunders international) Philadelphia, USA
22. Barradaile L.A. & Potts F.A. – The Invertebrate
23. Nigam – Biology of Nonchordates
24. Kotpal, Agrawal & Khetrapal – Modern Text Book of Zoology - Invertebrates, Rastogi Publication, Meerut
25. Puranik P.G. & Thakur R.S. – Invertebrate Zoology
26. Majupuria T.C. – Invertebrate Zoology
27. Dhami & Dhami – Invertebrate Zoology
28. Parker & Hashwell, Textbook of Zoology Vol. I (Invertebrates) A.Z.T.B.S. Publishers & Distributors, New Delhi
29. Dr. S.S. Lal Practical Zoology Invertebrates 9<sup>th</sup> edition, Rastogi Publication Meerut
30. EJW Barrington– Invertebrate Structure and Function ELBS III Edition
31. R.L. Kotpal – Phylum Protozoa to Echinodermata (series), Rastogi and Publication, Meerut
32. Parker J. and Haswell W. – Text Book of Zoology, ELBS Edition
33. Vidyarthi – Text Book of Zoology, Agrasia Publishers, Agra
34. Jordan E.L. and Verma P.S. – Chordate Zoology, S. Chand and Co., New Delhi
35. Ayer E. – Manual of Zoology
36. M.D. Bhatia – The Indian Zoological Memories – Leech
37. Beni Prasad – The Indian Zoological Memories – Pila
38. P. K. Gupta – Vermicomposting for Sustainable Agriculture, Agrobios India Ltd
39. A manual of Practical Zoology Invertebrates – P. S. Verma

## B.Sc. Semester II

### Paper II: Life and Diversity of Animals – Chordates

#### UNIT - I (12 Periods)

- 1.1 Chordata – Origin, Phylogenetic Tree of Evolution- animals
- 1.2 Protochordata: General Characters and Classification with examples
- 1.3 *Herdmania* : Structure, Ascidian tadpole and retrogressive metamorphosis
- 1.4 *Branchiostoma* : External Characters and Sense organs

#### UNIT - II (12 Periods)

- 2.1 Agnatha :- Agnatha concept and Affinities
- 2.2 General Characters of Cyclostomata : *Petromyzon* and *Myxine*
- 2.3 Class Pisces: Origin, General features of *Chondrichthyes* and *Osteichthyes*,
- 2.4 Origin of paired fins in fishes ; Migration in fishes-Types, causes, and significance

#### UNIT - III (12 Periods)

- 3.1 Accessory respiratory organs in fishes
- 3.2 Osmoregulation in Fishes
- 3.3 Class Amphibia : Origin, General features and Classification with examples
- 3.4 Parental care and Neotony in Amphibia.

#### UNIT - IV (12 Periods)

- 4.1 Class Reptilia- Origin, General features and classification
- 4.2 Classification based on temporal vacuities
- 4.3 Snakes : General Characters, Poisonous and Non-Poisonous snakes,
- 4.4 Biting mechanism in snakes, Poison apparatus, snake venom properties

#### UNIT - V (12 Periods)

- 5.1 Class Aves– Origin, General features and Classification
- 5.2 Comparison of Ratitae and Caranitae
- 5.3 Flight adaptations ; Flightless Birds : Origin and general characters with examples
- 5.4 Migration in birds

## Unit VI

(12 Periods)

- 6.1 Class Mammalia – Origin, General characters of Prototheria, Metatheria and Eutheria with type
- 6.2 Adaptive radiations in mammals
- 6.3 Comparative account of Heart in Fishes, Amphibian, Reptiles, Birds and Mammals
- 6.4 Urinogenital systems in Mammals

### PRACTICAL - II Based on Life and Diversity of Animals –Chordates

#### Identification, Classification, Distinguishing Characters and Adaptive features of

|                 |   |
|-----------------|---|
| Urochordata     | :- Herdmania, Salpa, Doliolum                                   |
| Cephalochordata | :- Amphioxus  |
| Cyclostomata    | :- Petromyzon, Myxine   |
| Pisces          | :- Pristis, Torpedo, Exocoetus, Clarius,                        |
| Amphibia        | :- Ichthyophis, Bufo, Salamander                                |
| Reptilia        | :- Chameleon, Draco, Tortoise, Cobra, Russel's Viper, Rat Snake |
| Birds           | :- Owl, Kingfisher, Duck, Parrot                                |
| Mammals         | :- Squirrel, Bat, Loris, Rabbit                                 |

