

B.Sc. Zoology Syllabus

Under Choice Based Credit System

**w.e.f
2019-20**



Department of Zoology

Nizam College (Autonomous)

Osmania University, Hyderabad-500001

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B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20
CURRICULUM FOR ZOOLOGY
IN UNDER GRADUATE DEGREE PROGRAMME
CBCS SYLLABUS SCHEDULE 2019-20
Osmania University

Year	Semester	Paper		Title of the Paper	No. of Credits	Exam Hrs.	Max. Marks		
							I.A	End Exam	Total
I	I	Paper - I	Core-I Theory	Animal Diversity- Invertebrates	4	2	20	80	100
			Core-I Practical	Animal Diversity- Invertebrates	1	2	10	40	50
	II	Paper - II	Core-II Theory	Animal Diversity- Vertebrates	4	2	20	80	100
			Core-II Practical	Animal Diversity- Vertebrates	1	2	10	40	50
II	III	Paper - III	Core-III Theory	Animal Physiology and Animal Behaviour	4	2	20	80	100
			Core-III Practical	Animal Physiology and Animal Behaviour	1	2	10	40	50
			SEC-1	Sericulture / Apiculture	2	2	10	40	50
			SEC-2	Public Health and Hygiene/ Medical Diagnostics	2	2	10	40	50
	IV	Paper - IV	Core-IV Theory	Cell Biology, Genetics, and Developmental Biology	4	2	20	80	100
			Core-IV Practical	Cell Biology, Genetics, and Developmental Biology	1	2	10	40	50
			SEC-3	Poultry and Animal Husbandry/ Vermiculture/ Vector Biology	2	2	10	40	50
			SEC-4	Biomaterials from Animals sources / Aquaculture/ Aquarium Fish Keeping	2	2	10	40	50
III	V	Paper - V	DSE-I Theory	Physiological Chemistry and Endocrinology/ Laboratory Animals Maintenance and Applications / Immunology and Animal Biotechnology	4	2	20	80	100
			DSE -I Practical	Physiological Chemistry and Endocrinology/ Laboratory Animals Maintenance and Applications / Immunology and Animal Biotechnology	1	2	10	40	50
			GE - I Theory	Preventive Medicine / Integrated Pest Management	4	2	20	80	100
	VI	Paper - VI	DSE-II Theory	Fisheries / Limnology / Ecology, Zoogeography and Evolution	4	2	20	80	100
			DSE-II Practical	Fisheries / Limnology / Ecology, Zoogeography and Evolution	1	2	10	40	50
			Project / Tools and Techniques in Biology		4	2	20	80	100
					46	36	260	1040	1300

DSC – Discipline Specific Core; DSE – Discipline Specific Elective; SEC – Skill enhancement Course; GE- Generic Elective (Open streams)

*Practical one credit equal to 3 hours of instruction

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. ZOOLOGY I YEAR
SEMESTER-I
CORE PAPER – I
ANIMAL DIVERSITY – INVERTEBRATES

Instructions: 4 hr per week

No. of period: 60

No. of credits: 4

UNIT – I : (15 Periods)

1.1 Protozoa.

- 1.1.1 General characters and classification of Protozoa upto order levels with examples
- 1.1.2 Type study – *Elphidium*
- 1.1.3 Locomotion and Reproduction in Protozoa.
- 1.1.4 Epidemiology of Protozoan diseases - Amoebiasis; Giardiasis; Leishmaniasis and Malaria.

1.2 Porifera

- 1.2.1. General characters and classification of Porifera upto order levels with examples
- 1.2.2 Type study – *Sycon*
- 1.2.3 Canal system in sponges and Spicules.

UNIT – II: (15 Periods)

2.1. Cnidaria

- 2.1.1 General characters and classification of Cnidaria upto order levels with examples
- 2.1.2 Type study - *Obelia*
- 2.1.3 Polymorphism in Siphonophora
- 2.1.4 Corals and coral reef formation

2.2 Platyhelminthes

- 2.2.1 General characters
- 2.2.2 Classification of Platyhelminthes up to classes with examples
- 2.2.3 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 Coelomoducts 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 Crustacean larvae
- 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

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"*

B.Sc. ZOOLOGY I YEAR
ZOOLOGY PRACTICAL SYLLABUS FOR I SEMESTER
CORE PAPER – I
ANIMAL DIVERSITY – INVERTEBRATES

Instructions: 3hr per week

No. of credits: 1

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*, *Chaetopteurs*, *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

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

B.Sc. ZOOLOGY I YEAR
SEMESTER-II
CORE PAPER – II
ANIMAL DIVERSITY- VERTEBRATES

Instructions: 4 hr per week

No. of period: 60

No. of credits: 4

UNIT – I:

1.1 Hemichordata

(15 Periods)

1.1.1 General characters

1.1.2 Classification of Hemichordata up to classes with examples

1.1.3 *Balanoglossus* - Structure and affinities

1.2. Urochordata, Cephalochordata, Cyclostomata

1.2.1. Salient features of Urochordata

1.2.2. Retrogressive metamorphosis and its significance in Urochordata

1.2.3. Salient features and affinities of Cephalochordata

1.2.4. General characters of Cyclostomata

1.2.5. Comparison of the *Petromyzon* and *Myxine*

1.2.6. General characters and classification of Chordata upto orders with examples.

UNIT – II:

2.1. Pisces

(15 Periods)

2.1.1. General characters of Fishes

2.1.2. Classification of fishes up to order level with examples

2.1.3. *Scoliodon* – Respiratory, Circulatory and Nervous system.

2.1.4. Types of Scales and types of Fins

2.2. Amphibia

2.2.1. General characters of Amphibians

2.2.2. Classification of Amphibians up to orders with examples.

2.2.3. *Rana tigrina* - Respiratory, Circulatory and Nervous system.

2.2.4. Parental care in amphibian; neoteny and paedogenesis.

UNIT – III :

3.1 Reptilia

(15 Periods)

3.1.1. General characters of Reptilia

3.1.2. Classification of Reptilia up to orders with examples

3.1.3. *Calotes* – Respiratory system, Circulatory and Nervous system.

3.1.4. Temporal fosse in reptiles and its evolutionary importance

3.1.5. Distinguished characters of Poisonous and Non poisonous snakes.

3.2. 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 Nervous system.

3.1.4. Migration in Birds

3.1.5. Flight adaptation in Birds

UNIT – IV :

(15 Periods)

4.1. Mammalia

- 4.1.1. General characters of Mammalia
- 4.1.2. Classification of Mammalia up to orders with examples
- 4.1.3. Rabbit –Digestive, Respiratory, Circulatory and Nervous system.
- 4.1.4. Dentition in mammals.
- 4.1.5. Aquatic adaptations in Mammals.

