

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

CURRICULUM FOR ZOOLOGY

IN UNDER GRADUATE DEGREE PROGRAMME CBCS SYLLABUS SCHEDULE 2016 – 2017

MAHATMA GANDHI UNIVERSITY

Year	Semester	Paper	Code	Course Type*	Title of the Paper	No. of Credits	No. of hours per week	Exam Hrs.	Max. Marks			
									I.A	End Exam	Total	
I	I	I	BS105	DSC-2A Theory	Animal Diversity-Invertebrates	4	4	2	20	40	60	
				DSC-2A Practical	Animal Diversity-Invertebrates	1	2	2	-	40	40	
	II	II	BS205	DSC-2B Theory	Ecology, Zoogeography and Animal Behavior	4	4	2	20	40	60	
				DSC-2B Practical	Ecology, Zoogeography and Animal Behavior	1	2	2	-	40	40	
				BS301	SEC-1	SEC	2	2	2	10	40	50
II	III	III	BS305	DSC-2C Theory	Animal Diversity-Vertebrates and Developmental Biology	4	4	2	20	40	60	
				DSC-2C Practical	Animal Diversity-Vertebrates and Developmental Biology	1	2	2	-	40	40	
				BS401	SEC-2	SEC	2	2	2	10	40	50
	IV	IV	BS405	DSC-2D Theory	Cell Biology, Genetics and Evolution	4	4	2	20	40	60	
				DSC-2D Practical	Cell Biology, Genetics and Evolution	1	2	2	-	40	40	
III			BS501	SEC-3	SEC	2	2	2	10	40	50	
			BS502	GE-1 Theory	Generic Elective	2	2	2	20	40	60	
	V	V	BS504	DSC-2E Theory	Physiology and Biochemistry	3	3	2	20	40	60	
				DSC-2E Practical	Physiology and Biochemistry	1	2	2	-	40	40	
	VI	VI	BS507	DSE-2E (A, B, C) Theory	Applied Zoology/ Entomology/Sericulture	3	3	2	20	40	60	
				DSE-2E (A, B, C) Practical	Applied Zoology/ Entomology/Sericulture	1	2	2	-	40	40	
				BS601	SEC-4	SEC	2	2	2	10	40	50
				BS602	GE-2 Theory	Generic Elective	2	2	2	20	40	60
	VII	VII	BS604	DSC-2F Theory	Immunology and Animal Biotechnology	3	3	2	20	40	60	
				DSC-2F Practical	Immunology and Animal Biotechnology	1	2	2	-	40	40	
		VIII	VIII	BS607	DSE-2F (A, B, C) Theory	Aquatic Biology/Public Health and Hygiene / Poultry Science	3	3	2	20	40	60
					DSE-2F (A, B, C) Practical	Aquatic Biology / Public Health and Hygiene / Poultry Science	1	2	2	-	40	40
							48	48				920

*DSC – Discipline Specific Course, DSE – Discipline Specific Elective, GE – Generic Elective, SEC – Skill Enhancement Course

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. ZOOLOGY MODEL PAPER
ZOOLOGY – CORE / ELECTIVE PAPER**

Time: 3 hrs

Max. Marks: 40

**Section- I (Marks: 8x2=16 Marks)
Answer any TWO of the following
Draw labeled diagrams wherever necessary**

1.

or

.....

2.

or

.....

**Section- II (Marks: 4x4=16)
Answer any FOUR of the following
(Minimum One from each Unit)**

3.

4.

5.

6.

7.

8.

**Section- III (Marks: 8x1=8)
Answer EIGHT from the following
(TWO from each Unit)**

9.

10.

11.

12.

13.

14.

15.

16.

17.

18.

19.

20.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. I Year
I - SEMESTER**

**Discipline Specific Course, Paper – I
[Code: BS105; Course Type DSC 2A]
Animal Diversity – Invertebrates**

Periods: 60

Max. Marks: 40

UNIT – I

(15 Periods)

1.1 Brief history of Invertebrates

- 1.1.1 Kingdom Animalia
- 1.1.2 Brief history of Invertebrates

1.2 Protozoa

- 1.2.1 General characters
- 1.2.2 Classification up to classes with examples
- 1.2.3 Type study - *Elphidium*
- 1.2.4 Life cycle of *Plasmodium*.
- 1.2.5 Locomotion, Reproduction and Diseases

1.3 Porifera

- 1.3.1 General characters
- 1.3.2 Classification of Porifera up to classes with examples
- 1.3.3 Type study - *Sycon*
- 1.3.4 Canal system in sponges and Spicules.

UNIT – II

(15 Periods)

2.1. Cnidaria

- 2.1.1 General characters
- 2.1.2 Classification of Cnidaria up to classes with examples
- 2.1.3 Type study - *Obelia*
- 2.1.4 Polymorphism in hydrozoa
- 2.1.5 Corals and coral reef formation

2.2 Platyhelminthes

- 2.1.1 General characters
- 2.1.2 Classification of Platyhelminthes up to classes with examples
- 2.1.3 Type study- *Schistosoma*

2.3 Nematelminthes

- 2.3.1 General characters
- 2.3.2 Classification of Nematelminthes up to classes with examples
- 2.3.3 Type study - *Dracunculus*
- 2.3.4 Parasitic Adaptations in Helminthes

UNIT – III

(15 Periods)

3.1 Annelida

- 3.1.1 General characters
- 3.1.2 Classification of Annelida up to classes with examples
- 3.1.3 Type study - *Hirudinaria granulosa*.
- 3.1.4 Evolutionary significance of Coelome and Coelomducts and metamerism

3.2 Arthropoda

- 3.2.1 General characters
- 3.2.2 Classification of Arthropoda up to classes with examples
- 3.2.3 Type study - Prawn
- 3.2.4 Mouth parts of Insects
- 3.2.5 Insect metamorphosis
- 3.2.6 *Peripatus* - Structure and affinities

UNIT – IV

(15 Periods)

4.1 Mollusca

- 4.1.1 General characters
- 4.1.2 Classification of Mollusca up to classes with examples
- 4.1.3 Type study - *Pila*
- 4.1.4 Pearl formation
- 4.1.5 Torsion and detorsion in gastropods

4.2 Echinodermata

- 4.2.1 General characters
- 4.2.2 Classification of Echinodermata up to classes with examples
- 4.2.3 Water vascular system in star fish
- 4.2.4 Echinoderm larvae and their significance

4.3 Hemichordata

- 4.3.1 General characters
- 4.3.2 Classification of Hemichordata up to classes with examples
- 4.3.3 *Balanoglossus* - Structure and affinities

Suggested Readings

1. L.H. Hyman 'The Invertebrates' Vol I, II and V. – M.C. Graw Hill Company Ltd.
2. Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. E.L. Jordan and P.S. Verma 'Invertebrate Zoology' S. Chand and Company.
4. R.D. Barnes 'Invertebrate Zoology' by: W.B. Saunders CO., 1986.
5. Barrington. E.J.W., 'Invertebrate structure and Function' by ELBS.
- 6 P.S. Dhami and J.K. Dhami. Invertebrate Zoology. S. Chand and Co. New Delhi.
7. Parker, T.J. and Haswell 'A text book of Zoology' by, W.A., Mac Millan Co. London.
8. Barnes, R.D. (1982). *Invertebrate Zoology, V Edition*

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B.Sc. I Year

ZOOLOGY PRACTICAL SYLLABUS FOR I SEMESTER

Discipline Specific Course, Paper – I

[Code: BS105; Course Type DSC 2A]

