



YBN UNIVERSITY

Established by the Act of Government of Jharkhand Act 15, 2017
Gazette Notification No. 505, Dated 17th July 2017
As per Section 2(f) of UGC Act. 1956

DEPARTMENT OF ZOOLOGY

COURSE-STRUCTURE For Three Years Bachelor Course ZOOLOGY (B.Sc. Hons.)

(To be implemented from the Academic Year 2020 onwards)

CHOICE BASED CREDIT SYSTEM



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COURSE-STRUCTURE FOR THREE YEARS ZOOLOGY (Hons.) COURSE

COURSE STRUCTURE OF B.Sc. ZOOLOGY HONS. FIRST SEMESTER													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject-wise Distribution
				Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks				
1Y3ZOO101	Ability Enhancement Compulsory Course	English Communications-I/Environmental Science-I	100	50	17	20	07	30	10	2	-	-	2
1Y3ZOO102	CC-I	Non-chordates I: Protista to Pseudocoelomates	70	50	17	-	-	20	07	4	-	-	4
1Y3ZOO102P	CC-I Practical	Practical-CC-I	30	30	10	-	-	-	-	-	-	2	2
1Y3ZOO103	CC-II	Principles of Ecology	70	50	17	-	-	20	07	4	-	-	4
1Y3ZOO103P	CC-II Practical	Practical-CC-II	30	30	10	-	-	-	-	-	-	2	2
1Y3ZOO104	GE-I	Animal Cell Biotechnology	70	50	17	-	-	20	07	4	-	-	4
1Y3ZOO104P	GE-I Practical	Practical - GE-I	30	30	10	-	-	-	-	-	-	2	2
	Grand Total		400										20

COURSE STRUCTURE OF B.Sc. ZOOLOGY HONS. SECOND SEMESTER													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject-wise Distribution
				Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks				
1Y3 ZOO201	Ability Enhancement Compulsory Course	English Communications-II/Environmental Science-II	100	50	17	20	07	30	-	2	-	-	2
1Y3 ZOO 202	CC-III	Non-chordates II: Coelomates	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO 202P	CC-III Practical	Practical-CC-III	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO 203	CC-IV	Cell Biology	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO 203P	CC-IV Practical	Practical-CC-IV	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO204	GE-II	Animal Diversity	70	50	17	-	-	20	07	4	-	-	4
1Y3EVS 204P	GE-II Practical	Practical-GE-II	30	30	10	-	-	-	-	-	-	2	2
	Grand Total		400										20

Minimum Passing Marks are equivalent to Grade D

Lectures T- Tutorials P- Practical, Major- Term End Theory Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

Syllabus of Generic Elective will be as per concerned Department Syllabus

COURSE STRUCTURE OF B.Sc. ZOOLOGY HONS. THIRD SEMESTER													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject-wise Distribution
				Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks				
1Y3 ZOO 301	CC-V	Diversity of Chordates	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO 301P	CC-V Practical	Practical-CC-V	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO3 02	CC-VI	Physiology: Controlling and Coordinating Systems	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO3 02P	CC-VI Practical	Practical-CC-VI	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO 303	CC-VII	Fundamentals of Biochemistry	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO 303P	CC-VII Practical	Practical-CC-VII	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO3 04	SEC-1	Apiculture	70	50	17	-	-	20	-	1	-	-	1
1Y3 ZOO 304P	SEC-1 Practical	Practical-SEC-1	30	30	10	-	-	-	-	-	-	1	1
1Y3 ZOO 305	GE-III	Aquatic Biology	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO3 05P	GE-III Practical	Practical-GE-III	30	30	10	-	-	20	07	-	-	2	2

	Grand Total		500										26
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Minimum Passing Marks are equivalent to Grade D

Lectures T- Tutorials P- Practical, Major- Term End Theory Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

Syllabus of Generic Elective will be as per concerned Department Syllabus

COURSE STRUCTURE OF B.Sc. ZOOLOGY HONS. FOURTH SEMESTER													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject-wise Distribution
				Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks				
1Y3 ZOO401	CC-VIII	Comparative Anatomy of Vertebrates	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO401P	CC-VIII Practical	Practical-CC-VIII	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO402	CC-IX	Physiology: Life Sustaining Systems	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO402P	CC-IX Practical	Practical-CC-IX	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO403	CC-X	Biochemistry of Metabolic Processes	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO403P	CC-X Practical	Practical-CC-X	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO 404	SEC-2	Aquarium Fish Keeping	70	50	17	-	-	20	-	1	-	-	1
1Y3 ZOO 404P	SEC-2 Practical	Practical-SEC- -2	30	30	10	-	-	-	-	-	-	1	1
1Y3 ZOO 405	GE-IV	Environment and Public Health	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO405P	GE-IV Practical	Practical-GE-IV	30	30	10	-	-	20	07	-	-	2	2
	Grand Total		500										26

Minimum Passing Marks are equivalent to Grade D

Lectures T- Tutorials P- Practical, Major- Term End Theory Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