#### 2. Study of skeleton of Rabbit

#### 3. Dissection of the locally available culturable fish -

- i. Digestive system
- ii. Brain

#### 4. Study of permanent slides

Amphioxus through Gonad, V.S. of Skin of fish, V.S. of Skin of frog, V.S. of skin reptiles, V.S. skin of Bird, V.S. of skin of mammals with the help available permanent slides/ ICT tools / Charts / Photographs

#### 5. Permanent stained micro preparation:

Fish scales – Placoid / cycloid / ctenoid / striated muscle with the help available permanent slides/ ICT tools / Charts / Photographs

#### 6. Local Biodiversity in J.B. Campus (Chordates) field visit and diary or visit to National park & sanctuary & submission of tour report.

| <b>Distribution of Marks -</b>  | <b>Total Marks 30</b> |
|---|-----------------------|
| 1. Identification and comment on spots<br>( 5 Museum specimens, 2slides, 3 bones) | 10                    |
| 2. Dissection (through ICT tools)   | 04                    |
| 3. Permanent stained Preparation  | 03                    |
| 4. Submission of certified practical record                                       | 05                    |
| 5. Submission of slides & Field diary   | 04                    |
| 6. Viva voce  | 04                    |

### **List of Recommended Books :-**

#### **Life and Diversity of Animals -Chordates**

1. T. B. of Zoology vol II – Parker & Haswell
2. T. B. of Vertebrate Zoology - S. N. Prasad
3. Chordate Zoology – E. L. Jorden and P. S. Verma
4. Vertebrate Zoology –Vishwanath
5. Zoology of Chordates – Nigam H. C.
6. Phylum: Chordata – Newman H.H.
7. Biology of Vertebrates –Walter & Sayles
8. The Vertebrate Body –Romer A. S.
9. Comparative Anatomy of the Vertebrates - Kingslay J. D.
10. The Biology of Amphibia –Noble G. K.
11. Snakes of India – Gharpura K. G.
12. Life of Mammals – Young J.Z.
13. Vertebrates – Kotpal R. L.
14. Introduction to Chordates - Majupuria T.C.
15. Vertebrate Zoology – Dhami & Dhami
16. T. B. Vertebrate Zoology – Agrawal
17. Protochordates – Chatterjee & Pandey
18. Protochordates – Bhatia
19. T. B. of Chordates – Bhamrah and Juneja
20. Chordate Anatomy - Arora M.P.
21. The Chordates – Alexander.
22. Practical Zoology Vertebrates – Dr.S. S. Lal, Rastogi Publication, Meerut
23. A manual of Practical Zoology Vertebrates –P. S. Verma



## **B.Sc. Semester – III**

### **Paper – III (Cell Biology & Environmental Biology)**

#### **UNIT – I (12 Periods)**

- 1.1 Ultrastructure of Prokaryotic and Eukaryotic Cell
- 1.2 Plasma Membrane: Structure- Fluid Mosaic Model and Functions
- 1.3 Endoplasmic Reticulum: Types, Ultrastructure and Functions
- 1.4 Golgi Complex: Ultrastructure and Functions

#### **UNIT – II (12 Periods)**

- 2.1 Ultrastructure Of Mitochondria & functions
- 2.2 Ribosome: Structure, Types, Lake's Model and Functions.
- 2.3 Lysosome: Structure, Polymorphism and Functions .
- 2.4 Nucleus: Ultrastructure of Nuclear Membrane, Structure and Functions of Nucleolus

#### **UNIT – III (12 Periods)**

- 3.1 Heterochromatin. Euchromatin
- 3.2 Chromosome: Structure and Types.
- 3.3 Giant Chromosomes: Lamp-Brush and Polytene Chromosome.
- 3.4 Structure of Nucleosome.

#### **UNIT - IV (12 Periods)**

- 4.1 Peroxisomes : Structure and Function.
- 4.2 Microtubules.
- 4.3 Microfilaments.
- 4.4 Mitosis , Meiosis (Different Phases and Significance)

#### **UNIT – V (12 Periods)**

- 5.1 Somatic Cell Division: Cell Cycle, Check points of Cell Cycle
- 5.2 Elementary Idea of Cancer
- 5.3 Types of Stem Cell
- 5.4 Introduction to Animal Cell Culture.

#### **UNIT - VI (12 Periods)**

- 6.1 Concept & Types of Ecosystem
- 6.2 Structure of Ecosystem: Abiotic factors and Biotic factors; Producer, Consumer , Decomposer.
- 6.3 Food Chain , Food web; Ecological Pyramids.
- 6.4 Concept of Biodiversity; Hot Spots of Biodiversity.