ANIMAL DIVERSITY - INVERTEBRATES

Periods: 30

Max. Marks: 40

1. Study of museum slides / specimens / models (Classification of animals up to orders)

- i. **Protozoa:** *Amoeba*, *Paramecium*, *Paramecium* Binary fission and Conjugation, *Vorticella*, *Entamoeba histolytica*, *Plasmodium vivax*
- ii. **Porifera:** *Sycon*, *Spongilla*, *Euspongia*, *Sycon* - T.S & L.S, Spicules, Gemmule
- iii. **Coelenterata:** *Obelia* – Colony & Medusa, *Aurelia*, *Physalia*, *Velella*, *Corallium*, *Gorgonia*, *Pennatula*
- iv. **Platyhelminthes:** *Planaria*, *Fasciola hepatica*, *Fasciola* larval forms – Miracidium, Redia, Cercaria, *Echinococcus granulosus*, *Taenia solium*, *Schistosoma haematobium*
- v. **Nemathelminthes:** *Ascaris*(Male & Female), *Dracunculus*, *Ancylostoma*, *Wuchereria*
- vi. **Annelida:** *Nereis*, *Aphrodite*, *Chaetopterus*, *Hirudinaria*, Trochophore larva
- vii. **Arthropoda:** *Cancer*, *Palaemon*, *Scorpion*, *Scolopendra*, *Sacculina*, *Limulus*, *Peripatus*, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female *Anopheles* and *Culex*, Mouthparts of Housefly and Butterfly.
- viii. **Mollusca:** *Chiton*, *Pila*, *Unio*, *Pteredo*, *Murex*, *Sepia*, *Loligo*, *Octopus*, *Nautilus*, Glochidium larva
- ix. **Echinodermata:** *Asterias*, *Ophiothrix*, *Echinus*, *Clypeaster*, *Cucumaria*, *Antedon*, Bipinnaria larva
- x. **Hemichordata:** *Balanoglossus*, Tornaria larva

2. Dissections:

Prawn: Appendages, Digestive system, Nervous system, Mounting of Statocyst
Insect Mouth Parts

3. Laboratory Record work shall be submitted at the time of practical examination

4. An “**Animal album**” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

5. Computer aided techniques should be adopted – show virtual dissections

Suggested manuals:

1. Practical Zoology- Invertebrates S.S. Lal
2. Practical Zoology - Invertebrates P.S. Verma
3. Practical Zoology - Invertebrates K.P. Kurl

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**B.Sc. I Year
ZOOLOGY PRACTICAL SYLLABUS FOR I SEMESTER
Discipline Specific Course, Paper – I
[Code: BS105; Course Type DSC 2A]
ANIMAL DIVERSITY - INVERTEBRATES**

Time: 2 Hrs.

Max. Marks: 40

1. Identification, labeled diagram and salient features of spots: (7 Museum specimens + 2 slides)	18
2. Dissection (one) (Diagram -02 + Dissection & Display-05)	07
3. Field Visit & Note Book	04
4. Project Work	03
5. Certified practical record	03
6. Animal Album	03
7. Viva voce	02

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B.Sc. I Year

II - SEMESTER

Discipline Specific Course, Paper – II

[Code: BS205; Course Type DSC 2B]

Ecology, Zoogeography and Animal Behavior

Periods: 60

Max. Marks: 40

UNIT – I

(15Periods)

1.1 Ecology - I

- 1.1.1 Ecosystem structure and functions.
- 1.1.2 Types of Ecosystems –Aquatic and Terrestrial.
- 1.1.3 Biogeochemical cycles - Nitrogen, Carbon, Phosphorus and Water.
- 1.1.4 Energy flow in ecosystem.
- 1.1.5 Food chain, food web and ecological pyramids.
- 1.1.6 Animal Associations - Mutualism, commensalism, parasitism, competition, predation.

UNIT – II

(15 Periods)

2.1 Ecology – II

- 2.1.1 Concept of Species, Population dynamics and Growth curves.
- 2.1.2 Community Structure and dynamics and Ecological Succession.
- 2.1.3 Ecological Adaptations.
- 2.1.4 Environmental Pollution – Sources, Effect and Control measures of Air, Water, Soil and Noise pollution,
- 2.1.5 Wildlife conservation - National parks and Sanctuaries of India, Endangered species.
- 2.1.6. Biodiversity and hotspots of Biodiversity in India.

UNIT – III

(15 Periods)

3.1 Zoogeography

- 3.1.1 Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities
- 3.1.2 Wallace line, Discontinuous distribution
- 3.1.3. Continental Drift

UNIT – IV

(15 Periods)

4.1 Animal Behaviour

- 4.1.1 Types of Behaviour- Innate and Acquired, Instinctive and Motivated behaviour
- 4.1.2 Taxes, Reflexes, Tropisms
- 4.1.3 Physiology and phylogeny of learning, trial and error learning, Imprinting, habituation, Classical conditioning, Instrumental conditioning
- 4.1.5 Social behavior, Communication, Pheromones

4.1.6 Biological rhythms, Biological clocks, Circadian rhythms

Suggested Readings

M.P.Arora, '*Ecology*' Himalaya Publishing company.

P.D.Sharma, '*Environmental Biology*'.

P.R.Trivedi and Gurdeep Raj. '*Environmental Ecology*'

Buddhadev Sarma and Tej Kumar, '*Indian Wildlife Threats and Preservation*

Chapman J.L. and Reiss M.J, '*Ecology Principles and Applications*', Second Ed., Cambridge University Press, London.

Benny Joseph, '*Environmental Studies*', TATA McGraw Hill Com., New Delhi.

Eugene P. Odum, '*Fundamentals of Ecology*' Third Ed., Nataraj Publishers, Dehradun.

Veer Bala Rastogi, "Ecology and Animal Distribution"

P.K. Gupta, "Text Book of Ecology and Environment"

Bhatnagar and Bansal, "Ecology and Wildlife biology"

Dasmann, "Wild life Biology"

Reena Mathur, "Animal Behaviour"

Alocock, "Animal Behaviour- an Evolutionary Approach"

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B.Sc. I Year

B.Sc. PRACTICAL SYLLABUS FOR II SEMESTER

Discipline Specific Course, Paper – II

[Code: BS205; Course Type DSC 2B]

Ecology, Zoogeography and Animal Behavior

Periods: 30

Max. Marks: 40

1. Determination of pH of Soil and Water
2. Estimation of salinity (chlorides) of water in given samples.
3. Estimation of Carbonates and bicarbonates in the given water samples.
4. Estimation of dissolved oxygen of pond water, sewage water and effluents.
5. Identification of Zooplankton from a nearby water body.
6. Study of Pond Ecosystem / local polluted site - Report submission
7. Study of at least 3 endangered or threatened wild animals of India through photographs / specimens / models
8. Field visit to Zoo Park to study the management, behavior and enumeration of wild animals.
9. Identification of Zoogeographical realms from the Map and identify specific fauna of respective regions.
10. Observe the response of invertebrates in different lightening conditions

Computer aided techniques should be adopted as per UGC guide lines.

Suggested manuals

1. **Robert Desharnais, Jeffrey Bell**, 'Ecology Student Lab Manual, Biology Labs'
2. **Darrell S Vodopich**, 'Ecology Lab Manual'

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**B.Sc. I Year
PRACTICAL MODEL PAPER FOR II SEMESTER
Discipline Specific Course, Paper – II
[Code: BS205; Course Type DSC 2B]
Ecology, Zoogeography and Animal Behavior**

Time: 2 Hrs.