Syllabus of Generic Elective will be as per concerned Department Syllabus

COURSE STRUCTURE OF B.Sc. ZOOLOGY HONS. FIFTH SEMESTER

Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject-wise Distribution
				Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks				
1Y3 ZOO 501	CC-XI	Molecular Biology	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO501P	CC-XI Practical	Practical-CC-XI	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO 502	CC-XII	Principles of Genetics	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO502P	CC-XII Practical	Practical-CC-XII	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO503	DSE-1	Agrochemicals and Pest Management	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO 503P	DSE-1 Practical	Practical-DSE-I	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO 504	DSE-2	Animal Behaviour and Chronobiology	70	50	17	-	-	20	-	4	-	-	4
1Y3 ZOO504P	DSE-2 Practical	Practical-DSE-II	30	30	10	-	-	-	-	-	-	2	2
	Grand Total		400										24

Minimum Passing Marks are equivalent to Grade D

Lectures T- Tutorials P- Practical, Major- Term End Theory Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

COURSE STRUCTURE OF B.Sc. ZOOLOGY HONS. SIXTH SEMESTER

Course Details				External Assessment		Internal Assessment				Credit Distribution			Alotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject-wise Distribution
				Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks				
1Y3 ZOO601	CC-XIII	Developmental Biology	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO601P	Practical-CC-XIII	Practical-CC-XIII	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO602	CC-XIV	Evolutionary Biology	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO602P	Practical-CC-XIV	Practical-CC-XIV	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO603	DSE-3	Animal Biotechnology	70	50	17	-	-	20	07	4	-	-	4
1Y3 ZOO603P	DSE-3-Practical	Practical - DSE-III	30	30	10	-	-	-	-	-	-	2	2
1Y3 ZOO604	DSE-4	Basics of Neuroscience	70	50	17	-	-	20	-	4	-	-	4
1Y3 ZOO604P	DSE-4-Practical	Practical- DSE-IV	30	30	10	-	-	-	-	-	-	2	2
	Grand Total		400										24

Minimum Passing Marks are equivalent to Grade D

Lectures T- Tutorials P- Practical, Major- Term End Theory Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

B.Sc. ZOOLOGY HONS. FIRST SEMESTER

CORE COURSE – I: NON-CHORDATES I: PROTISTA TO PSEUDOCOELOMATES

COURSE CODE: 1Y3ZOO102

THEORY

Credits 4

Unit 1: Protista, Parazoa and Metazoa

19

- I. General characteristics and Classification up to classes
- II. Study of Euglena, Amoeba and Paramecium
- III. Life cycle and pathogenicity of Plasmodium vivax and Entamoeba histolytica
- IV. Locomotion and Reproduction in Protista
- V. Evolution of symmetry and segmentation of Metazoa

Unit 2: Porifera

7

- I. General characteristics and Classification up to classes
- II. Canal system and spicules in sponges

Unit 3: Cnidaria

12

- I. General characteristics and Classification up to classes
- II. Metagenesis in *Obelia*
- III. Polymorphism in Cnidaria
- IV. Corals and coral reefs

Unit 4: Ctenophora

4

- I. General characteristics and Evolutionary significance

Unit 5: Platyhelminthes

10

- I. General characteristics and Classification up to classes
- II. Life cycle and pathogenicity of *Fasciola hepatica* and *Taenia solium*

Unit 6: Nematelminthes

8

- I. General characteristics and Classification up to classes
- II. Life cycle, and pathogenicity of *Ascaris lumbricoides* and *Wuchereria bancrofti*
- III. Parasitic adaptations in helminthes

CORE COURSE-1:NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

COURSE CODE: 1Y3ZOO102P

PRACTICALS I

(Credits 2)

1. Study of whole mount of *Euglena*, *Amoeba* and *Paramecium*, Binary fission and Conjugation in *Paramecium*
2. Examination of pond water collected from different places for diversity in protista
3. Study of *Sycon* (T.S. and L.S.), *Hyalonema*, *Euplectella*, *Spongilla*
4. Study of *Obelia*, *Physalia*, *Millepora*, *Aurelia*, *Tubipora*, *Corallium*, *Alcyonium*, *Gorgonia*, *Metridium*, *Pennatula*, *Fungia*, *Meandrina*, *Madrepora*
5. One specimen/slide of any ctenophore
- 6 . Study of adult *Fasciola hepatica*, *Taenia solium* and their life cycles (Slides/microphotographs)
7. Study of adult *Ascaris lumbricoides* and its life stages (Slides/micro-photographs)
8. To submit a Project Report on any related topic on life cycles/coral/ coral reefs.

Note: Classification to be followed from “Ruppert and Barnes (2006) *Invertebrate Zoology*, 8th edition, Holt Saunders International Edition”

SUGGESTED READINGS

- . Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
- .Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- . Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson

CORE COURSE-II: PRINCIPLES OF ECOLOGY

COURSE CODE: 1Y3ZOO103

THEORY	(Credits 4)
Unit 1: Introduction to Ecology	6
History of ecology, Autecology and synecology, Levels of organization, Laws of Limiting factors, Study of physical factors	
Unit 2: Population	24
Unitary and Modular populations Unique and group attributes of population: Density, natality, mortality, life tables, Fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors Population interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition and Predation, functional and numerical Responses	
Unit 3: Community	12
Community characteristics: species richness, dominance, diversity, abundance, Vertical stratification, Ecotone and edge effect; Ecological succession with one Example Theories pertaining to climax community	
Unit 4: Ecosystem	14
Types of ecosystems with one example in detail, Food chain: Detritus and grazing Food chains, Linear and Y-shaped food chains, Food web, Energy flow through the Ecosystem, Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with one example of Nitrogen cycle Human modified ecosystem	
Unit 5: Applied Ecology	4
Ecology in Wildlife Conservation and Management	