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.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. ZOOLOGY I YEAR
ZOOLOGY PRACTICAL SYLLABUS FOR II SEMESTER
ZOOLOGY - CORE PAPER - II
ANIMAL DIVERSITY- VERTEBRATES

Instructions: 3hr per week

No. of credits: 1

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

1. **Hemichordata:** *Balanoglossus*, *Tornaria* larva
2. **Protochordata:** *Amphioxus*, *Amphioxus* T.S. through pharynx
3. **Cyclostomata:** *Petromyzon*, *Myxine*, *Ammocoetus* larva
4. **Pisces:** *Sphyrna Pristis*, *Torpedo*, *Channa*, *Pleuronectes*, *Hippocampus*, *Exocoetus*, *Echieneis*, *Labeo*, *Catla*, *Clarius*, *Auguilla*, *Protopterus*, Scales: Placoid, Cycloid, Ctenoid
5. **Amphibia:** *Ichthyophis*, *Amblystoma*, *Siren*, *Hyla*, *Rachophous*, *Bufo*, *Rana*, Axolotal larva
6. **Reptilia :** *Draco*, *Chamaeleon*, *Gecko*, *Uromastix*, *Vipera russelli*, *Naja*, *Bungarus*, *Enhydrina*, *Typhlops*, *Testudo*, *Trionyx*, *Crocodylus*, *Ptyas*.
7. **Aves:** *Archaeopteryx*, *Passer*, *Psittacula*, *Bubo*, *Alcedo*, *Columba*, *Corvus*, *Pavo*; Collection and study of different types of feathers: Quill, Contour, Filoplume, Down
8. **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

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

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. ZOOLOGY II YEAR

SEMESTER-III

CORE PAPER – III: ANIMAL PHYSIOLOGY AND ANIMAL BEHAVIOUR

Instructions: 4 hr per week

No. of period: 60

No. of credits: 4

UNIT – I:

(15 periods)

1.1 Digestion

1.1.1 Enzymes: Definition, classification, inhibition, regulation.

1.1.2 Digestion of carbohydrates, proteins, lipids and cellulose

1.1.3 Absorption, assimilation of digested food

1.1.4 Role of gastrointestinal hormones in digestion

1.2 Excretion

1.2.1 Classification of animals on the basis of excretory products: Ammonotelic, Uricotelic and Ureotelic

1.2.2 Structure and function of nephron

1.2.3 Urine formation counter current mechanism

1.3 Osmoregulation

1.3.1 Water and ionic regulation by fresh water

1.3.2 Brackish water and marine water animals

UNIT – II:

(15 periods)

2.1 Homeostasis

2.1.1 Concept of homeostasis

2.1.2 Mechanism of homeostasis

2.2 Respiration

2.2.1 Definition of respiration, respiratory mechanism, external, internal and cellular Respiration

2.2.2 Respiratory pigments, transport of oxygen, oxygen dissociation curves, Bohr's effect, transport of carbon dioxide, chloride shift

2.2.3 Regulation of respiration: nervous and chemical mechanism

2.3 Circulation

2.3.1 Types of circulation: open and closed: Structure of mammalian heart

2.3.2 Types of hearts: neurogenic and myogenic

2.3.3 Heart functions, conduction and regulation of heartbeat, regulation of heart rate

2.3.4 Tachycardia, bradycardia: blood clotting mechanism

UNIT – III:

(15 periods)

3.1 Muscle contraction

3.1.1 Types of muscles

3.1.2 Ultrastructure of skeletal muscle fibre

3.1.3 Sliding filament theory of muscle contraction mechanism and energetics

3.1.4 Twitch tetanus summation, Treppe fatigue

3.2 Nerves

3.2.1 Structure of neuron

3.2.2 Resting potential, threshold potential, action potential, conduction of nerve impulse

3.2.3 Transmission of nerve impulse

3.2.4 Synapse, synaptic transmission neurotransmitters EPSP, IPSP

3.3 Endocrine systems

- 3.3.1 Endocrine glands- Structure, secretion, function 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 human beings

UNIT – IV:

(15 periods)

4.1 Animal behaviour

- 4.1.1 Types of behaviour and acquired instinctive behaviour
- 4.1.2 Behaviour taxes, reflexes tropisms

4.2 Learning and memory

- 4.2.1 Types of learning, trial and error learning imprinting, habituation,
- 4.2.2 **Conditioning:** classical conditioning, instrumental conditioning, examples of conditioning, Pavlov's experiment

4.3 Social behaviour and communication:

- 4.3.1 Colonial existence of bees and termites, pheromones

4.4 Biological rhythms

- 4.4.1 Biological clocks, circadian rhythms, circumlunar rhythms, circannual rhythms

Suggested readings

1. **Gerard J. Tortora and Sandra Reynolds Garbowski** *Principles of Anatomy and Physiology*, Tenth Ed., John Wiley & Sons
2. **Arthur C. Guyton MD**, *A Text Book of Medical Physiology*, Eleventh ed., John E. Hall, Harcourt Asia Ltd.
3. **William F. Ganong**, *A Review of Medical Physiology*, 22 ed, McGraw Hill, 2005
4. **Sherwood, Klandrof, Yanc**, *Animal Physiology*, Thompson Brooks/Coole, 2005.
5. **Sherwood, Klandrof, Yanc**, *Human Physiology*, Thompson Brooks/Coole, 2005.
6. **Knut Schmidt-Nielson**, *Animal Physiology*, 5th ed, Cambridge Low Price Edition.
7. **Roger Eckert and Randal**, *Animal Physiology*, 4th ed, Freeman Co, New York.
8. **Singh. H.R**, *Text Book of Animal Physiology and Biochemistry*
9. **Nagabhushanam**, *Comparative Animal Physiology*
10. **Veer Bal Rastogi**, *Text Book of Animal Physiology*

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

**B.Sc. ZOOLOGY PRACTICAL SYLLABUS
SEMESTER-III
CORE PAPER – III: ANIMAL PHYSIOLOGY AND ANIMAL BEHAVIOUR**

Instructions: 3hr per week

No. of credits: 1

1. Qualitative test of identification of carbohydrates, proteins and lipids.
 2. Qualitative test of identification of ammonia, urea, uric acid (nitrogenous excretory products).
 3. Zonation of gut in cockroaches.
 4. Effect of pH and temperature on salivary amylase activity.
 5. Study of permanent histological sections of mammalian endocrine glands: pituitary, thyroid, pancreas, adrenal glands.
 6. Estimation of haemoglobin by Sahil's method.
 7. Estimation of blood clotting time.
 8. Estimation of total protein by Biuret's method.
 9. Estimation of unit metabolism of fish.
- Laboratory record work shall be submitted at the time of practical examinations.
 - Computer – aided techniques shall be adopted as per UGC guidelines.

B.Sc. ZOOLOGY II Year
SEMESTER- III
PAPER-III (SEC – I): SERICULTURE

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT- I:

(15 Periods)

- 1.1 History and economic importance of sericulture – types of silkworm – Mulberry and non-Mulberry (Tassar, Eri and Muga).
- 1.2 Systematic position of Bombyx and Life Cycle - Morphology of silk gland.
- 1.3 Horticulture – mulberry cultivation – Environmental conditions for mulberry cultivation – soil, climatic factors, preparation of land.
- 1.4 Intercultivation – pruning methods – harvesting
- 1.5 Diseases and pests of mulberry and control methods.

UNIT- II:

(15 Periods)

- 2.1 Silkworm rearing – general principles of silkworm rearing – primary requisite for successful rearing.
- 2.2 Feeding of silkworm, bed cleaning, sparing, moulting, late age silkworms – Moulting and harvesting economics of silkworm.
- 2.3 Diseases and pests of silkworm.
- 2.4 Reeling –reeling appliances and process of reeling cocoons.
- 2.5 Sericulture as cottage industry.