Max. Marks: 40

1. Identification, labeled diagram and salient features of Spots: (06 spots)	12
2. Estimation of dissolved oxygen of a pond,	09
3. Identify any Five Zooplankton in a given water samples	05
4. Field Visit & Note Book	04
5. Project Report	04
6. Certified practical record	04
7. Viva voce	02

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III - SEMESTER

Discipline Specific Course, Paper – III

[Code: BS305; Course Type DSC 2C]

Animal Diversity- Vertebrates and Developmental Biology

Periods: 60

Max. Marks: 40

UNIT – I

(15 Periods)

1.1. Urochordata, Cephalochordata, Cyclostomata

- 1.1.1. Salient features of Urochordata
- 1.1.2. Retrogressive metamorphosis and its significance in Urochordata
- 1.1.3. Salient features and affinities of Cephalochordata
- 1.1.4. General characters of Cyclostomata
- 1.1.5. Comparison of the *Petromyzon* and *Myxine*
- 1.1.6. General characters and classification of Chordata upto orders with examples.

1.2. Pisces

- 1.2.1. General characters of Fishes
- 1.2.2. Classification of fishes up to order level with examples
- 1.2.3. *Scoliodon* – Respiratory, Circulatory and Nervous system.
- 1.2.4. Types of Scales and types of Fins

UNIT – II

(15 Periods)

2.1. Amphibia

- 2.1.1. General characters of Amphibians
- 2.1.2. Classification of Amphibians up to orders with examples.
- 2.1.3. *Rana tigrina* - Respiratory, Circulatory and Nervous system.
- 2.1.4. Parental care in amphibian; neoteny and paedogenesis.

2.2 Reptilia

- 2.2.1. General characters of Reptilia
- 2.2.2. Classification of Reptilia up to orders with examples
- 2.2.3. *Calotes* – Respiratory system, Circulatory and Nervous system.
- 2.2.4. Temporal fosse in reptiles and its evolutionary importance
- 2.2.5. Distinguished characters of Poisonous and Non poisonous snakes.
- 2.2.6. Rhynchocephalia.

UNIT – III

(15 Periods)

3.1. Aves

- 3.1.1. General characters of Aves
- 3.1.2. Classification of Aves up to orders with examples.
- 3.1.3. *Columba livia* -, Digestive system, Circulatory systems, Respiratory system and

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Nervous system.

3.1.4. Migration in Birds

3.1.5. Flight adaptation in Birds

3.2. Mammalia

3.2.1. General characters of Mammalia

3.2.2. Classification of Mammalia up to orders with examples

3.2.3. Rabbit –Digestive, Respiratory, Circulatory and Nervous system.

3.2.4. Dentition in mammals.

3.2.5. Aquatic adaptations in Mammals.

UNIT – IV

(15 Periods)

4.1 Developmental Biology and Embryology

4.1.1 Gametogenesis (Spermatogenesis and Oogenesis)

4.1.2 Fertilization

4.1.3 Types of eggs

4.1.4 Types of cleavages

4.1.5 Development of Frog up to formation of primary germ layers

4.1.6 Formation of Foetal membrane in chick embryo and their functions

4.1.7 Types and functions of Placenta in mammals

4.1.8 Regeneration in Turbellaria and Lizards

Suggested Readings:

1. **E.L.Jordan and P.S. Verma** '*Chordate Zoology*' -. S. Chand Publications.
2. **Mohan P.Arora.** '*Chordata – I*, Himalaya Publishing House Pvt.Ltd.
3. **Marshal, Parker and Haswell** '*Text book of Vertebrates*'. ELBS and McMillan, England.
4. **Alfred Sherwood Romer.** Thomas S. Pearson '*The Vertebrate Body*, Sixth edition, CBS college Publishing, Saunders College Publishing
5. **George C. Kent, Robert K. Carr.** *Comparative Anatomy of the Vertebrates*, 9th ed. McGraw Hill.
6. **Kenneth Kardong** *Vertebrates: Comparative Anatomy, Function and Evolution*, 4th ed, 'McGraw Hill.
7. **J.W. Young**, *The Life of Vertebrates*, 3rd ed, Oxford University press.
8. **Harvey Pough F, Christine M. Janis, B. Heiser**, *Vertebrate Life*, Pearson, 6th ed, Pearson Education Inc.2002.

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B.Sc. II Year

ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER

Discipline Specific Course, Paper – III

[Code: BS305; Course Type DSC 2C]

Animal Diversity- Vertebrates and Developmental Biology

Periods: 30

Max. Marks: 40

Study of museum slides / specimens / models (Classification of animals up to orders)

1. **Protochordata:** *Amphioxus*, *Amphioxus* T.S. through pharynx
2. **Cyclostomata:** *Petromyzon*, *Myxine*, *Ammocoetus larva*
3. **Pisces:** *Sphyrna Pristis*, *Torpedo*, *Channa*, *Pleuronectes*, *Hippocampus*, *Exocoetus*, *Echieneis*, *Labeo*, *Catla*, *Clarius*, *Auguilla*, *Protopterus*, Scales: Placoid, Cycloid, Ctenoid
4. **Amphibia:** *Ichthyophis*, *Amblystoma*, *Siren*, *Hyla*, *Rachophous*, *Bufo*, *Rana*, Axolotal larva
5. **Reptilia :** *Draco*, *Chamaeleon*, *Gecko*, *Uromastix*, *Vipera russelli*, *Naja*, *Bungarus*, *Enhydrina*, *Typhlops*, *Testudo*, *Trionyx*, *Crocodylus*, *Ptyas*.
6. **Aves:** *Archaeopteryx*, *Passer*, *Psittacula*, *Bubo*, *Alcedo*, *Columba*, *Corvus*, *Pavo*; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down
7. **Mammalia:** *Ornithorhynchus*, *Tachyglossus*, *Pteropus*, *Funambulus*, *Manis*, *Loris*, Hedgehog

Histology: T.S. of Liver, Pancreas, Kidney, Stomach, Intestine, Lungs Artery, Vein, Bone T.S., Spinal cord.

Osteology :

1. Rabbit – Axial skeleton system (bones of Skull and Vertebral Column)
2. Varanus, Pigeon and Rabbit – Appendicular skeleton system (bones of limbs and girdles)

Dissections of *Labeo/Tilapia*:

1. Digestive system.
2. Brain, Weberian ossicles
3. V, VII, IX, X cranial nerves

Embryology

1. Study of T.S. of Testis and Ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8, 16 cell stages); Morula, Blastula
3. Study of chick embryos of 18 hours, 24 hours, 33 hours and 48 hours of incubation

Laboratory Record work shall be submitted at the time of practical examination

An “**Animal album**” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

Computer aided virtual dissections.

Suggested manuals

1. **S.S.Lal**, Practical Zoology – Vertebrata
2. **P.S.Verma**, A manual of Practical Zoology – Chordata
3. **Freeman & Bracegirdle**, An atlas of embryology

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B.Sc. II Year

ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER

Discipline Specific Course, Paper – III

[Code: BS305; Course Type DSC 2C]

Animal Diversity- Vertebrates and Developmental Biology

Time: 2 Hrs.