CORE COURSE-II: PRINCIPLES OF ECOLOGY

COURSE CODE: 1Y3ZOO103P

PRACTICALS II

(Credits 2)

1. Study of life tables and plotting of survivorship curves of different types from the Hypothetical/real data provided
2. Determination of population density in a natural/hypothetical community by quadrat Method and calculation of Shannon-Weiner diversity index for the same community
3. Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, Temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen Content (Winkler's method), Chemical Oxygen Demand and free CO₂
4. Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

SUGGESTED READINGS

- . Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
- . Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
- . Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
- . Robert Leo Smith Ecology and field biology Harper and Row publisher
- . Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres

GENERIC ELECTIVE COURSE (GE-1): ANIMAL CELL BIOTECHNOLOGY

COURSE CODE: 1Y3ZOO104

THEORY	(CREDITS 4)
UNIT 1: Introduction	5
Concept and Scope of Biotechnology	
UNIT2: Techniques in Gene manipulation	15
Outline process of genetic engineering and recombinant DNA technology, Isolation of genes, Concept of restriction and modification: Restriction Endonucleases, DNA modifying enzymes Cloning Vectors: Plasmids, Phage vectors, Cosmids, Phagemids, BAC, YAC, HAC. Shuttle and Expression Vectors. Construction of Genomic libraries and cDNA libraries Transformation techniques: microbial, plants and animals: Cloning in mammalian Cells, Integration of DNA into mammalian genome- Electroporation and Calcium Phosphate Precipitation method	
UNIT 3: Animal cell Culture	12
Basic techniques in animal cell culture and organ culture, Primary Culture and Cell Lines, Culture media- Natural and Synthetic, Stem cells, Cryopreservation of cultures. Agarose and Polyacrylamide Gel Electrophoresis, Southern, Northern and Western blotting, DNA sequencing: Sanger method, Polymerase chain reaction, DNA Fingerprinting and DNA microarrays.	
UNIT 4: Fermentation	8
Different types of Fermentation: Submerged & Solid state; batch, Fed batch &Continuous; Stirred tank, Air Lift, Fixed Bed and Fluidized. Downstream Processing: Filtration, centrifugation, extraction, chromatography, Spray drying and lyophilization.	
UNIT 5: Transgenic Animal Technology	
Production of transgenic animals: nuclear transplantation, retroviral method, DNA microinjection method, Dolly and Polly.	
UNIT6: Application in Health	8
Development of recombinant Vaccines, Hybridoma technology, Gene Therapy. Production of recombinant Proteins: Insulin and growth hormones.	
UNIT 7: Bio safety Physical and Biological containment.	4

PRACTICAL -I

(CREDITS 2)

1. Packing and sterilization of glass and plastic wares for cell culture.
2. Preparation of culture media.
3. Preparation of genomic DNA from *E. coli*/animals/ human.
4. Plasmid DNA isolation (pUC 18/19) and DNA quantitation using agarose Gel electrophoresis (by using lambda DNA as standard).
5. Restriction digestion of lambda (λ) DNA using EcoR1 and Hind III.
6. Preparation of competent cells and Transformation of *E. coli* with plasmid DNA using CaCl₂, Selection of transformants on X-gal and IPTG (Optional).
7. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting, PCR, DNA Microarrays

SUGGESTED READINGS

- . Animal Cells Culture and Media, D.C. Darling and S.J. Morgan, 1994. BIOS Scientific Publishers Limited.
- . Methods in Cell Biology, Volume 57, Jennie P. Mathur and David Barnes, 1998. Animal Cell Culture Methods Academic Press.
- . P.K. Gupta: Biotechnology and Genomics, Rastogi publishers (2003).
- . B.D. Singh: Biotechnology, Kalyani publishers, 1998 (Reprint 2001).
- . T.A. Brown: Gene cloning and DNA analysis: An Introduction, Blackwell Science (2001).
- . Bernard R. Click & Jack J. Pasternak: Molecular Biotechnology, ASM Press, Washington (1998).
- . Methods in Gene Biotechnology, W. Wu, M.J. Welsh, P.B. Kaufman & H.H. Zhang, 1997, CRC Press, New York
- . Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An introduction to genetic analysis. IX Edition. Freeman & Co., N.Y., USA

B.Sc. ZOOLOGY HONS SECOND SEMESTER

CORE COURSE-III: NON-CHORDATES-II: COELOMATES

CORSE CODE: 1Y3ZOO202

THEORY	(Credits 4)
Unit 1: Introduction to Coelomates	2
Evolution of coelom and metamerism	
Unit 2: Annelida	10
General characteristics and Classification up to classes Excretion in Annelida	
Unit 3: Arthropoda	17
General characteristics and Classification up to classes Vision and Respiration in Arthropoda Metamorphosis in Insects Social life in bees and termites	
Unit 4: Onychophora	4
General characteristics and Evolutionary significance	
Unit 5: Mollusca	
General characteristics and Classification up to classes Respiration in Mollusca Torsion and detorsion in Gastropoda Pearl formation in bivalves Evolutionary significance of trochophore larva	
Unit 6: Echinodermata	12
General characteristics and Classification up to classes Water-vascular system in Asteroidea Larval forms in Echinodermata Affinities with Chordates	