## Practical III Based on Cell Biology & Environmental Biology :-

### Section – A (Practical based on Cell Biology)

1. Principle and working of microscope.
2. Use of Ocular Micrometer and Measurement of micro objects.
3. Study of Slide of Prokaryotic Cell & Eukaryotic Cell .
4. Study of Osmosis in any Cell
5. Identification of Stages of Mitosis
6. Principles and Working of Centrifuge
7. Isolation, Separation of Cell Organelle – Nucleus Mitochondria.
8. ATC Laboratory set up.
9. Primary Cell culture.
10. Lymphocyte Separation.
11. Cell Count
12. Cell Viability

### Section B (Practical based on Environmental Biology)

1. Estimation of Dissolved oxygen in water samples.
2. Estimation of free CO<sub>2</sub> in water samples
3. Study of Pond ecosystem – Producer, Consumer and Decomposer
4. Identification of common animals in your surroundings and classification based on Trophic Level (Producer, Consumer and Decomposer) Preparation of Diary

| <b>Distribution of Marks –</b> |  | <b>Total Marks 30</b> |
|--------------------------------|--|-----------------------|
| 1.                             | Identification and comment on spots<br>( 3 Cell Biology, 1Environmental Biology) | 04                    |
| 2.                             | Experiment on Cell Biology   | 06                    |
| 3.                             | Experiment on Environmental Biology  | 04                    |
| 4.                             | Experiment of Cell Viability   | 03                    |
| 5.                             | Submission of certified practical record   | 05                    |
| 6.                             | Submission of Field diary  | 04                    |
| 7.                             | Viva voce  | 04                    |

## **Reference Books on :-**

### **Cell Biology**

1. C.B. Powar, Cell Biology – Himalaya Publication, New Delhi
2. Dr. S.P. Singh, Dr. B.S. Tomar – Cell Biology 9th revised edition, Rastogi Publication, Meerut
3. Gupta P.K. – Cell and Molecular Biology, Rastogi Publication, Meerut
4. Veer BalaRastogi – Introduction to Cell Biology, Rastogi Publication, Meerut
5. Gerald Karp – Cell and Molecular Biology-Concepts and Experiments, John Wiley, 2007
6. De-Robertis – Cell Biology
7. Verma and Agrawal– Concepts of Cell Biology
8. Dowben– Cell Biology
9. Witt – Biology of Cell
10. Ambrose and Eastyr – Cell Biology
11. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology – P.S.Verma&V.K.Agrawal.
12. Ecology – odum

## B.Sc. Semester IV

### Paper IV - Genetics and Molecular Biology

#### UNIT - I

(12 Periods)

- 1.1 Mendelian Principles: Mendel and his experiments with pea plant. Law of segregation: Monohybrid cross, back cross and test cross. Dominance and Recessive, Law of Independent Assortment: Dihybrid cross in Pea plant and *Drosophila*.
- 1.2 Interaction of genes- Chromosome theory of inheritance, Epistasis-dominant and recessive, codominance, incomplete dominance.
- 1.3 Linkage and crossing over - Chromosome theory of Linkage, kinds of linkage, mechanism of Meiotic Crossing over, significance of Crossing over.
- 1.4 Cytoplasmic inheritance- *Kappa* particles in *Paramecium*, CO<sub>2</sub> sensitivity in *Drosophila*, Extra nuclear inheritance: (mitochondria).

#### UNIT - II

(12 Periods)

- 2.1 Chromosomal variation in Number: ( Euploidy, Aneuploidy- Monosomes, Nullisomes and Trisomes) Disorders related to chromosomal number- Turner syndrome, Klinefelter syndrome and Down syndrome.
- 2.2 Chromosomal aberrations: Deletion, Duplication, Inversion, Translocation, Position Effect, Centromeric & Non-centromeric breaks in chromosomes. (Chronic Myeloid Leukemia (CML) and Burkitt's Lymphoma.
- 2.3 Introduction and Types of Gene mutations (Spontaneous and induced mutations) - Base substitution, Frame shift mutation (insertion, deletion, missense, nonsense mutation)
- 2.4 Mutagens - Physical, chemical and biological.

#### UNIT - III

(12 Periods)

- 3.1 Human karyotype and its applications
- 3.2 Amniocentesis and it's applications with examples
- 3.3 Population genetics: Basic concepts in population genetics, Genetic Drift, Hardy Weinberg equilibrium and its significance
- 3.4 Ames test.