Max. Marks: 40

1. Identification, labeled diagram and salient features of spots: (6 Museum specimens + 2 slides)	16
2. Osteology (02 Spots)	04
3. Dissection (one) (Diagram -02 + Dissection & Display-05)	07
4. Embryology (02 Spots)	04
5. Certified practical record	04
6. Animal Album	03
7. Viva voce	02

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**B.Sc. II Year
IV - SEMESTER**

**Discipline Specific Course, Paper – IV
[Code: BS405; Course Type DSC 2D]
Cell Biology, Genetics & Evolution**

Periods: 60

Max. Marks: 40

UNIT – I

(15 Periods)

1. Cell Biology

- 1.1. Cell theory, Differences of Prokaryotic and Eukaryotic cells
- 1.2. Ultrastructure of animal cell
- 1.3. Structure and functions of plasma membrane proteins.
- 1.4. Structure and functions of cell organelles –
Endoplasmic reticulum, Golgi body, Ribosomes, Lysosomes, centrosomes, Mitochondria and Nucleus
- 1.1.5 Chromosomes – Structure, types, giant chromosomes
- 1.1.6 Cell Division - Mitosis, Meiosis.
- 1.1.7. Cell cycle and its regulation.

UNIT – II

(15 Periods)

2. Molecular Biology

- 2.1 DNA (Deoxyribo Nucleic Acid) - Structure
- 2.2 RNA (Ribo Nucleic Acid) - Structure, types
- 2.3 DNA Replication
- 2.4 Protein Synthesis – Transcription and Translation
- 2.5 Gene Expression – Genetic Code; operon concept
- 2.6 Molecular Biology Techniques- Polymerase Chain Reaction, Electrophoresis

UNIT – III

(15 Periods)

3. Genetics

- 3.1 Mendels laws of Inheritance and Non-Medelian Inheritance
- 3.2 Linkage and Crossing over
- 3.3. Sex determination and sex-linked inheritance
- 3.4 Chromosomal Mutations- Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy.
- 3.5. Gene mutations- Induced versus Spontaneous mutations.
- 3.6. Inborn errors of metabolism.
- 3.7. One gene one enzyme, one gene one polypeptide theory.

UNIT – IV

(15 Periods)

4. Evolution

- 4.1. Theories of evolution – Lamarckism and Neo-Lamarckism, Darwinism and Neo-Darwinism, Modern synthetic theory.
- 4.2. Evidences of Evolution and Hardy Weinberg Law.
- 4.3. Forces of Evolution – mutation, gene flow, genetic drift, and natural selection.
- 4.4. Isolation – Pre-mating and post mating isolating mechanisms
- 4.5. Speciation: Methods of speciation - Allopatric and sympatric
- 4.6. Causes and Role of Extinction in Evolution.

Suggested readings

1. **Lodish, Berk, Zipursky, Matsudaria, Baltimore, Darnell** '*Molecular Cell Biology*' W.H. Free man and company New York.
2. **Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008).** *Principles of Genetics*. VIII Edition. Wiley India.
3. **Snustad, D.P., Simmons, M.J. (2009).** *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
4. **Klug, W.S., Cummings, M.R., Spencer, C.A. (2012).** *Concepts of Genetics*. X Edition. Benjamin Cummings.
5. **Russell, P. J. (2009).** *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings.
6. **Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.** *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
7. **Ridley, M. (2004).** *Evolution*. III Edition. Blackwell Publishing
8. **Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007).** *Evolution*. Cold Spring, Harbour Laboratory Press.
9. **Hall, B. K. and Hallgrimsson, B. (2008).** *Evolution*. IV Edition. Jones and Bartlett Publishers
10. **Campbell, N. A. and Reece J. B. (2011).** *Biology*. IX Edition, Pearson, Benjamin, Cummings.
11. **Douglas, J. Futuyma (1997).** *Evolutionary Biology*. Sinauer Associates.
12. **Minkoff, E. (1983).** *Evolutionary Biology*. Addison-Wesley.
13. **James D. Watson, Nancy H. Hopkins** '*Molecular Biology of the Gene*'
14. **Jan M. Savage.** *Evolution*, 2nd ed, Oxford and IBH Publishing Co., New Delhi.
15. **Gupta P.K.,** '*Genetics*'

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

B.Sc. II Year

ZOOLOGY PRACTICAL SYLLABUS FOR III SEMESTER

Discipline Specific Course, Paper – IV

[Code: BS405; Course Type DSC 2D]

Cell Biology, Genetics and Evolution

Periods: 30

Max. Marks: 40

I. Cytology

1. Preparation and Identification of slides of Mitotic divisions with onion root tips
2. Preparation and Identification of different stages of Meiosis in Grasshopper Testes
3. Identification and study of the following slides
 - i). Different stages of Mitosis and Meiosis
 - ii) Lamp brush and Polytene chromosomes

II. Genetics

1. Problems on Genetics - Mendelian inheritance, Linkage and crossing over, Sex linked inheritance

III. Evolution

1. Museum Study of Fossil animals: *Peripatus*, *Coelacanth Fish*, *Dipnoi fishes*, *Sphenodon*, *Archeopteryx*.
2. Study of homology and analogy from suitable specimens and pictures
3. Problems on Hardy-Weinberg Law
4. Macroevolution using Darwin finches (pictures)

Laboratory Record work shall be submitted at the time of practical examination

An “**Album**” containing photographs, cut outs, with appropriate write-up about Genetics and Evolution.

Computer aided techniques should be adopted as per UGC guide lines.

Suggested manuals

Manual of laboratory experiments in cell biology Edward, G.

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B.Sc. II Year

B.Sc. PRACTICAL MODEL PAPER FOR IV SEMESTER

Discipline Specific Course, Paper – IV

[Code: BS405; Course Type DSC 2D]

Cell Biology, Genetics and Evolution

Time:2 Hrs.

Max. Marks: 40

1. Identification, labeled diagram and salient features of spots: (06 spots)	12
2. Prepare and Identify Mitotic divisions with onion root tips:	08
3. One Problem from Genetics	05
4. One Problem from Evolution	05
5. Certified practical record	05
6. Album	03
7. Viva voce	02

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

B.Sc. III Year

V - SEMESTER

Discipline Specific Course, Paper – V

[Code: BS504; Course Type DSC 2E]

Physiology and Biochemistry

Periods: 45

Max. Marks: 40

UNIT – I Physiology

(15 Periods)

1.1 Digestion

- 1.1.1 Digestion definition and extra and intracellular digestion.
- 1.1.2 Digestion of Carbohydrates, Proteins, Lipids and Cellulose.
- 1.1.3 Absorption and Assimilation of digested food; role of Gastrointestinal hormones in digestion

1.2 Respiration

- 1.2.1 Definition of Respiration and Respiratory mechanisms – External, Internal and cellular.
- 1.2.2 Respiratory Pigments; Transport of oxygen, Oxygen dissociation curves. Bohr's effect.
- 1.2.3 Transport of CO₂ – Chloride shift; Regulation of respiration – nervous and chemical

1.5.1 Circulation

- 1.3.1 Types of circulation - Open and Closed circulation
- 1.3.2 Structure of Mammalian Heart, Types of hearts – Neurogenic and Myogenic; Heart function – Conduction and regulation of heart beat.
- 1.3.3 Regulation of Heart rate – Tachycardia and Bradycardia; Blood Clotting mechanism

1.4. Excretion

- 1.4.1 Classification of Animals on the basis of excretory products- Ammonotelic, Uricotelic, Ureotelic
- 1.4.2 Structure and function of Nephron.
- 1.4.3 Urine formation, Counter current mechanism.