References:

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

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

**B.Sc. ZOOLOGY II YEAR
SEMESTER- III
PAPER-III (SEC – I): APICULTURE**

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT-I: (15 Periods)

- 1.1 History, classification and present status of apiculture industry in India
- 1.2 Biology of honey bees and bee economy
- 1.3 Social organization of bee colony
- 1.4 Selection of bee species for apiculture
- 1.5 Bee rearing method: artificial Bee rearing (Apiary), Bee hives

UNIT-II: (15 Periods)

- 2.1 Products of apiculture industry and its use – honey; Bees wax; propalic
- 2.2 Methods of extraction of honey – indigenous and modern
- 2.3 Bee keeping equipment
- 2.4 Colony inspection and maintenance of the equipment
- 2.5 Bee diseases and enemies; control and preventive method

Suggested Reading:

1. Textbook of Applied Zoology, Telugu Academy.
2. Apiculture by Prost P.J. Oxford aro IBH, New Delhi
3. Apiculture by Bisht, ICAR publication

B.Sc. ZOOLOGY II YEAR
SEMESTER - III
PAPER-III (SEC – II): PUBLIC HEALTH AND HYGIENE

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT – I: Nutrition, Environment and Health

(15 Periods)

- 1.1 Classification of foods - Carbohydrates, proteins, lipids, vitamins and minerals
- 1.2 Nutritional deficiencies and disorders- Carbohydrates, proteins, lipids, vitamins and minerals.
- 1.3 Environment and health Impact assessment: concept, steps and applications.
- 1.4 Occupational, Industrial, agricultural and urban Health-Exposure at work place, urban areas, health disorders and diseases.
- 1.5 Environmental pollution and associated Health hazards

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.
- 2.3 Water borne diseases: Cholera, E. coli, Hepatitis and Polio; Air borne diseases: Chickenpox, Influenza, Measles and Tuberculosis
- 2.4 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. First Aid and Health awareness, personal health care record maintenance.
- 2.5 WHO Programmes – Government and Voluntary Organizations and their health services

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 II YEAR
SEMESTER - III
PAPER-III (SEC – II): MEDICAL DIAGNOSTICS

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT-I:

(15 Periods)

- 1.1 Introduction to medical diagnostic and its importance
- 1.2 Diagnostic methods used for analysis of Blood composition smear preparation. Differential leucocytes count (DLC). Cell counting-RBC, WBC platelet, ESR(Erythrocyte sedimentation Rate), PVC(Packed cell volume) Haemoglobin estimation, Bleeding clotting time. Blood grouping and Rh typing.
- 1.3 Bone marrow study, Haemopoiesis, Blood coagulation and anticoagulants, Blood banking blood transfusion.
- 1.4 Clinical biochemistry – blood glucose, serum protein, LFT(Liver Function Test) Lipid profile LDL, VDL, HDL, cholesterol, creatine kinase, LDH, SGPT, SGOT, Amylase, Bile pigments.
- 1.5 Histopathological techniques, Autopsy and Biopsy, FNAC technique

UNIT-II:

(15 Periods)

- 2.1 Urine analysis Physical chemical, microscopic dialysis analysis of body fluids (CSF Synovial fluid, pleural, pericardial, peritoneal Fluids). Sputum and faecal matter for infection.
- 2.2 Clinical diagnosis of diseases – bacterial (Tuberculosis and Typhoid) antibiotic sensitivity test, viral- hepatitis, AIDS, Polio, Protozoan Malaria, Amoebiasis, Helminthes- Ascaris, Taenia solium, Wucheria
- 2.3 Clinical diagnosis of non infection diseases – Diabetes, Hypertension, Asthma, Stroke, Arthritis, Heart attack, Cancer –benign, Malignant metastasis
- 2.4 Concept of Edema, Hyperaemia, Haemorrhage, Hemostasis, Thrombosis, Cellular responses – Hyperplasia, Hypertrapy, Metaplasia, Atrophy Necrosis, Apoptosis
- 2.5 Medical Imaging – X-ray, PET(Positron emission tomography), MRI (Magnetic Resonance Imaging), CT Scan ECG, EEG, Echo tests.

Suggested Readings:

1. Cheesebrough M., A Laboratory Manual for Rural Tropical Hospitals, A basis for training course.
2. Kania Mukherjee, Medical Laboratory Techniques Vol-I, II, III, . Tata MC Graw Hill Publishing company
3. Dr. K. N. Sachdev, Jaypee Brothers, (1988) Clinical Pathology and bacterial and medical publisher.
4. Ramnik Sood, Medical laboratory Techniques – Jaypee Brothers.
5. Prakash, G. Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
6. Robbins and Cotran, Pathology-I Basis of Disease, VIII Edition, Saunders.
7. Guyton A.C. and Hall J. E textbook of Medical Physiology, saunders.
8. Park, K. Preventive and social medicine, B. B. Publishers.

B.Sc. ZOOLOGY II YEAR
SEMESTER - IV
CORE PAPER – IV:
CELL BIOLOGY, GENETICS & DEVELOPMENTAL BIOLOGY

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT – I: (15 Periods)

1. Cell Biology

- 1.1. Ultrastructure of animal cell
- 1.2. Structure and functions of plasma membrane proteins.
- 1.3. Structure and functions of cell organelles –Endoplasmic reticulum, Golgi body, Ribosomes, Lysosomes, centrosomes, Mitochondria and Nucleus
- 1.4. Chromosomes – Structure, types, giant chromosomes
- 1.5. Cell Division - Mitosis, Meiosis; Cell cycle and its regulation.

UNIT – II: (15 Periods)

2. Molecular Biology

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

UNIT – III: (15 Periods)

3. Genetics

- 3.1 Mendals 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; Gene mutations- Induced versus Spontaneous mutations.
- 3.5 Inborn errors of metabolism.

UNIT – IV: (15 Periods)

4. Developmental Biology and Embryology

- 4.1 Gametogenesis (Spermatogenesis and Oogenesis) Fertilization; Types of eggs; Types of cleavages
- 4.2 Development of Frog up to formation of primary germ layers
- 4.3 Formation of Foetal membrane in chick embryo and their functions
- 4.4 Types and functions of Placenta in mammals
- 4.5 Regeneration in Turbellaria and Lizards

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.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

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. **Gupta P.K., 'Genetics'**
8. Developmental Biology by **Beryll**
9. Developmental Biology **S. Gilbert**
10. Developmental Biology - patterns, problems and principles by **W. Saunders Jr.**

B.Sc. ZOOLOGY II YEAR PRACTICAL SYLLABUS
SEMESTER - IV
CORE PAPER – IV
CELL BIOLOGY, GENETICS & DEVELOPMENTAL BIOLOGY

Instructions: 3hr per week

No. of credits: 1

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. 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 "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

1. Manual of laboratory experiments in cell biology Edward, G.
2. Freeman & Bracegirdle, An atlas of embryology

B.Sc. ZOOLOGY II YEAR
SEMESTER- IV
PAPER-IV(SEC-3): POULTRY AND ANIMAL HUSBANDRY

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT -I: Poultry

(15 Periods)

- 1.1 Poultry – present status and future prospects
- 1.2 Methods of Housing – Housing of chicks in floor and cages, Housing growers in cages and floor, Housing of layers on floor and cages, slatted floor
- 1.3 Importance of nutrition in poultry production – Classification of food stuffs and their categorization into energy feeds, protein feeds, minerals and vitamins
- 1.4 Common diseases of poultry and their causative agents, symptoms and treatment
 - (i) Viral diseases – Ranikhet disease, Fowl pox, EDS-76 (Egg Drop Syndrome), infection of bursal disease (gumbolo disease)
 - (ii) Bacterial diseases – Coli bacillosis, Salmonellosis
 - (iii) Fungal diseases – Aspergillosis
 - (iv) Parasitic diseases – Tapeworm, Coccidiosis
- 1.5 Vaccination procedures for broilers, broiler breeders, commercial layers, turkey, duck breeders and commercial ducklings.