#### UNIT - IV

(12 Periods)

##### (Introduction to Molecular biology)

- 4.1 Chemical Basis of Heredity: DNA as genetic material, Experiments of Griffith.
- 4.2 DNA Composition & Structure
- 4.3 RNA types and structure.
- 4.4 Fine structure of the Gene: Cistron, muton and recon.

## UNIT – V

(12 Periods)

- 5.1 Meselson– Stahl Experiment ,
- 5.2 DNA Replication in prokaryotes
- 5.3 Transcription in prokaryotes.
- 5.4 Genetic code: Nirenberg and Matthaei experiment, Khurana Experiment, Wobbles Hypothesis.

## UNIT – VI

(12 Periods)

- 6.1 Translation in Prokaryotes.( activation of amino acids, transfer of activated amino acids to tRNA, Initiation, elongation and termination of polypeptide chain.)
- 6.2 Eukaryotic vs. Prokaryotic gene structure..
- 6.3 Regulation of Gene expression in prokaryote
- 6.4 Operons – Lactose and Repressible operon – Tryptophan

### Practical based on Genetics and Molecular Biology and Immunology

#### Section A : Genetics –

1. Study of Monohybrid and Dihybrid ratio
2. Study of Normal Human Karyotype ( Normal male and female)
3. Study of characters and Karyotypes of Syndrome like Down, Klinefelter & Turner
4. Field survey of Genetic traits in Human being and Submission of Diary
5. *Drosophila* culture: Media preparation and handling of flies
6. Study of *Drosophila* life cycle and its external morphology.
7. Study of *Drosophila* mutants.

#### Section B: Molecular Biology and Immunology

##### Molecular Biology :

1. Introduction to basic laboratory instruments and equipment's - Autoclave, pH meter, Electrophoresis apparatus; Molar and normal solutions calculations
2. Isolation of DNA (Genomic DNA from any available source) by phenol extraction method or any other method.
3. Quantification of Isolated DNA using Spectrophotometer.
4. Principles and Working of PCR.
5. Thin Layer Chromatography.

(Note: PCR and TLC has to be introduced as its basic technique required in research)

| Distribution of Marks – |  | Total Marks 30 |
|-------------------------|--|----------------|
| 1.                      | Identification and comment on spots<br>( 2 Genetics, 2 Molecular Biology & Immunology) | 04             |
| 2.                      | Experiment on Genetics   | 06             |
| 3.                      | Experiment on Molecular Biology & Immunology   | 06             |
| 4.                      | Submission of certified practical record   | 05             |
| 5.                      | Submission of Field diary  | 05             |
| 6.                      | Viva voce  | 04             |

## **Reference Books:**

### **Genetics & Molecular Biology**

1. Genetics & Genetic Engineering – Joshi
2. Genetic Engineering & its applications – Joshi
3. Genetics – Gardener
4. Genetics – Winchester
5. Genetics – Gupta
6. Principles of Genetics – Sinnott Dunn, Dobzansy
7. Genetics – Ahluwalia
8. Genetics – Sarin
9. Elementary Genetics – Singleton
10. General Genetics – SRb, Owen & Edger
11. Genetics – Alenberg
12. Foundation of Genetics – Pai
13. Genetics - Strickberger
14. T. B. of Genetics- Veerbala Rastogi
15. Gene VI by Benjamin Lewis, Oxford press
16. Gene VIII by Benjamin Lewis, Oxford press
17. Genetics Vol. I and II by Pawar C. B., Himalaya publication

## **Molecular Biology**

1. Cell and Molecular Biology by De Robertis- E. D. P., I. S. E. publication
2. Molecular Biology by Turner P. C. and McLennan , Viva Books Pvt. Ltd
3. Advanced Molecular Biology by Twyman R. M., Viva Books Pvt. Ltd
4. Molecular Biology by Freifelder D., narosa publication House
5. Molecular Biology of Gene by Watson J. D. et. al., Benjamin publication
6. Molecular Cell Biology by Darnell J. Scientific American Books USA
7. Molecular Biology of the Cell by Alberts B., Bray D. Lewis J., garland publishing Inc
8. Essentials of Molecular Biology by Freifelder D., narosa publication House
9. Molecular Cell Biology by Laodish H., Berk A., Zipursky S. L., Matsudaira P. Baltimore D. and Darnell J., W. H. Freeman and Co.
10. The Cell: Molecular Approach by Cooper G. M.
11. Molecular Biology by Upadhay A and Upadhay K. Himalaya publication
12. Molecular cell Biology by Bamrach
13. Cell and Molecular Biology by P.K. Gupta