UNIT – II Physiology

(15 periods)

2.1. Muscle Contraction

- 2.1.1 Types of Muscles
- 2.1.2 Ultra structure of skeletal muscle fibre
- 2.1.3 Sliding Filament theory, muscle contraction mechanism and energetics.

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2.2. Nerve Impulse

- 2.2.1 Structure of Neuron
- 2.2.2 Nerve impulse - Resting potential and Action potential and Conduction of Nerve impulse
- 2.2.3 Synapse, types of synapses and Synaptic transmission.

2.3. Endocrine System

- 3.3.1 Endocrine glands - Structure, secretions and functions of Pituitary, Thyroid, Parathyroid, Adrenal glands and Pancreas
- 3.3.2 Hormone action and concept of Secondary messengers
- 3.3.3 Male and Female Hormones, Hormonal control of Menstrual cycle in humans.

UNIT – III Physiology and Biochemistry

(15 periods)

3.1. Homeostasis and Enzymes

- 3.1.1 Concept of Homeostasis.
- 3.1.2 Mechanism of Homeostasis.
- 3.1.3 Osmoregulation - Water and ionic regulation by freshwater, brackish water and marine animals
- 3.1.4 Enzymes: Definition, Classification, Inhibition and Regulation

3.2. Biomolecules and Metabolism

- 3.2.1. Carbohydrates: Classification and function of Carbohydrates
- 3.2.2. Carbohydrate metabolism - Glycolysis, Krebs cycle, , Electron transport and oxidative phosphorylation.
- 3.2.3 Proteins: Classification of proteins based on functions and Chemical nature
- 3.2.4 Protein Metabolism - Transamination, Deamination and Urea Cycle
- 3.2.5 Lipids: Classification of Lipids
- 3.2.6. Lipid Metabolism - Fatty acid synthesis and Fatty acid oxidation.

Suggested readings

Gerard J. Tortora and Sandra Reynolds Garbowski *Principles of Anatomy and Physiology*, Tenth Ed., John Wiley & Sons

Arthur C. Guyton MD, *A Text Book of Medical Physiology*, Eleventh ed., John E. Hall, Harcourt Asia Ltd.

William F. Ganong, *A Review of Medical Physiology*, 22 ed, McGraw Hill, 2005

Sherwood, Klandrof, Yanc, *Animal Physiology*, Thompson Brooks/Coole, 2005.

Sherwood, Klandrof, Yanc, *Human Physiology*, Thompson Brooks/Coole, 2005.

Knut Schmidt-Nielson, *Animal Physiology*, 5th ed, Cambridge Low Price Edition.

Roger Eckert and Randal, *Animal Physiology*, 4th ed, Freeman Co, New York.

Singh. H.R, *Text Book of Animal Physiology and Biochemistry*

Nagabhusanam , *Comparative Animal Physiology*

Veer Bal Rastogi, *Text Book of Animal Physiology*

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. III Year PRACTICAL SYLLABUS
V - SEMESTER**

**Discipline Specific Course, Paper – V
[Code: BS504; Course Type DSC 2E]
Physiology and Biochemistry**

Periods: 30

Max. Marks: 40

1. Qualitative tests for identification of carbohydrates, proteins and lipids.
 2. Qualitative tests for identification of ammonia, urea and uric acid (Nitrogenous excretory products)
 3. Effect of pH and Temperature on salivary amylase activity.
 4. Study of permanent histological sections of Mammalian Endocrine glands - pituitary, thyroid, pancreas, adrenal gland.
 5. Estimation of Haemoglobin by Sahlis method.
 6. Estimation of total protein by Lowry's method.
 7. Estimation of unit Oxygen consumption of fish with reference to body weight.
- **Laboratory Record work shall be submitted at the time of practical examination**
 - **Computer aided techniques should be adopted as per UGC guide lines.**

Suggested manuals

Tortora, G.J. and Derrickson, B.H. (2009). *Principles of Anatomy and Physiology*, XII Edition, John Wiley & Sons, Inc.

Widmaier, E.P., Raff, H. and Strang, K.T. (2008) *Vander's Human Physiology*, XI Edition., McGraw Hill

Guyton, A.C. and Hall, J.E. (2011). *Textbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company

Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). *Biochemistry*. VI Edition. W.H Freeman and Co.

Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). *Principles of Biochemistry*. IV Edition. W.H. Freeman and Co.

Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). *Harper's Illustrated Biochemistry*. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. III Year PRACTICAL MODEL PAPER
V - SEMESTER**

**Discipline Specific Course, Paper – V
[Code: BS504; Course Type DSC 2E]
Physiology and Biochemistry**

Time:2 Hrs.

Max. Marks: 40

1. Identification, labeled diagram and salient features of spots: (05 spots)	10
2. Estimation offrom Biochemistry	06
3. Identification/Study of.....from Physiology	06
4. Qualitative Test	06
5. Project Work	05
6. Certified practical record	05
7. Viva voce	02

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

B.Sc. III Year

VI – SEMESTER

Discipline Specific Elective, Paper – VI

[Code: BS507; Course Type DSE 2E]

Applied Zoology

Periods: 45

Max. Marks: 40

UNIT – I

(15 Periods)

1. Aquaculture and Sericulture

- 1.1 Types of Fisheries; Fresh Water Fish and Prawn culture
- 1.2 Fresh water fishing gears and crafts; Induced Breeding.
- 1.3 Hatchery design and Management of fish and prawn; Transportation of fish and prawn seed.
- 1.4 Preservation, Processing and By-products of fishes.
- 1.5 Fish Diseases and control measures
- 1.6 Life cycle of *Bombyx mori*
- 1.7 Structure of silk gland and secretion of silk
- 1.8 Silkworm rearing technology.
- 1.9 Spinning, harvesting and storage of cocoons.
- 1.10 Silk worm Pests and Diseases: Uzi fly; Protozoan, Viral, Fungal and Bacterial; Control and prevention.
- 1.11 Prospects of Sericulture in India

UNIT – II

(15 Periods)

2. Apiculture and Vermiculture

- 2.1 Selection of Bee Species for Apiculture.
- 2.2 Bee Keeping Equipment.
- 2.3 Methods of Extraction of Honey (Indigenous and Modern).
- 2.4 Bee Diseases and Enemies.
- 2.5 Products of Apiculture Industry and its Uses (Honey, Bees Wax).
- 2.6 Introduction of Vermiculture and Vermicomposting.
- 2.7 Vermiculture techniques.
- 2.8 Bedding, Essential parameters for Vermiculture and Management
- 2.9 Methods of Harvesting (Manual & Mechanical).
- 2.10 Economic Importance of Vermiculture.