CORE COURSE-III PRACTICAL NON-CHORDATES-II: COELOMATES

COURSE CODE: 1Y3ZOO202P

PRACTICAL

(Credits 2)

1. Study of following specimens:
Annelids - Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria
Arthropods - Limulus, Palamnaeus, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scolopendra, Julus, Bombyx, Periplaneta, termites and honey bees
Onychophora - Peripatus
Molluscs - Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus
Echinodermites - Pentaceros/Asterias, Ophiura, Clypeaster, Echinus, Cucumaria and Antedon
2. Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm
3. T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm
4. Mount of mouth parts and dissection of digestive system and nervous system of *Periplaneta**
5. To submit a Project Report on any related topic to larval forms (crustacean, mollusc And echinoderm)

Note: Classification to be followed from “Ruppert and Barnes (2006) *Invertebrate Zoology*, 8th edition, Holt Saunders International Edition”

SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition
- Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. And Nelson

CORE COURSE-IV CELL BIOLOGY

COURSE CODE: 1Y3ZOO203

THEORY	(Credits 4)
Unit 1: Overview of Cells	3
Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions	
Unit 2: Plasma Membrane	7
Various models of plasma membrane structure Transport across membranes: Active and Passive transport, Facilitated transport Cell junctions: Tight junctions, Desmosomes, Gap junctions	
Unit 3: Endomembrane System	10
Structure and Functions: Endoplasmic Reticulum, Golgi apparatus, Lysosomes	
Unit 4: Mitochondria and Peroxisomes	8
Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis Peroxisomes	
Unit 5: Cytoskeleton	8
Structure and Functions: Microtubules, Microfilaments and Intermediate filaments	
Unit 6: Nucleus	12
Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome)	
Unit 7: Cell Division	8
Mitosis, Meiosis, Cell cycle and its regulation	
Unit 8: Cell Signaling	4
GPCR and Role of second messenger (cAMP)	

CORE COURSE-IV PRACTICAL CELL BIOLOGY

COURSE CODE: 1Y3ZOO203P

PRACTICAL -IV

(Credits 2)

1. Preparation of temporary stained squash of onion root tip to study various Stages of mitosis
2. Study of various stages of meiosis.
3. Preparation of permanent slide to show the presence of Barr body in human Female blood cells/cheek cells.
4. Preparation of permanent slide to demonstrate:
 - i. DNA by Feulgen reaction
 - ii. DNA and RNA by MGP
 - iii. Mucopolysaccharides by PAS reaction
 - iv. Proteins by Mercurobromophenol blue/Fast Green

SUGGESTED READINGS

- . Karp, G. (2010). *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc.
- . De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- . Cooper, G.M. and Hausman, R.E. (2009). *The Cell: A Molecular Approach*. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- . Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). *The World of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- . Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). *Molecular Biology of the Cell*, V Edition, Garland publishing Inc., New York and London.

GENERIC ELECTIVE (GE-II) ANIMAL DIVERSITY

COURSE CODE 1Y3ZOO204

THEORY	(CREDITS 4)
Unit 1. Protista General characters of Protozoa; Life cycle of Plasmodium	4
Unit 2. Porifera General characters and canal system in Porifera	3
Unit 3. Radiata General characters of Cnidarians and polymorphism	3
Unit 4. Aceolomates General characters of Helminthes; Life cycle of <i>Taenia solium</i>	3
Unit 5. Pseudocoelomates General characters of Nemethelminthes; Parasitic adaptations	3
Unit 6. Coelomate Protostomes General characters of Annelida ; Metamerism.	3
Unit 7. Arthropoda General characters. Social life in insects.	4
Unit 8. Mollusca General characters of mollusca; Pearl Formation	3
Unit 9. Coelomate Deuterostomes General characters of Echinodermata, Water Vascular system in Starfish.	3
Unit 10. Protochordata Salient features	2
Unit 11. Pisces Osmoregulation, Migration of Fishes	4
Unit 12. Amphibia General characters, Adaptations for terrestrial life, Parental care in Amphibia	4
Unit 13. Amniotes; Origin of reptiles. Terrestrial adaptations in reptiles.	5
Unit 14. Aves: The origin of birds; Flight adaptations	5
Unit 15. Mammalia Early evolution of mammals; Primates; Dentition in mammals.	6

GENERIC ELECTIVE (GE-II) PRACTICAL ANIMAL DIVERSITY

COURSE CODE: 1Y3EVS204P

PRACTICAL -II

(CREDITS 2)

1. Packing and sterilization of glass and plastic wares for cell culture.
2. Preparation of culture media.
3. Preparation of genomic DNA from *E. coli*/animals/ human.
4. Plasmid DNA isolation (pUC 18/19) and DNA quantitation using agarose Gel electrophoresis (by using lambda DNA as standard).
5. Restriction digestion of lambda (λ) DNA using EcoR1 and Hind III.
6. Preparation of competent cells and Transformation of *E. coli* with plasmid DNA using CaCl₂, Selection of transformants on X-gal and IPTG (Optional).
7. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting, PCR, DNA Microarrays