UNIT-II: Animal Husbandry

(15 Periods)

- 2.1 Introduction to dairy farming in India and its present and future prospects
- 2.2 Dairy farm- Water supply, Light, Ventilation, Drainage system, Maintenance of recycling of waster and hygienic conditions of farm
- 2.3 Study of general management practices of animals: Grooming, Drying off, control of bad habits, castration, deworming, trimming
- 2.4 Cattle and Buffalo management – Calf raising, management of pregnant, parturient, lactating and dry cows, buffalos and breeding bull, summer management of buffalo
- 2.5 Sheep and Goat management – Management of Lambs and kids, Management of pregnant, parturient and lactating doe, General management practices of pigs

Suggested Readings:

1. Poultry Science and practice – Nilotpal Ghosh, CBS publisher
2. Poultry production and Management - Jagadeesh Prasad, Kalyani publisher
3. A text book of Animal husbandry – C. C. Banjer Joe, IBH publishing
4. A text book of Animal husbandry – S. K. Kaushish, Kalyani publisher

B.Sc. ZOOLOGY II YEAR
SEMESTER- IV
PAPER-IV(SEC-3): VERMICULTURE

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT-I:

(15 Periods)

- 1.1 Scope of vermi technology- Vermiculture and vermi composting – difference between vermiculture and vermi composting –
- 1.2 Earthworm diversity – Ecological groups of earthworms, biology of composting earthworms – *Eoisena foeitida*, *Eudrilus lugeniae*.
- 1.3 Soil – Physical, chemical and biological features
- 1.4 Organic waste sources – problems in traditional composting, vermi composting
- 1.5 Types small and large scale pit method, heap method.

UNIT-II:

(15 Periods)

- 2.1. Vermiculture techniques – vermi culture process – site selection - Selection and collection of species mono and poly culture
- 2.2. Essential parameters for vermi culture – bedding. Methods of harvesting worms general manual methods, self harvesting method, mechanical method
- 2.3. Nutritive value of vermi compost, storing and packing of compost
- 2.4. Applications of vermi composting in agricultural and horticultural practices
- 2.5. Economic of vermi culture, nationalized bank, NABARD support for vermi culture.

References:

1. Earthworm ecology by LEE
2. Biology of earthworm by Steven son
3. Vermicomposting tech – soil health to human health by Ranganathan L.S.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

**B.Sc. ZOOLOGY III YEAR
SEMESTER - VI
PAPER – VI (SEC-III): VECTOR BIOLOGY**

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

Unit-I: Vector Biology of Public Health Importance (15 Periods)

- 1.1 Introduction to vectors and vectors of human diseases – Public health nuisance.
- 1.2 Salient features and Life cycle of important Mosquito vector species – Anopheles, Aedes, Culex and Mansonia.
- 1.3 Salient features and life cycle of important other Dipteran vectors of public health Importance: Sandflies, Black flies, House flies and Myiasis causing flies.
- 1.4 Life cycle and public health importance of
-Fleas and lice
- 1.5 Life cycle and public health importance of
-Ticks and Mites.

Unit – II: Basic sanitation and Public Health (15 Periods)

- 2.1 Basic sanitation – Hygiene and personal protection – Human wastes and Health – Solid waste and Waste water management.
- 2.2 Distinguishing characters of different species of human malarial parasites Life cycle and host Parasite interactions.
- 2.3 Distinguishing characters of different species of human Filarial parasites Life cycle and host parasite interactions.
- 2.4 Distinguishing characters of different arboviral diseases and their mode of transmission.
- 2.5 Control Measures – Source reduction.

B.Sc. ZOOLOGY II YEAR
SEMESTER- IV
PAPER-IV(SEC-4:) BIOMATERIALS FROM ANIMALS SOURCES

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT-I: Biomaterials Introduction (15 Periods)

- 1.1 Introduction classification, Chemistry and characterization to biomaterial, biocompatibility with medical devices
- 1.2 Types of biomaterials degradable and reabsorbable materials, hydro gels and natural materials
- 1.3 Metallic biomaterial , ceramic biomaterials, composite for biomedical applications
- 1.4 Biomaterials and its applications – muscular skeletal systems
- 1.5 Delivery of drugs: for tissue engineering and regenerative medicine

UNIT-II: Biomaterials and their applications (15 Periods)

- 2.1 Collagen Definition, Types of Collagen, Structure of Collagen, Collagen Sources from Animal Origin Such as Bovine, Porcine, Marine and Fishes; Applications in Pharmaceutical, Tissue Engineering and Biomedical Industries.
- 2.2 Introduction to silk biomaterials: Silk fibroin and silk sericin proteins, molecular structure. Properties of silk fibroin: mechanical strength and biocompatibility. Spider dragline silk structure and properties, production from glands, spinning mechanism, Chemical Composition and Applications.
- 2.3 Structural Properties, Isolation and Processing Methods, Conversion of Chitin to Chitosan, Chemical and Biological properties; Bio Medical Applications.
- 2.4 Physico Chemical Properties, Structure, Synthesis Methods, Mechanism of Action, Physiological Function, Wound and Skin Repairs, Receptors of Hyaluronic Acid and Biomedical Applications
- 2.5 Introduction, elastin- structure, properties, Production from Various Sources, Biological Function and Biomedical Applications

Suggested Readings:

1. Biomaterial science: An introduction to materials in medicine, Buddy D. Ratner, et. al., Elsevier academic press 3rd edition.
2. Biomaterial compositor by Luigi Ambroio 210 CRC press
3. Styata V. Bhat, Biomaterial 2nd edition, Naros Publishing House, New Delhi
4. Biological Materials Science, Biological Materials, Bioinspired Materials, and Biomaterials; Marc André Meyers, Po-Yu Chen.
5. Biomaterials, Medical Devices, and Combination Products; Biocompatibility Testing and Safety Assessment; Shayne Cox Gad, Samantha Gad-McDonald.
6. Biologically Responsive Biomaterials for Tissue Engineering. Iulian Antoniac.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. ZOOLOGY II YEAR
SEMESTER – IV
PAPER-IV(SEC-4) – AQUACULTURE

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT-I: Aquaculture systems (15 Periods)

- 1.1 Concept of aquaculture. Culture systems: Freshwater culture: Prawn and fish culture in paddy fields; Brackish water culture; Mariculture: Culture of Oyster, Crab, Lobster, Mussel, Eels, aquatic weeds.
- 1.2 Definition and patterns of Composite fish culture in India. Techniques of composite culture. Culture of Catfishes and miscellaneous fishes.
- 1.3 Preparation and management of fish culture ponds: Nursery, Rearing, and Stocking ponds. Predatory and Weed fishes and their control using fish toxicants. Aquatic insects and their control.
- 1.4 Fertilization. Fish food organisms and their production. Supplementary feeding.
- 1.5 Transport of fish seed and Brood fish. Causes of mortality in transport. Methods for packaging and transport- Open and Closed systems. Use of chemicals, anesthetic drugs, antiseptics and antibiotics in live fish transport.

UNIT-II: Fish pathology and Technologies in Fisheries development (15 Periods)

- 2.1 Parasitic and Non-parasitic diseases; Fungal infections, Protozoan diseases, Worm diseases.
- 2.2 Fish breeding: Natural and artificial. Harvesting: Fishing techniques, preservation and processing of fish.
- 2.3 Fresh water prawn culture - Introduction. Breeding characteristics. Juvenile prawn migration. Seasonal & regional distribution of seeds. Identification of juveniles. Controlled breeding. Culture: Monoculture and Mixed culture in ponds. Role of hard water in culture of *Macrobrachium* species. Fertilization and feeds.
- 2.4 Pearl culture: Introduction, Pearl producing mollusks, pearl formation, collection and rearing of oysters, insertion of nucleus, harvesting, composition and quality of pearl.
- 2.5 Recirculation technology, Geographic Information System (GIS) technology, use of Information and Communication Technology (ICT) in fishes: production aspects, marketing aspects.