UNIT – III

(15 Periods)

3. Poultry Farming & Animal Husbandry

- 3.1 Classification of Fowls based on their use – Broilers and Commercial layers.
- 3.2 Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs.
- 3.3 Poultry diseases - Viral, Bacterial, Fungal, Protozoan

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

- 3.4 Management of a modern Poultry Farm, progressive plans to promote Poultry as a Self-Employment venture
- 3.5 Dairy farm and its management
- 3.6 Animal Husbandry – Introduction, Preservation of semen, artificial insemination of cattle, Induction of early puberty and synchronization of estrus in cattle

Suggested Readings

1. **Prost, P. J. (1962).** *Apiculture*. Oxford and IBH, New Delhi.
2. **Bisht. D.S.,** *Apiculture*, ICAR Publication.
3. **Singh S.,** *Beekeeping in India*, Indian council of Agricultural Research, New Delhi.
4. **Ullal S.R. and Narasimhanna, M.N.** Handbook of Practical Sericulture: CSB, Bangalore
5. **Jolly. M. S.** Appropriate Sericultural Techniques; Ed., Director, CSR & TI, Mysore.
6. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co.
7. **Narasimhanna, M. N.** Manual of Silkworm Egg Production,, CSB, Bangalore 1988.
8. **Wupang—Chun and Chen Da-Chung,** Silkworm Rearing,, Pub. By FAO, Rome 1988.
9. **Sengupta, K.** A Guide for Bivoltine Sericulture; Director, CSR & TI, Mysore 1989.
10. **Krishnaswamy, S.** Improved Method of Rearing Young age silkworm; CSB, Bangalore, 1986.
11. **Jhingran. V.G.** Fish and fisheries in India.,
12. **Khanna. S.S,** An introduction to fishes
13. **Santanam, B. et al,** A manual of freshwater aquaculture,
14. **Boyd. C.E. & Tucker.C.S,** Pond aquaculture water quality management,
15. **Biswas.K.P,** Fish and prawn diseases,
16. **Hafez, E. S. E. (1962).** *Reproduction in Farm Animals*. Lea & Fabiger Publisher
17. **Dunham R.A. (2004).** *Aquaculture and Fisheries Biotechnology Genetic Approaches*. CABI
18. **Pedigo, L.P. (2002).** *Entomology and Pest Management*, Prentice Hall.
19. **Lee,** Earthworm Ecology
20. **Stevenson,** Biology of Earthworms
21. **Ranganathan L.S,** Vermicomposting technology- soil health to human health

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. III Year PRACTICAL SYLLABUS
VI – SEMESTER**

**Discipline Specific Elective, Paper – VI
[Code: BS507; Course Type DSE 2E]
Applied Zoology**

Periods: 30

Max. Marks: 40

1. Identification and study of important cultivable and edible fishes - Any five
 2. Identification and study of important cultivable and edible crustaceans - Any five
 3. Identification different larvae of silk worm- Using specimens / pictures
 4. Identification of mulberry and non mulberry silkworms
 5. Mounting of mouth parts of adult silk worm and silk gland of larva
 6. Estimation of quality of milk from different dairy farm units – specific gravity, fat content, pH viscosity.
 7. Identification of purity of Honey in different samples
 8. Field visits to a Vermiculture / Sericulture / fisheries / apiculture / poultry / dairy farm-submission of any 3 Reports
- **Laboratory Record work shall be submitted at the time of practical examination**
 - **Computer aided techniques should be adopted as per UGC guide lines.**

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

B.Sc. III Year PRACTICAL MODEL PAPER

VI – SEMESTER

Discipline Specific Elective, Paper – VI

[Code: BS507; Course Type DSE 2E]

Applied Zoology

Time: 2 Hrs.

Max. Marks: 40

1. Identification, labeled diagram and salient features of spots: - (05 spots)	10
2. Identification	06
3. Field trip reports (3)	12
4. Project Work	04
5. Certified practical record	04
6. Viva voce	04

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. III Year
VI - SEMESTER**

**Discipline Specific Elective, Paper – VI
[Code: BS507; Course Type DSE 2E]
Entomology**

Periods: 45

Max. Marks: 40

UNIT – I: Basics of Entomology

(15 Periods)

- 1.1. Definition, scope and importance of Entomology.
- 1.2. Insect classification and their distinctive characters.
- 1.3. Insect External morphology- Head, Thorax, and Abdomen.
- 1.4. Insect Internal Morphology – Digestive, Respiratory, Circulatory, Excretory, Nervous, and Reproductive systems.
- 1.5. Insect growth and development.

UNIT – II: Insect vectors and pests.

(15 Periods)

- 2.1. Introduction and history of medical entomology
- 2.2. Vectors of public health importance – Mosquitoes, Housefly, Sand fly, Lice & Bedbugs
- 2.3. Vector-borne diseases- (Malaria, Dengue, Filariasis) and their control measures.
- 2.4. Role of pests in Agriculture.
- 2.5. Crop Pests and their control measures

UNIT – III: Beneficial Insects and Harmful Insects

(15 Periods)

- 3.1. Apiculture.
- 3.2. Lac culture.
- 3.3. Sericulture.
- 3.4. Social life of Insects.
- 3.5. Venomous Insects.

Practicals:

1. Identification and study of house hold Insects - Cockroach, Silver fish, Crickets
2. Identification and study of important Insect vectors – Mosquitoes, House fly, Head lice.
3. Mounting of mouth parts of mosquitoes.
4. Identification different larvae of silk worm- Using specimens / pictures.
5. Field visits to a Sericulture/ apiculture farm and submission of report.

References

1. Text Book of Applied Entomology Vol. I & II by K. P. Srivastava
2. General Applied Entomology by B V David and T N Anathkrishnan
3. Destructive and Useful Insects by C. L. Metcalf
4. A text book of Entomology by Mathur and Upadhyay

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**B.Sc. III Year
V – SEMESTER**

**Discipline Specific Elective, Paper – VI
[Code: BS507; Course Type DSE 2E]
SERICULTURE**

Periods: 45

Max. Marks: 40

UNIT – I – Introduction of Sericulture

(15 Periods)

- 1.1 History of Sericulture and Present status of sericulture industry in India.
- 1.2 Sericulture as Agro-industry - Perspectives and prospects of Sericulture in India.
- 1.3 Geographical distribution of various species and economic races of silkworms - mulberry, tasar, eri and muga silkworm.
- 1.4 Types of silkworm host plants and their systematic position.
- 1.5 Morphology and anatomy of Silk glands

UNIT – II – Biology and diseases of Silkworms

(15 Periods)

- 2.1 Life cycle, External morphology and biology of mulberry silkworm.
- 2.2 Internal morphology of Silkworm – Digestive, Respiratory, Nervous, Excretory, and Reproductive systems.
- 2.3 Influence of biotic and a biotic factor on the incidence of diseases.
- 2.4 Diseases of *Bombyx mori* and *Philosamia ricini* —Viral, bacterial protozoan and fungal. Preventive and control measures.
- 2.5 Insect and vertebrate Pests of silkworm and their management.

UNIT – III – Silkworm Rearing

(15 Periods)

- 3.1. Silkworm rearing house and rearing appliances.
- 3.2. Feeding and Rearing methods of mulberry silk worms.
- 3.3. Mounting and harvesting of mulberry silk cocoons.
- 3.4. Properties and composition of silk.
- 3.5. Commercial characters of cocoons and price fixation.