SUGGESTED READINGS

- Animal Cells Culture and Media, D.C. Darling and S.J. Morgan, 1994. BIOS Scientific Publishers Limited.
- Methods in Cell Biology, Volume 57, Jennie P. Mathur and David Barnes, 1998. Animal Cell Culture Methods Academic Press.
- P.K. Gupta: Biotechnology and Genomics, Rastogi publishers (2003).
- B.D. Singh: Biotechnology, Kalyani publishers, 1998 (Reprint 2001)
- T.A. Brown: Gene cloning and DNA analysis: An Introduction, Blackwell Science (2001)
- Bernard R. Click & Jack J. Pasternak: Molecular Biotechnology, ASM Press, Washington (1998).
- Methods in Gene Biotechnology, W. Wu, M.J. Welsh, P.B. Kaufman & H.H. Zhang, 1997, CRC Press, New York
- Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An introduction to genetic analysis. IX Edition. Freeman & Co., N.Y., USA

B.SC ZOOLOGY HONS. THIRD SEMESTER
CORE COURSE-V DIVERSITY OF CHORDATES
COURSE CODE: 1YZOO301

THEORY	(Credits 4)
Unit 1: Introduction to Chordates General characteristics and outline classification	2
Unit 2: Protochordata General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata	8
Unit 3: Origin of Chordata Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata	3
Unit 4: Agnatha General characteristics and classification of cyclostomes up to class	2
Unit 5: Pisces General characteristics of Chondrichthyes and Osteichthyes, classification up to Order Migration, Osmoregulation and Parental care in fishes	8
Unit 6: Amphibia Origin of <i>Tetrapoda</i> (Evolution of terrestrial ectotherms); General Characteristics and classification up to order; Parental care in Amphibians	6
Unit 7: Reptilia General characteristics and classification up to order; Affinities of <i>Sphenodon</i> ; Poison apparatus and Biting mechanism in snakes	7
Unit 8: Aves General characteristics and classification up to order <i>Archaeopteryx</i> -- a Connecting link; Principles and aerodynamics of flight, Flight adaptations And Migration in birds	8
Unit 9: Mammals General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages	8
Unit 10: Zoogeography Zoogeographical realms, Theories pertaining to distribution of animals, Plate Tectonic and Continental drift theory, distribution of vertebrates in different Realms	8

CORE COURSE-V PRACTICAL DIVERSITY OF CHORDATES

COURSE CODE: 1YZOO301P

PRACTICAL -V

(Credits 2)

1. Protochordata

Balanoglossus, *Herdmania*, *Branchiostoma*, Colonial Urochordata Sections of *Balanoglossus* through proboscis and branchiogenital regions, Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions. Permanent slide of *Herdmania* spicules

2. Agnatha

Petromyzon, *Myxine*

3. Fishes

Scoliodon, *Sphyrna*, *Pristis*, *Torpedo*, *Chimaera*, *Mystus*, *Heteropneustes*, *Labeo*, *Exocoetus*, *Echeneis*, *Anguilla*, *Hippocampus*, *Tetrodon/Diodon*, *Anabas*, Flat fish

4. Amphibia

Ichthyophis/Ureotyphlus, *Necturus*, *Bufo*, *Hyla*, *Alytes*, *Salamandra*

5. Reptilia

Chelone, *Trionyx*, *Hemidactylus*, *Varanus*, *Uromastix*, *Chamaeleon*, *Ophiosaurus*, *Draco*, *Bungarus*, *Vipera*, *Naja*, *Hydrophis*, *Zamenis*, *Crocodylus*
Key for Identification of poisonous and non-poisonous snakes

6. Aves

Study of six common birds from different orders. Types of beaks and claws

7. Mammalia

Sorex, Bat (Insectivorous and Frugivorous), *Funambulus*, *Loris*, *Herpestes*, *Erinaceous*.

Mount of weberian ossicles of *Mystus*, pecten from Fowl head

Dissection of Fowl head (Dissections and mounts subject to permission)

Power point presentation on study of any two animals from two different classes

By students (may be included if dissections not given permission)

Classification from Young, J. Z. (2004) to be followed

SUGGESTED READINGS

- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub Co.
- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition.

THEORY	(Credits 4)
Unit 1: Tissues Structure, location, classification and functions of epithelial tissue, Connective tissue, muscular tissue and nervous tissue	6
Unit 2: Bone and Cartilage Structure and types of bones and cartilages, Ossification, bone growth and Resorption	4
Unit 3: Nervous System Structure of neuron, resting membrane potential, Origin of action potential And its propagation across the myelinated and nmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc; Physiology of hearing and vision.	10
Unit 4: Muscle Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of Muscle twitch; Motor unit, summation and tetanus	12
Unit 5: Reproductive System Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methods of contraception in male and female	10
Unit 6: Endocrine System Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, Pancreas, adrenal; hormones secreted by them and their mechanism of Action; Classification of hormones; Regulation of their secretion; Mode of Bormone action, Signal transduction pathways for steroidal and non-steroidal Hormones; Hypothalamus (neuroendocrine gland) - principal nuclei involved In neuroendocrine control of anterior pituitary and endocrine system; Placental hormones	18

CORE COURSE - VI PRACTICAL PHYSIOLOGY CONTROLLING AND SYSTEMS

CORSE CODE: 1Y3ZOO302P

PRACTICALS-VI

(Credits 2)

1. Recording of simple muscle twitch with electrical stimulation (or Virtual)
2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as Knee jerk reflex)
3. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres And nerve cells
4. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid
5. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues

(*Subject to UGC guidelines)

SUGGESTED BOOKS

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd. /W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional Correlations. XII Edition. Lippincott W. & Wilkins.