References:

1. Jingran, V.G. (1983). Fish and fisheries of India, Hindustan pub. Corp., New Delhi.
2. Hute, M. and Kahn, H. (2000). Textbook of fish culture, Blackwell Scientific Publication, Australia.
3. Srinivasulu, M., Reddy, K.R.S. Rao, S. (1999). Text book of Aquaculture, Discovery Publishing House, New Delhi.
4. Yawn Mehta, Fisheries & Aquaculture Biotechnology (2011). Campus Books International, Prahalad street, Ansari Road, Durga Ganj, New Delhi.

B.Sc. ZOOLOGY II YEAR
SEMESTER – IV
PAPER-IV(SEC-4) – AQUARIUM FISH KEEPING

Instructions: 2hr per week

No. of period: 30

No. of credits: 2

UNIT- I: Designing and preparation of aquaria with all accessories (15 Periods)

- 1.1 Importance, history and scope of aquarium fish keeping as a Cottage Industry.
- 1.2 Aquarium fabrication- shape, size, volume, type of glass tank, cutting of glass, preparation of glass tank, strengthening and supporting of tank; aquarium floor setting- type and size of pebbles, gravels, granites used for bed setting and its advantages.
- 1.3 Filters-biological, chemical and mechanical. Aquarium accessories like aerators, decorative, lighting, heating and feeding trays.
- 1.4 Water quality management in aquarium systems-sources of water, temperature, pH, dissolved oxygen, carbon dioxide, ammonia, hardness, turbidity.
- 1.5 Aquarium plants: Uses of different varieties of submerged plants (tubers, rooted plants) and emerged plants.

UNIT- II: Biology, food & feeding and control of diseases of aquarium fishes (15 Periods)

- 2.1 Common characters and sexual dimorphism of common freshwater and marine exotic and indigenous species of aquarium fishes: Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish.
- 2.2 Food and feeding Use of live fish feed organisms (Artemia, Infusoria, Spirulina). Preparation and composition of formulated fish feed.
- 2.3 Brood stock management: Maintenance of breeding conditions- pH, temperature and sex ratio; Selective breeding and hybridization techniques, induced breeding, colour enhancement techniques.
- 2.4 Common diseases of aquarium fishes – their causative agents viz., virus, bacteria, fungi, protozoa and nematodes; symptoms, treatment and prophylactic measures.
- 2.5 Budget for setting up an Aquarium Fish Farm as a Cottage Industry.

References:

1. Hansen, J. (1979). Making your own aquarium. Bell and Hyman Ltd., London.
2. Axelord, H.R. (1967). Breeding aquarium fishes, T F H Publications.
3. Lovell, T. (1998). Nutrition and feeding of fish. Second Ed. Kluwer Academic publishers.
4. Mills, D. and Vevers, G. (1982). The Practical encyclopedia of fresh water, Tropical Aquarium fishes, Salamander Books Limited, London.
5. Brunner, G. (1973). Aquarium plants, T F H Publications Inc. Ltd., Hongkong.
6. Mills, D. (1981). Aquarium Fishes, Arco publishing.
7. Gahlawat, S.K., et. al. (2007). Manual of experimental Ichthyology, Daya publishing House, Delhi.
8. Talwar, P.K., and Jhingran, A.G. (1991). Inland fishes. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

B.Sc. ZOOLOGY III YEAR

SEMESTER – V

PAPER-V (DSE – I): PHYSIOLOGICAL CHEMISTRY AND ENDOCRINOLOGY

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT-I: Biomolecules of Importance (15 Periods)

- 1.1 Types of biomolecules –Carbohydrates,Proteins ,Lipids,Nucleic acids and their significance in biological systems.
- 1.2 Classification of protein; Function of proteins based on their chemical nature
- 1.3 Protein metabolism: Transamination, deamination, urea cycle
- 1.4 Classification and function of carbohydrates
- 1.5 Carbohydrate metabolism: Glycolysis, Kreb's cycle, electron transport and oxidative phosphorylation

UNIT-II: Lipids and enzyme Classification (15 Periods)

- 2.1 Lipids: nomenclature and classification of lipids
- 2.2 Fatty acid synthesis and beta oxidation of lipids
- 2.3 Cholesterol synthesis and metabolism of steroidal hormones
- 2.4 Enzyme definition, nomenclature, classification and Enzyme kinetics, Lineweaver-Burk plot
- 2.5 Mechanism of enzymes: Action, enzyme inhibition, coenzymes

UNIT - III: Introduction to Endocrinology (15 Periods)

- 3.1 Concept and Scope of endocrinology; Hormones as chemical messengers.
- 3.2 Classification of hormones
- 3.3 Mechanism of action of aminoacid derivatives, peptide hormones and steroid hormones.
- 3.4 Positive feedback mechanism and Negative feedback control
- 3.5 Concept of internal environment and homeostasis.

UNIT - IV: Endocrine Glands and their Hormones (15 Periods)

- 4.1 Hypothalamus and its Hormones.
- 4.2 Structure, hormones and functions of Pituitary gland.
- 4.3 Structure, hormones and functions of Thyroid, Parathyroid, thymus
- 4.4 Structure, hormones and functions of Adrenal, Pancreas, Pineal,
- 4.5 Hormones and reproduction

REFERENCE BOOKS:

1. Text book of biochemistry
2. Text book of biochemistry
3. Text book of physiology and biochemistry
4. Text book of biochemistry
5. Molecular cell biology
6. Comparative Endocrinology of Invertebrates by Highman and Hill.
7. Comparative Vertebrate Endocrinology by P.J.Bentley, Cambridge Univ. Press
8. Text Book of Endocrinology by Turner and Bangnara (W.B.Sanders)
9. Essential Endocrinology by Joen Laycock and Peter Loise Oxford Univ. Press.
10. Text Book of Endocrinology by R.H.Williams (W.B.Saunders).

B.Sc. ZOOLOGY III Year PRACTICAL SYLLABUS
SEMESTER – V
PAPER-V (DSE – I): PHYSIOLOGICAL CHEMISTRY AND ENDOCRINOLOGY

Instructions: 3hr per week

No. of credits: 1

1. Identification of carbohydrates –Molisch test,Benedict's/Fehling's test,Iodine test,Barfoed's test.
 2. Identification of proteins-Biuret test,Sodium hydroxide test
 3. Identification of amino acids-Xanthoproteic test,Nin-hydrin test,Millon's test.
 4. Identification of lipids-Sudan-IV test.
 5. Histology of Endocrine glands, Pituitary, Thyroid, Parathyroid, Thymus, Adrenal Pancreas, Ovary & Testis, Uterus.
 6. Effect of Eye Stalk ablation on Blood Glucose levels in Crabs.
 7. Identification of Gonadotrophin in Human urine samples.
 8. Effect of Thyrosine and thiourea (antithyroid agent) on oxygen consumption in fish.
- Laboratory record work shall be submitted at the time of practical examinations
 - Computer-aided techniques shall be adopted as per UGC guidelines

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. III Year

SEMESTER-V,

Paper – V (DSE – I): LABORATORY ANIMALS MAINTENANCE AND APPLICATIONS

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT I: Introduction to Laboratory Animals & Animal Care (15 Periods)