Practicals:

1. Identification of different types of silkworms.
2. Morphology of egg larva, pupa and adult of different silkworm types.
3. Life history of different silkworm types.
4. Dissection of digestive system and salivary gland of silkworm larva.
6. Dissection of the nervous system of larva silkworm.
7. Rearing appliances
8. Sex differentiation of Larva, Pupa and Adult silkworms
9. Calculation of Shell Ratio.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

References:

1. Handbook of Practical Sericulture : Ullal, S.R. and Narasimhanna, M.N. (1987), Central Silk Board Publication, Bangalore.
2. FAO Manuals on Sericulture : Anonymous (1972), Vol. I-IV
3. Sericulture for Rural Development : Hanumappa (1978), Himalaya Publication,
4. The Silkworm, an Important Laboratory Tool : Tazima, Y. (1978), Kodansha Publications, Tokyo.
5. Control of Silkworm Reproduction, Development and Sex : Strunnikov, V.A. (1983), MIR Publications, Moscow.
6. Sericulture in India Sarkar, D.C. (1988), CSB, Bangalore.
7. Silkworm Rearing : Wupang—Chun and Chen Da-Chung (1988), Pub. By FAO.
8. Handbook of Silkworm Rearing : Anonymous (1972), Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan.
9. Improved Method of Rearing Young age silkworm : Krishnaswamy (1986), CSB Publication, Bangalore.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

B.Sc. III Year

V- SEMESTER

Discipline Specific Course, Paper – VII

[Code: BS604; Course Type DSC 2F]

Immunology and Animal Biotechnology

Periods: 45

Max. Marks: 40

UNIT – I Immunology – Basic concepts; antigens and antibodies

(15 Periods)

- 1.1 Basic concepts of immunology.
- 1.2 Cells of immune system
- 1.3 Primary and secondary Organs of immune system
- 1.4 Types of Immunity – Innate and acquired
- 1.5 Basic properties of antigens
- 1.6 Structure, function and types of an antibody.
- 1.7 B and T cell epitopes, haptens, adjuvants.
- 1.8 Antigen-antibody reactions,
- 1.9 T-Cell and B-Cell activation
- 1.10 Monoclonal antibodies and their production

UNIT – II Working of an Immune system; Immune system in health and disease

(15 Periods)

- 2.1 Structure and functions of major histocompatibility complex.
- 2.2 Basic properties and functions of Cytokines, Interferons and complement proteins
- 2.3 Humoral and Cell mediated immunity.
- 2.4 Types of hyper sensitivity.
- 2.5 Concepts of autoimmunity and immunodeficiency.
- 2.6 Introduction to Vaccines and types of Vaccines

UNIT – III Animal Biotechnology and Genetically modified organisms

(15 Periods)

- 3.1 Concept and Scope of Animal Biotechnology.
- 3.2 Cloning vectors - Plasmids, Cosmids, Lambda bacteriophage, YAC
- 3.3 Cloning- Cloning methods (Cell, Animal and Gene cloning)
- 3.4 Animal Cell culture - Equipment and materials for animal cell culture; applications of cell culture techniques
- 3.5 Recombinant DNA technology and its applications
- 3.6 Transgenesis – Methods of Transgenesis.
- 3.7 Production of Transgenic animals and Application of Transgenic animals in Biotechnology.
- 3.8 Stem cells –types and their applications

Suggested Readings

- Arthur C. Guyton MD**, *A Text Book of Medical Physiology*, Eleventh ed., John E. Hall, Harcourt Asia Ltd.
- William F. Ganong**, *A Review of Medical Physiology*, 22 ed, McGraw Hill, 2005
- Sherwood, Klandrof, Yanc**, *Human Physiology*, Thompson Brooks/Coole, 2005.
- Knut Schmidt-Nielson**, *Animal Physiology*, 5th ed, Cambridge Low Price Edition.
- Richard A. Glodsby, Thomas J Kind, Barbara A. Osborne, Janis Kuby**, *Immunology*, 5th ed, Freeman and Co. New York
- Ivan Roitt**, *Immunology*, 4th ed, Johanthan Brostoff, Moshy, London.
- Thomas C. Chung**, *General Parasitology*, Hardcourt Brace and Co ltd. Asia. New Delhi.
- Gerard D. Schmidt and Larry S Roberts**, *Foundations of Parasitology*, McGraw Hill
- Kindt, T. J., Goldsby, R. A., Osborne, B. A., Kuby, J. (2006)**. VI Edition. *Immunology*. W.H. Freeman and Company.
- Delves, P. J., Martin, S. J., Burton, D. R., Roitt, I.M. (2006)**. XI Edition. *Roitt's Essential Immunology*, Blackwell Publishing.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. III Year PRACTICAL SYLLABUS
V- SEMESTER**

**Discipline Specific Course, Paper – VII
[Code: BS604; Course Type DSC 2F]
Immunology and Animal Biotechnology**

Periods: 30

Max. Marks: 40

I. Immunology

1. Identification of Blood groups
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Enumeration of RBC & WBC from a given blood sample
4. Enumeration of Differential count of WBC from a given blood sample
5. Demonstration of
 - a. ELISA
 - b. Immuno-electrophoresis
6. Identification of Autoimmune disease through charts.

II. Animal Biotechnology

1. Study the following techniques through photographs / virtual lab
 - a. Southern blotting
 - b. Western blotting
 - c. DNA sequencing (Sanger's method)
 - d. DNA finger printing
 - e. Identification of Vectors
 - f. Identification of Transgenic animals
2. PCR demonstration /virtual lab

- **Laboratory Record work shall be submitted at the time of practical examination**
- **Computer aided techniques should be adopted as per UGC guide lines.**

Suggested manuals

Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition. W.H. Freeman and Company.

David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, VII Edition, Mosby, Elsevier Publication.

Abbas, K. Abul and Lichtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. III Year PRACTICAL MODEL PAPER
V- SEMESTER**

**Discipline Specific Course, Paper – VII
[Code: BS604; Course Type DSC 2F]
Immunology and Animal Biotechnology**

Time: 2 Hrs.

Max. Marks: 40

1. Identification, labeled diagram and salient features of spots: (05 spots)	10
2. Identification/Determination from Immunology	06
3. Identification/Study the technique from Anima Biotechnology	06
4. Demonstration of a technique	06
5. Project Work	05
6. Certified practical record	05
7. Viva voce	02

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

B.Sc. III Year

VI - SEMESTER

Discipline Specific Elective, Paper – VIII

[Code: BS607; Course Type DSE 2F]

AQUATIC BIOLOGY

Periods: 45

Max. Marks: 40

UNIT – I Aquatic Biomes

(15 periods)

- 1.1 Brief introduction of the aquatic biomes
- 1.2 Freshwater ecosystem (lakes, wetlands, streams and rivers),
- 1.3 Estuaries, intertidal zones,
- 1.4 Oceanic pelagic zone, marine benthic zone.
- 1.5 Coral reefs

UNIT – II Fresh Water Biology and Marine Biology

(15 periods)

- 2.1 Lakes: Origin and classification of lakes
- 2.2 Lake as an Ecosystem, Lake morphometry
- 2.3 Physico-chemical Characteristics of fresh water bodies: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity: dissolved gases (Oxygen, Carbon dioxide).
- 2.4 Nutrient Cycles and Lakes- Nitrogen, Sulphur and Phosphorous.
- 2.5 Streams: Different stages of stream development, Physico-chemical environment, adaptation of hill-stream fishes.
- 2.6 Salinity and density of sea water; Continental shelf; Adaptation of deep sea organisms; Sea weeds.

UNIT – III Management of Aquatic Resources

(15 periods)

- 3.1 Aquatic pollution - Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills,
- 3.2 Eutrophication
- 3.3 Management and conservation
- 3.4 Water pollution acts of India
- 3.5 Sewage treatment and water quality assessment - BOD and COD.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. III Year PRACTICAL SYLLABUS
VI - SEMESTER**

**Discipline Specific Elective, Paper – VIII
[Code: BS607; Course Type DSE 2F]
AQUATIC BIOLOGY**

Periods: 30

Max. Marks: 40

PRACTICAL

1. Study of the topography of a lake
2. Physico-Chemical and biological analysis of a lake
Physico-Chemical analysis of water - O₂, CO₂, BOD, COD
Biological– Zooplanktons – Identification and population density of Zooplanktons of a lake
3. Determination of - Turbidity / transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake / water body.
4. Instruments used in limnology (secchi disc, van dorn bottle, conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.
5. A Project Report on a visit to a Sewage treatment plant / Marine bio-reserve/Fisheries Institutes.