THEORY

(CREDITS 4)

Unit 1: Carbohydrates

8

Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates

Unit 2: Lipids

8

Structure and Significance: Physiologically important saturated and Unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids

Unit 3: Proteins

14

Amino acids: Structure, Classification and General Properties of α -amino Acids; Physiological importance of essential and non-essential α -amino acids

Proteins: Bonds stabilizing protein structure; Levels of organization in Proteins; Denaturation; Introduction to simple and conjugate proteins

Immunoglobulins: Basic Structure, Classes and Function, Antigenic Determinants

Unit 4: Nucleic Acids

12

Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids Cot Curves: Base pairing, Denaturation and Renaturation of DNA Types of DNA and RNA, Complementarity of DNA, Hypo-Hyperchromaticity of DNA

Unit 5: Enzymes

18

Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting Rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of K_m and V_{max} , Lineweaver-Burk plot; Multi-substrate reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme Action

CORE COURSE-VII PRACTICAL FUNDAMENTALS OF BIOCHEMISTRY

COURSE CODE: 1Y3ZOO303P

PRACTICAL

(CREDITS 2)

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Action of salivary amylase under optimum conditions.
4. Effect of pH, temperature and inhibitors on the action of salivary amylase.
5. Demonstration of proteins separation by SDS-PAGE.

SUGGESTED READING

- Cox, M.M and Nelson, D.L. (2008). *Lehninger's Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). *Molecular Biology of the Gene*, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

COURSE TYPE - SKILL ENHANCEMENT COURSE (SEC) – I

APICULTURE

COURSE CODE: 1Y3ZOO304

Unit 1: Biology of Bees	(4)
History, Classification and Biology of Honey Bees Social Organization of Bee Colony	
Unit 2: Rearing of Bees	(10)
Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth Bee Pasturage Selection of Bee Species for Apiculture Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern)	
Unit 3: Diseases and Enemies	(5)
Bee Diseases and Enemies Control and Preventive measures	
Unit 4: Bee Economy	(2)
Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen Etc	
Unit 5: Entrepreneurship in Apiculture	(4)
Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens	

SUGGESTED READINGS

- Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.
- Bisht D.S., *Apiculture*, ICAR Publication.
- Singh S., *Beekeeping in India*, Indian council of Agricultural Research, New Delhi.

COURSE TYPE - SKILL ENHANCEMENT COURSE (SEC-I) PRACTICAL

APICULTURE

COURSE CODE: 1Y3ZOO04P

THEORY

(Credits 4)

UNIT 1: Aquatic Biomes

Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, Streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine Benthic zone and coral reefs.

UNIT 2: Freshwater Biology

Lakes: Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; Dissolved gases (Oxygen, Carbon dioxide). Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous.

Streams: Different stages of stream development, Physico-chemical Environment, Adaptation of hill-stream fishes.

UNIT 3: Marine Biology

Salinity and density of Sea water, Continental shelf, Adaptations of deep sea Organisms, Coral reefs, Sea weeds.

UNIT 4: Management of Aquatic Resources

Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment Water quality assessment- BOD and COD.

PRACTICAL - III

(Credits 2)

1. Determine the area of a lake using graphimetric and gravimetric method.
2. Identify the important macrophytes, phytoplanktons and zooplanktons Present in a lake ecosystem.
3. Determine the amount 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 bioreserve/ Fisheries Institutes.

SUGGESTED READINGS

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

B.SC ZOOLOGY FOURTH SEMESTER

CORE COURSE – VIII COMPARATIVE ANATOMY OF VERTBRATES

COURSE CODE: 1Y3ZOO401

THEORY	(CREDITS 4)
Unit 1: Integumentary System Structure, functions and derivatives of integument	8
Unit 2: Skeletal System Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral Arches	8
Unit 3: Digestive System Alimentary canal and associated glands, dentition	8
Unit 4: Respiratory System Skin, gills, lungs and air sacs; Accessory respiratory organs	8
Unit 5: Circulatory System General plan of circulation, evolution of heart and aortic arches	8
Unit 6: Urinogenital System Succession of kidney, Evolution of urinogenital ducts, Types of mammalian Uteri	6
Unit 7: Nervous System Comparative account of brain Autonomic nervous system, Spinal cord, Cranial nerves in mammals	8
Unit 8: Sense Organs Classification of receptors Brief account of visual and auditory receptors in man	6

PRACTICAL - VIII

(CREDITS 2)

1. Study of placoid, cycloid and ctenoid scales through permanent Slides/photographs
2. Disarticulated skeleton of Frog, *Varanus*, Fowl, Rabbit
3. Carapace and plastron of turtle /tortoise
4. Mammalian skulls: One herbivorous and one carnivorous animal
5. Dissection of rat to study arterial and urinogenital System (subject to permission)
6. Study of structure of any two organs (heart, lung, kidney, eye and ear) from Video recording (may be included if dissection not permitted)
7. Project on skeletal modifications in vertebrates (may be included if dissection Not permitted)

SUGGESTED READINGS

- Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition. McGraw-Hill Higher Education
- Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies
- Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons
- Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House

THEORY

(Credits 4)

Unit 1: Physiology of Digestion

14

Structural organization and functions of gastrointestinal tract and associated Glands; Mechanical and chemical digestion of food; Absorptions of Carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal Control of secretion of enzymes in gastrointestinal tract.