- 1.1 Laboratory Animals – Introduction; Species of Laboratory Animals; Laboratory Animals for Research; Genetically Modified Laboratory Animals
- 1.2 Animal Experimentations – Implications; Principles, Laboratory Animals and Models of Human Diseases, Results of Animal Experimentations
- 1.3 Animal Care – Animal Ethics; ethical theories – Virtue ethics, Humean Theory, Utilitarian Theory, Capabilities Theory, Persons Theory
- 1.4 Animal Care – Regulations and Policies; Prevention of Cruelty to Animal Act, 1960; Breeding of and Experiments on Animals (Control and Supervision) Rules, 2006
- 1.5 Animal Care – CPCSEA, Standard Operating Procedures (SOP) for IAEC; CPCSEA Guidelines for Laboratory Animal Facility

UNIT II: Maintenance, Quality Control & Welfare of Laboratory Animals (15 Periods)

- 2.1 Environment and Facilities of Laboratory Animals for Terrestrial Animals and Aquatic Animals
- 2.2 Nutrition and Animal Experimentation – Nutrients, energy, nutritional needs, animal feeds
- 2.3 Genetic Standardization of Laboratory Animals – Animal Breeding System; Inbred strains; Strains Made from Multiple Inbred Strains; F1 Hybrids, Outbred Strains and Closed Colonies; Genetic Quality Control
- 2.4 Microbiological Standardization of Laboratory Animals – Reasons, causes, zoonosis; Contamination sources and routes of transmission
- 2.5 Concept of Animal Welfare – Origin and Connotation; Concept of Stress, Pain, and Distress in Laboratory Animals; Humane End Points of Animal Experiments

UNIT III: Management & Husbandry of Laboratory Animals (15 Periods)

- 3.1 Management of Laboratory Animals – Introduction, Laboratory Animal Welfare and controversy of animal experimentation
- 3.2 Alternative Methods of Animal Experimentation - 3Rs Theory; Protocol of animal experimentation
- 3.3 Laboratory Management and Husbandry – Mice: general biological characteristics including anatomy and physiology; sexual differentiation, health features, cages and housing; husbandry and recording
- 3.4 Laboratory Management and Husbandry - Rats: general biological characteristics including anatomy and physiology; sexual differentiation, health features, cages and housing; husbandry and recording
- 3.5 Laboratory Management and Husbandry – Fishes; general biological characteristics including anatomy and physiology; health features, water system, water management, feeding

UNIT IV: Applications of Laboratory Animals (15 Periods)

- 4.1 Animal Models – Need, Classification and Selection of animal models
- 4.2 Animal Models – Types: Induced AM, Spontaneous AM, and Genetically Modified AM
- 4.3 Applications in biomedical research – systemic diseases, transplantation studies, studies on embryogenesis and developmental biology
- 4.4 Applications in behavioural research – neurological responses, behavioural changes, brain function, acclimatization studies
- 4.5 Applications in toxicology and drug research – safety testing of pesticides, medications, food additives; cosmetic testing; drug testing: metabolic tests, toxicology tests

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. III Year PRACTICAL SYLLABUS

SEMESTER-V, DSE – I

Paper – V

LABORATORY ANIMALS MAINTENANCE AND APPLICATIONS

Instructions: 3hr per week

No. of credits: 1

1. Mounting zooplanktons for microscopic viewing
 2. Demonstration of microscopic drawings of zooplanktons
 3. SDH or LDH activity using colorimeter
 4. Demonstration of ELISA using kit
 5. Measurements of soil characteristics – temperature, pH, humus content and moisture content
 6. Measurement of physico-chemical parameters of water – temperature, pH, oxygen levels, alkalinity
 7. Exercise on data collection, tabulation and preparation of graphs
 8. Calculation of averages (mean, median, mode) and standard deviation
 9. Calculation of difference in means using Student's t Test
- **Laboratory record work shall be submitted at the time of Practical Examination.**
 - **Computer-aided teaching material too can be used for these experiments as per UGC guidelines**

B.Sc. ZOOLOGY III YEAR
SEMESTER-V

PAPER – V(DSE – I): IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT-I: Basics of Immune system (15 Periods)

- 1.1 Cells of the immune system and the lymphoid organs(Primary and secondary).
- 1.2 First line of defenses-physical and chemical barriers; second line of defenses- inflammation and phagocytosis.
- 1.3 Types of immunity-Inherent(Active and passive) and acquired immunity(Active and passive) Humoral and cell mediated immunity
- 1.4 Major histocompatibility complex (MHC)–structure and function of class I and class II proteins.
- 1.5 Significance of MHC in organ transplantation.MHC restriction

UNIT-II: Antibodies and Antigens and Immune system diseases (15 Periods)

- 2.1 Antibodies/immunoglobulins- structure, functions and classification, antibody diversity, Monoclonal antibodies and applications.
- 2.2 Antigens structure, antigenic determinants/epitopes, haptens, adjuvants and antigenicity.
- 2.3 Antigen-antibody reactions-agglutination, precipitation, opsonization, cytotoxicity
- 2.4 Hypersensitivity reactions
- 2.5 Autoimmunity and Immunodeficiency diseases.

UNIT – III: Animal Biotechnology and Genetically modified organisms (15 Periods)

- 3.1 Concept and Scope of Animal Biotechnology.
- 3.2 Recombinant DNA technology and its applications.
- 3.3 Cloning vectors - Plasmids, Cosmids and shuttle vectors; Cloning methods (Cell, Animal and Gene cloning).
- 3.4 Transgenesis – Methods of Transgenesis.
- 3.5 Production of Transgenic animals - sheep and fish.

UNIT –IV: Applications of Biotechnology (15 Periods)

- 4.1 In vitro fertilization and embryo transfer.
- 4.2 Hybridoma technology – concepts and applications.
- 4.3 Stem cells –types and their applications.
- 4.4 Biopesticides; *Bacillus thuringiensis* – mode of action of toxin.
- 4.5 Animal Bioreactors – concepts and applications.

Reference Books:

1. Text book of immunology-Ivan Riott
2. Text book of immunology-C.V.Rao
3. Text book of immunology-Nandini shetty
4. Text book of immunology-Kubey
5. Culture of Animal cells. R. Ian Freshney, Wiley Liss.
6. Biotechnology – S. Mitra.
7. Animal Cell culture – Practical Approach – Ed. John R W Masters, Oxford.
8. Biotechnology – B. D. Singh

B.Sc. ZOOLOGY III YEAR PRACTICAL SYLLABUS
SEMESTER-V
PAPER – V(DSE – I): IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

Instructions: 3hr per week

No. of credits: 1

I. Immunology

1. Demonstration of agglutination(ABO-blood grouping/Widal test) using kit
2. Demonstration of precipitation(VDRL/RPR test)using kit
3. Radial immunodiffusion using kit.
4. Histology of lymphoid organs-Spleen, Thymus, Lymphnode, Bone marrow.