Suggested Readings

1. Ananthakrishnan : Bioresources Ecology 3rd Edition
2. Goldman – Limnology, 2nd Edition
3. Odum and Barrett – Fundamentals of Ecology, 5th Edition\
4. Pawlowski: Physicochemical Methods for water and Wastewater Treatment, 1st Edition
5. Wetzel: Limnology, 3rd edition
6. Trivedi and Goyal: Chemical and biological methods for water pollution studies
Welch: Limnology Vols.I-II

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. III Year
VI - SEMESTER**

**Discipline Specific Elective, Paper – VIII
[Code: BS607; Course Type DSE 2F]
Public Health and Hygiene**

Periods: 45

Max. Marks: 40

UNIT – I Nutrition, Environment and Health

(15 Periods)

- 1.1 Classification of foods - Carbohydrates, proteins, lipids, vitamins and minerals
- 1.2 Balanced diet and malnutrition.
- 1.3 Nutritional deficiencies and disorders- Carbohydrates, proteins, lipids, vitamins and minerals.
- 1.4 Environment and health Impact assessment: concept, steps and applications.
- 1.5 Occupational, Industrial, agricultural and urban Health-Exposure at work place, urban areas, industrial workers, farmers and agricultural labourers, Health workers and health disorders and diseases.
- 1.6 Environmental pollution and associated Health hazards
- 1.7 Water borne diseases; Air borne diseases

UNIT-II Communicable and Non-Communicable diseases

(15 Periods)

- 2.1 Causes, Symptoms, Diagnosis, Treatment and Prevention of Communicable diseases - Malaria, Filariasis, Measles, Polio, Chicken pox, Rabies, Plague, Leprosy, Tuberculosis and AIDS.
- 2.2 Causes, Symptoms, Diagnosis, Treatment and Prevention of Non-Communicable diseases - Hypertension, Coronary Heart diseases, Stroke, Diabetes, Obesity and Mental ill-health.

UNIT-III Health Education in India

(15 periods)

- 3.1 Health care legislation in India – termination of pregnancy act, Maternity benefit act, Transplantation of human organs act, Child Labour act, Biomedical waste act, ESI act.
- 3.2 WHO Programmes – Government and Voluntary Organizations and their health services
- 3.3 First Aid and Health awareness, personal health care record maintenance.

Suggested Readings

1. Park and Park, 1995: Text Book of Preventive and Social Medicine – Banarsidas Bhanot Publ. Jodhpur – India.
2. Public Health at the Crossroads Achievements and Prospects. Robert Beaglehole and Ruth
3. Bonita 2nd Edition Cambridge University Press 3. Maxcy Rosenau Last Public Health &
4. Preventive Medicine, Fourteenth Edition Ed RobertWallace, MD, et al. 4.
5. Epidemiology and Management for Health Care: Sathe, P.V. Sathe, A.P., PopularPrakashan,
6. Mumbai, 1991. 5.
7. International Public Health: Diseases, Programs, Systems, and Policies by
8. MichaelMerson, Robert E Black, Anne J Mills Jones and Bartlett Publishers. 6.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. III Year PRACTICAL SYLLABUS
VI - SEMESTER**

**Discipline Specific Elective, Paper – VIII
[Code: BS607; Course Type DSE 2F]
Public Health and Hygiene**

Periods: 30

Max. Marks: 40

1. Medical fitness– Determine the following:
BMI, Blood Pressure, Cholesterol (LDL, HDL) Hemoglobin
Complete Blood Picture; Complete urine examination
 2. Qualitative identification of carbohydrates, Lipids, vitamins, lipids and minerals,
 3. Estimation of fat content and tests milk adulteration.
 4. Qualitative and quantitative survey methods in public health sciences.
 5. Identification of parasitic stages of malaria and filaria through permanent slides
 6. Estimation of blood glucose level in a normal and diabetic persons.
 7. Project report on Epidemiological survey, different diseases such as
Malaria; Chicken gunya; AIDS, Diarrhoea
 8. Epidemiological survey of a slum area to identify the diseases due to poor sanitation and
contaminated drinking water.
 9. Visit to a community water purification and treatment plant.
 10. Visit to an industry to study occupational health hazard and safety of industrial workers
(sugar/milk dairy/textile/cement).
 11. Visit to agricultural fields to study occupational health of farmers and agricultural laborers.
- **Laboratory Record work shall be submitted at the time of practical examination**
 - **Computer aided techniques should be adopted as per UGC guide lines.**

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

**B.Sc. III Year PRACTICAL MODEL PAPER
VI - SEMESTER**

**Discipline Specific Elective, Paper – VIII
[Code: BS607; Course Type DSE 2F]
Public Health and Hygiene**

Time: 2 Hrs.

Max. Marks: 40

- | | | |
|---|--|----|
| 1 | Epidemiological survey report of a slum area health status | 10 |
| 2 | Estimation of ----- from food or water or milk | 10 |
| 3 | Project work | 10 |
| 4 | Certified practical record | 05 |
| 5 | Viva voce | 05 |

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS

B.Sc. III Year

VI - SEMESTER

Discipline Specific Elective, Paper – VIII

[Code: BS607; Course Type DSE 2F]

Poultry Science

Periods: 45

Max. Marks: 40

Unit -I: Poultry Nutrition and Physiology

15 hours

- 1.1 Essential amino acids, proteins, fatty acids, vitamins and minerals their inter-relationships.
- 1.2 Functional regulation of digestion, absorption and metabolism of nutrients.
- 1.3 Feed formulation for different species and groups
- 1.4 Different systems of feeding wet mash, dry mash, crumble and pellet feeding. Feed Passage rate in G.I. tract in relation to digestion and absorption efficiency;
- 1.5 Characteristics features of endocrine glands. Endocrine control and variable factors influencing growth process

Unit II: Poultry Products technology

15 hours

- 2.1 Structure, chemical composition and nutritive value of egg.
- 2.2 Various measures of egg quality. Shell, albumen and yolk quality assessment.
- 2.3 Factors influencing egg quality traits. Mechanism of deterioration of egg quality.
- 2.4 Different methods of preservation of table eggs and their relative merits and demerits.
- 2.5 Physical, chemicals, microbial and organoleptic evaluation of meat quality

Unit III: Poultry Health Management

15 hours

- 3.1 Common diseases of poultry – bacterial, viral, fungal, protozoan, parasitic and other emerging diseases of poultry, their prevention, control and treatment.
- 3.2 Metabolic and nutrient deficiency diseases and disorders.
- 3.3 Vaccination programmes and Deworming programmes.
- 3.4 Control of coccidiosis, worms, ectoparasites and flies. Medication procedures.
- 3.5 Cleaning and disinfection of poultry houses. Drinking water sanitation

Practical

1. Estimation of amino acids, proteins and fatty acids in feed
2. Virtual demonstration of endocrine glands and their influence on growth of poultry
3. Estimation of albumen and yolk quantity in eggs
4. Estimation of calcium in egg shell.
5. Estimation of carotenes, cholesterol and peroxides in meat of chicken.