Unit 2: Physiology of Respiration

12

Histology of trachea and lung; Mechanism of respiration, Pulmonary Ventilation; Respiratory volumes and capacities; Transport of oxygen and Carbon dioxide in blood; Respiratory pigments, Dissociation curves and the Factors influencing it; Carbon monoxide poisoning; Control of respiration

Unit 3: Renal Physiology

8

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance

Unit 4: Blood

14

Components of blood and their functions; Structure and functions of haemoglobin

Haemostasis: Blood clotting system, Kallikrein- Kininogen system, Complement system& Fibrinolytic system, Haemopoiesis

Blood groups: Rh factor, ABO and MN

Unit 5: Physiology of Heart

12

Structure of mammalian heart; Coronary circulation; Structure and working Of conducting myocardial fibers. Origin and conduction of cardiac impulses Cardiac cycle; Cardiac output and its regulation, Frank-Starling Law of the Heart, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation

PRACTICALS

(CREDITS 2)

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of hemoglobin using Sahli's hemoglobin meter
4. Preparation of haemin and haemochromogen crystals
5. Recording of frog's heart beat under *in situ* and perfused conditions*
6. Recording of blood pressure using a sphygmomanometer
7. Examination of sections of mammalian oesophagus, stomach, duodenum, ileum, Rectum liver, trachea, lung, kidney

(*Subject to UGC guidelines)

SUGGESTED READINGS

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Harcourt Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional Correlations. XII Edition. Lippincott W. & Wilkins.
- Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills

CORE COURSE – X BIOCHEMISTRY OF METABOLIC PROCESSES

COURSE CODE: 1Y3ZOO403

THEORY	(CREDITS 4)
Unit 1: Overview of Metabolism Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of Metabolic pathways, Shuttle systems and membrane transporters; ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents And cofactors; Intermediary metabolism and regulatory mechanisms	10
Unit 2: Carbohydrate Metabolism Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis	16
Unit 3: Lipid Metabolism β -oxidation and omega -oxidation of saturated fatty acids with even and odd Number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis	14
Unit 4: Protein Metabolism Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate Of C-skeleton of Glucogenic and Ketogenic amino acids	10
Unit 5: Oxidative Phosphorylation Redox systems; Review of mitochondrial respiratory chain, Inhibitors and Un-couplers of Electron Transport System	10

PRACTICALS

(CREDITS 2)

1. Estimation of total protein in given solutions by Lowry's method.
2. Detection of SGOT and SGPT or GST and GSH in serum/ tissue
3. To study the enzymatic activity of Trypsin and Lipase.
4. Study of biological oxidation (SDH) [goat liver]
5. To perform the Acid and Alkaline phosphatase assay from serum/ tissue.
6. Dry Lab: To trace the labelled C atoms of Acetyl-CoA till they evolve as CO₂ in The TCA cycle

SUGGESTED READINGS

- Cox, M.M and Nelson, D.L. (2008). *Lehninger Principles of Biochemistry*, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). *Biochemistry*, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). *Harper's Illustrated Biochemistry*, XXVIII Edition, International Edition, the McGraw-Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). *Instant Notes in Biochemistry*, II Edition, BIOS Scientific Publishers Ltd., U.K.

COURSE TYPE – SKILL ENHANCEMENT COURSE (SEC-2)

AQUARIUM FISH KEEPING

COURSE CODE: 1Y3ZOO404

(CREDITS 2)

Unit1: Introduction to Aquarium Fish Keeping

The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic Species of Aquarium Fishes

Unit 2: Biology of Aquarium Fishes

Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes
Such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish

Unit 3: Food and feeding of Aquarium fishes

Use of live fish feed organisms. Preparation and composition of formulated fish feeds

Unit 4: Fish Transportation

Live fish transport - Fish handling, packing and forwarding techniques.

Unit 5: Maintenance of Aquarium

General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry

PRACTICALS

(CREDITS 2)

- Identification of common Aquarium fishes
- Identification of live feed organisms
- Study of different types of formulated feeds
- Preparation of formulated feed
- Study of slides of parasites and diseases
- Setting up of an aquarium
- Study of ornamental plants

Suggested Readings

- Rath, R.K. (2000) Freshwater Aquaculture. Scientific Publishers (India). PO Box :91, Jodhpur.
- Jhingran, AVG (1991) Fish and Fisheries of India. Hindustan Publishing Co.
- Baradach, JE, JH Ryther and WO McLarney (1972). Aquaculture. The Farming and Husbandry of Freshwater and Marine Organisms. Wiley Interscience, NewYork.
- Jameson, J.D. and R.Santhanam (1996). Manual of ornamental fisheries and farming technology. Fisheries College and Research Institute, Thoothukudi.
- Mitchell Beazley, 1998. The complete guide to tropical aquarium fish care. Read and Consumes Book Ltd.,London.
- Everything for the aquarist. Tetra Werke Publication, West Germany. • Jameson, J.D. AlangaraMeenValarpu (in Tamil). National Book House, New Delhi.

COURSE TYPE – GENERIC ELECTIVE COURSE (GE-IV)

ENVIRONMENT AND PUBLIC HEALTH

COURSE CODE: 1Y3ZOO405

THEORY

(Credits

4)

UNIT I: Introduction

Sources of Environmental hazards, hazard identification and accounting, fate of Toxic and persistent substances in the environment, dose Response Evaluation, Exposure Assessment.