II. Animal Biotechnology

1. Study the following techniques through photographs / virtual lab

- a. Identification of Vectors
- b. Identification of Transgenic animals
- c. DNA sequencing (Sanger's method)
- d. DNA finger printing
- e. Southern blotting
- f. Western blotting

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.**

Reference Books:

1. A hand book of practical immunology-Ivan Riott
2. Animal Biotechnology – PK Gupta

B.Sc. ZOOLOGY III Year
SEMESTER – V
PAPER – V (GE-I): PREVENTIVE MEDICINE

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT-I: -Man and Medicine: Health for all (15 Periods)

- 1.1. Antiquity medicine, types of medicine.
- 1.2. Dawn of scientific medicine, modern medicine – curative medicine, preventive medicine and social medicine.
- 1.3. Definition of health, dimensions of health – Physical, Mental, Social Spiritual, Emotional and Vocational health,
- 1.4. Determinants of health – Biological, Behavioural, Environmental, Socio-economic and Health services
- 1.5. Concept of well being – Standard of living, Level of living and quality of life.

UNIT-II: Principles of Epidemiology (15 Periods)

- 2.1. Definition of epidemiology, measurements in epidemiology- rates, ratio and proportion.
- 2.2. Epidemiologic methods- observational and experimental studies.
- 2.3. Uses of epidemiology and definitions of infectious disease epidemiology.
- 2.4. Dynamics of disease transmission – source and reservoirs.
- 2.5. Epidemiological triad, modes of disease transmission – direct and indirect.

UNIT-III: Concept of Disease causation (15 Periods)

- 3.1. Germ theory of Diseases
- 3.2. Disinfection- types of disinfection
- 3.3. Immunity- Active Immunity, Passive immunity, immunizing agents.
- 3.4. Nutrition and Health – Classification of foods; Nutritional requirements.
- 3.5. Screening of disease – uses of screening, types of screening.

UNIT-IV: Concepts of control & prevention (15 Periods)

- 4.1. Health care of the community – health care systems, levels of health care.
- 4.2. Modes of health interventions: Health Promotion, Specific Protection, Early Diagnosis and Treatment, Disability Limitations, and Rehabilitations.
- 4.3. Concepts of control - Monitoring and Surveillance.
- 4.4. Concepts of Prevention- Primary, Secondary & Tertiary.
- 4.5. Health programmes in India.

References:

1. Park's Textbook of Preventive and Social Medicine.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

B.Sc. ZOOLOGY III YEAR

SEMESTER – V

PAPER – V (GE-I): INTEGRATED PEST MANAGEMENT

Instructions: 4 hr per week

No. of period: 60

No. of credits: 4

UNIT-I: Pest

(15 Periods)

- 1.1 Introduction, History and origin
- 1.2 Definition of pest and its ecology
- 1.3 Pest, population dynamics
- 1.4 Economic injury level (EIL), Economic threshold
- 1.5 Pest surveillance

UNIT-II: Integrated Pest Management

(15 Periods)

- 2.1 Concepts of IPM
- 2.2 Components of IPM
- 2.3 Major IPM strategies
- 2.4 Strategies for IPM Mechanical, Physical, Cultural and Biological

UNIT-III: Biological and Genetic Control

(15 Periods)

- 3.1 Introduction and Principle
- 3.2 Bio control agents
- 3.3 Parasitoids, predators and pathogens (NPV, Bacteria, fungi and nematodes)
- 3.4 Merits and demerits
- 3.5 Genetic Control – sterile insect technique; sterile insect release method

UNIT-IV: Chemical Control

(15 Periods)

- 4.1 Classification of insecticides
- 4.2 Insecticide adjuvant and formulation
- 4.3 Chemical control with reference to organo chloride, organophosphate carbamates
- 4.4 Synthetic pyrethroids; fumigants; pheromones legal or regulatory control- Quarantine acts

REFERENCES

1. K.P.Srivastava: A Text Book of applied Entomology Vol.i&ii. Kalyani Publishers New Delhi.
2. B.V.David and KumaraSwamy. Elements of Economic Entomology
3. B.V.David and KumaraSwamy. Elements of Economic Entomology
4. Pedigo, L.P. Entomology and Pest Management. Prentice-Hall, New Delhi
5. Pradhan, S. Insect Pests of Crops, National Book Trust, New Delhi
6. Agricultural Pests of India and South East Asia by Atloal A.S. Kalyani Publisher, New Delhi
7. Insect Pest of Crops by S. Pradhan, National Book Trust, New Delhi

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT-I: Introduction to Fisheries, aquaculture systems, management practices (15 periods)

- 1.1 Introduction, definition, history, scope and significance of 'Fisheries'. Present status and prospects of Fisheries at global, national and local (state) level. Blue revolution.
- 1.2 Classification of Fisheries.
 - i) Fin fisheries & Shell fisheries;
 - ii) Capture fisheries & Culture fisheries;
 - iii) Freshwater (inland), Brackish water & Marine fisheries.
- 1.3 Aquaculture systems: Pond culture, pen culture, cage culture. Monoculture, composite culture, integrated culture systems.
- 1.4 Culture phases and management practices: Nursery, rearing and grow-out pond preparation. Liming, fertilization/manuring, and water quality management. Control of aquatic weeds, algal blooms, and weed fishes.
- 1.5 Traits of important cultivable finfish and shellfish: Indian major carps and Minor carps, Exotic carps, air breathing fishes, cold water fishes, fresh water prawns, mussels.

UNIT-II: Feeding, Breeding and hatchery management of finfish and shellfish (15 periods)

- 2.1 Bundh breeding: Concept; wet and dry bundhs; Collection and hatching of eggs.
- 2.2 Induced breeding: Environmental factors affecting spawning; Hypophysation of fishes; Fish pituitary gland: Structure, collection, preservation, and preparation of extract for injection, dosages and methods of injection, dosages and methods of injection.
- 2.3 Brood-stock management and transportation of brood fish. Synthetic hormones are used for induced breeding of carps.
- 2.4 Types of fish hatcheries: Traditional, Chinese, Glass jar, Modern controlled hatcheries. Breeding and hatchery management of *Penaeus monodon* and *Macrobrachium rosenbergii*.
- 2.5 Fish nutrition: Natural and supplementary feeding of cultivable finfish and shellfishes. Forms of feeds: Wet feeds, dry feeds, mashes, pelleted feeds, floating and sinking pellets.

UNIT-III: Limnology (15 periods)

- 3.1 Introduction to limnology, Inland water bodies: Characteristics and distribution of Ponds, Lakes, Reservoirs, Streams and Rivers.
- 3.2 Dynamics of lentic and lotic environments.
- 3.3 Major rivers and fresh water lakes of India. Origin, classification and morphometry of lakes.
- 3.4 Influence of physical and chemical conditions on living organisms in inland waters- Temperature, Light, pH, Turbidity, Thermal stratification, Dissolved Oxygen (DO), Alkalinity, Acidity, Hardness, BOD, COD etc.
- 3.5 Major groups of organisms in freshwater bodies: Planktons, Periphytons, Neustons, Nektons, Benthos, large aquatic plants etc. Ecological adaptations of freshwater fauna.

UNIT-IV: Productivity of lakes (15 periods)

- 4.1 Ecology of ponds and lakes (Lentic ecosystems) – Structure and dynamics – Energy flow.
- 4.2 Productivity of water bodies: Concept of productivity, primary, secondary and tertiary productivity. Factors affecting productivity. Classification of lakes based on productivity.
- 4.3 Laws of minimum and quantitative relationships in a standing crop.

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- 4.4 Biotic potential and environmental resistance. Succession phenomenon and indices of productivity of lakes.
- 4.5 Eutrophication – causes, consequences and control mechanisms.

Reference Books:

1. Goldman CR. And Home AJ. 1983. Limnology. Mc Graw – Hill International Book Company.
2. Ruttner F. 1953. Fundamentals of Limnology. University of Toronto press, Toronto.
3. Welch PS, 1952. Limnology, 2nd Ed. Mc Graw-Hill Book Co., New York.
4. Golterman, HL. 1975. Physiological Limnology. Elsevier Publishing Co., Amsterdam
5. Cole GA. 1983. Text book of Limnology. C.V Mosby Company, St. Louis, Missouri, USA.
6. Wetzel RG. 1975. Limnology. W.B. Sanders Company, Philadelphia.

B.Sc. ZOOLOGY III YEAR PRACTICAL SYLLABUS
SEMESTER – VI
PAPER-VI (DSE-II): FISHERIES AND LIMNOLOGY

Instructions: 3hr per week

No. of credits: 1

1. Aquaculture production statistics – World, India, and Telangana state.
2. Aquaculture resources of the World, India, and Telangana state.
3. Histological studies of testis, ovary of fish.
4. Identification of important cultivable fresh water fishes-Indian major carps, exotic carps, mahaseers, trouts, tilapias, catfishes, murrel fish.
5. Removal of fish pituitary gland and preparation of pituitary gland extract.
6. Morphometry of lakes, ponds and streams.
7. Determination of physical and chemical characteristics of lotic and lentic water bodies: Temperature, transparency, turbidity, pH, electrical conductivity, salinity, total dissolved solids, dissolved oxygen, free carbondioxide, total alkalinity, total hardness, calcium, magnesium, inorganic nitrogen(ammonium and nitrate) and phosphorous.
8. Collection and identification of fresh water Phytoplankton.
9. Collection and identification of fresh water Zooplankton.
10. Estimation of primary productivity in fresh water bodies.
11. Field trip to local or nearby fisheries unit/fresh water body is to be conducted and certified field note book should be submitted at the time of practical examination.

References:

1. Ayyappan, S., 2011. Handbook of Fisheries and Aquaculture, ICAR Publications, New Delhi.
2. Rath, R.K., 2011. Freshwater Aquaculture, Scientific publications.
3. Santhanam, R., Sukumaran, N. and Natarajan, P. 1987. A manual of Aquaculture. Oxford-IBH, New Delhi.
4. Ramanathan, N. and Francis T., 1996. Manual on breeding and larval rearing of cultivable fishes, Fisheries College and Research Institute, Tuticorin.
5. Jhingran, V.G., Pullin, R.S.V., 1997. A hatchery manual for the Common, Chinese and Indian Major Carps. Asian Development Bank, International Centre for living Aquatic Resources Management, Philippines.

B.Sc. ZOOLOGY III YEAR
SEMESTER-VI
PAPER – VI (DSE-II): ECOLOGY, ZOOGEOGRAPHY AND EVOLUTION

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT – I: (15 Periods)

1.1 Ecology - I

- 1.1 Ecosystem structure and functions. Types of Ecosystems –Aquatic and Terrestrial.
- 1.2 Biogeochemical cycles - Nitrogen, Carbon, Phosphorus and Water.
- 1.3 Energy flow in ecosystem.
- 1.4 Food chain, food web and ecological pyramids.
- 1.5 Animal Associations - Mutualism, commensalism, parasitism, competition, predation

UNIT – II: (15 Periods)

2.1 Ecology - I

- 2.1 Concept of Species, Population dynamics and Growth curves.
- 2.2 Community Structure and dynamics and Ecological Succession.
- 2.3 Ecological Adaptations.
- 2.4 Environmental Pollution – Sources, Effect and Control measures of Air, Water, Soil and Noise Pollution.
- 2.5 Wildlife conservation - National parks and Sanctuaries of India, Endangered species.

UNIT – III: (15 Periods)

3.1 Zoogeography

- 3.1 Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions - their Climatic and faunal peculiarities
- 3.2 Wallace line, Discontinuous distribution
- 3.3 Continental Drift
- 3.4 Biodiversity and hotspots of Biodiversity in India.

UNIT – IV: (15 Periods)

4.1 Evolution

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

Suggested Readings:

1. **M.P.Arora**, 'Ecology' Himalaya Publishing company.
2. **P.D.Sharma**, 'Environmental Biology'.
3. **P.R.Trivedi and Gurdeep Raj**. 'Environmental Ecology'
4. **Buddhadev Sarma and Tej Kumar**, *Indian Wildlife Threats and Preservation*
5. **Chapman J.L. and Reiss M.J**, *Ecology Principles and Applications*, Second Ed., Cambridge University Press, London.
7. **Benny Joseph**, *Environmental Studies*, TATA McGraw Hill Com., New Delhi.

B.Sc. ZOOLOGY SYLLABUS UNDER CBCS 2019-20

8. **Eugene P. Odum**, *Fundamentals of Ecology* Third Ed., Nataraj Publishers, Dehradun.
9. **Veer Bala Rastogi**, "Ecology and Animal Distribution"
10. **P.K. Gupta**, "Text Book of Ecology and Environment"
11. **Bhatnagar and Bansal**, "Ecology and Wildlife biology"
12. **Ridley, M. (2004)**. *Evolution*. III Edition. Blackwell Publishing
13. **Douglas, J. Futuyma (1997)**. *Evolutionary Biology*. Sinauer Associates.
14. **Minkoff, E. (1983)**. *Evolutionary Biology*. Addison-Wesley.
15. **Jan M. Savage**. *Evolution*, 2nd ed, Oxford and IBH Publishing Co., New Delhi.

B.Sc. ZOOLOGY III YEAR PRACTICAL SYLLABUS
SEMESTER- VI
PAPER – VI (DSE-II): ECOLOGY, ZOOGEOGRAPHY AND EVOLUTION

Instructions: 1hr per week

No. of credits: 2

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

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

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

OPTIONAL PAPER IN PLACE OF THE PROJECT
B.Sc. ZOOLOGY III YEAR
SEMESTER - VI
PAPER – VI: TOOLS AND TECHNIQUES IN BIOLOGY

Instructions: 4hr per week

No. of period: 60

No. of credits: 4

UNIT- I: Microscopy Centrifugation (15 Periods)

- 1.1 Microscopy – Basic principle of microscopy, types of microscopes and their application
- 1.2 Histopathological techniques – principle and its applications
- 1.3 Centrifugation –Basic principle of centrifugation; Preparatory and analytical centrifugation techniques and its applications

UNIT- II: Separation techniques (15 Periods)

- 2.1 Colorimetry and Spectrophotometry – Basic principle of colorimetry and its applications, Basic principle of spectrophotometry, and applications.
- 2.2 Chromatography – Basic principle of chromatography; Types of chromatography techniques and their applications
- 2.3 Electrophoresis – Basic principle of electrophoresis and their applications

UNIT- III: Advanced techniques (15 Periods)

- 3.1 Immuno assay-Principle and applications of ELISA
- 3.2 PCR Techniques – DNA extraction and isolation; Principles and applications of PCR techniques
- 3.3 RIA and its applications

UNIT- IV: Statistical tools (15 Periods)

- 4.1 Data – Definition and types of data, Concept of variables; Summarising data: averages (mean, median, mode), dispersion (range, standard deviation, confidence limits);
- 4.2 Representing data – Arraying data, tabulation; graphical representation of data (histogram, bar graph, line graph, scatter plot, pie diagram)
- 4.3 Non-parametric tests –Chi Square test and Parametric tests –Correlation; Student's t-Test; Regression analysis

Reference Books

1. Gurumani, N. An Introduction to Biostatistics. MJP Publisher, Chennai
2. Gurumani, N. Research Methodology. MJP Publishers, Chennai
3. Tembhare, D.B. Techniques In Life Sciences, Himalaya Publishing House, Delhi


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