UNIT II Climate Change

Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect Of climate change on public health

Unit III Pollution

Air, water, noise pollution sources and effects, Pollution control

Unit IV Waste Management Technologies

Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Bio medical waste handling and disposal, nuclear waste Handling and disposal, Waste from thermal power plants, Case histories on Bhopal gas tragedy, Chernobyl disaster, Seveso disaster and Three Mile Island Accident and their aftermath.

Unit 5 Diseases

Causes, symptoms and control of tuberculosis, Asthma, Cholera, Minamata Disease, typhoid

COURSE TYPE – GENERIC ELECTIVE COURSE (GE-IV) PRACTICAL

ENVIRONMENT AND PUBLIC HEALTH

CORSE CODE: 1Y3ZOO405P

PRACTICAL -IV

(Credits 2)

1. To determine pH, Cl, SO₄, NO₃ in soil and water samples from different Locations.

SUGGESTED BOOKS

- Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
- Kolluru Rao, Bartell Steven, Pitblado R and Stricoff “Risk Assessment And Management Handbook”, McGraw Hill Inc., New York, 1996.
- Kofi Asante Duah “Risk Assessment in Environmental management”, John Wiley and sons, Singapore, 1998.
- Kasperson, J.X. and Kasperson, R.E. and Kasperson,R.E., Global Environmental Risks, V.N.University Press, New York, 2003.
- Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey 1997.

B.SC ZOOLOGY HONS. FIFTH SEMESTER
CORE COURSE – XI MOLECULAR BIOLOGY
COURSE CODE: 1Y3ZOO501

THEORY	(CREDITS 4)
Unit 1: Nucleic Acids Salient features of DNA and RNA Watson and Crick model of DNA	4
Unit 2: DNA Replication DNA Replication in prokaryotes and eukaryotes, mechanism of DNA Replication, Semi-conservative, bidirectional and semi-discontinuous Replication, RNA priming, Replication of circular and linear <i>ds</i> -DNA, Replication of telomeres	12
Unit 3: Transcription RNA polymerase and transcription Unit, mechanism of transcription in Prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription Factors	10
Unit 4: Translation Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of Protein synthesis in prokaryotes: Ribosome structure and assembly in Prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and Charging of tRNA; Proteins involved in initiation, elongation and termination of Polypeptide chain; Inhibitors of protein synthesis; Difference between prokaryotic And eukaryotic translation	12
Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA Structure of globin mRNA; Split genes: concept of introns and exons, splicing Mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of Trna	6
Unit 6: Gene Regulation Transcription regulation in prokaryotes: Principles of transcriptional Regulation with examples from <i>lac</i> operon and <i>trp</i> operon; Transcription Regulation in eukaryotes: Activators, repressors, enhancers, silencer Elements; Gene silencing, Genetic imprinting	10
Unit 7: DNA Repair Mechanisms Pyrimidine dimerization and mismatch repair	3
Unit 8: Regulatory RNAs Ribo-switches, RNA interference, mi RNA, si RNA	3

CORE COURSE – XI PRACTICAL MOLECULAR BIOLOGY

COURSE CODE: 1Y3ZOO501P

PRACTICAL

(CREDITS 2)

1. Study of Polytene chromosomes from Chironomous / *Drosophila* larvae
2. Preparation of liquid culture medium (LB) and raise culture of *E. coli*
3. Estimation of the growth kinetics of *E. coli* by turbidity method
4. Preparation of solid culture medium (LB) and growth of *E. coli* by spreading and Streaking
5. Demonstration of antibiotic sensitivity/resistance of *E. coli* to antibiotic pressure And interpretation of results
6. Quantitative estimation of salmon sperm/calf thymus DNA using colorimeter (Diphenylamine reagent) or spectrophotometer (A260 measurement)
7. Quantitative estimation of RNA using Orcinol reaction
8. Study and interpretation of electron micrographs/ photograph showing
 - (a) DNA replication
 - (b) Transcription
 - (c) Split genes

SUGGESTED READINGS

- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). *The World Of the Cell*. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: *Molecular Biology of the Cell*, IV Edition.
- Cooper G. M. and Robert E. Hausman R. E. *The Cell: A Molecular Approach*, V Edition, ASM Press and Sinauer Associates.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). *Cell and Molecular Biology*. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Karp, G. (2010) *Cell and Molecular Biology: Concepts and Experiments*. VI Edition. John Wiley and Sons. Inc.
- Lewin B. (2008). *Gene XI*, Jones and Bartlett
McLennan A., Bates A., Turner, P. and White M. (2015). *Molecular Biology IV* Edition. GS, Taylor and Francis Group, New York and London.

CORE COURSE – XII PRINCIPLES OF GENETICS

COURSE CODE: 1Y3ZOO502

THEORY	(CREDITS 4)
Unit 1: Mendelian Genetics and its Extension Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles lethal alleles, Epistasis, Pleiotropy, Sex-linked, sexinfluenced And sex-limited characters inheritance.	8
Unit 2: Linkage, Crossing Over and Chromosomal Mapping Linkage and crossing over, Cytological basis of crossing over, Molecular Mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and Three factor crosses, Interference and coincidence, Somatic cell Hybridization.	12
Unit 3: Mutations Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular Basis of mutations in relation to UV light and chemical mutagens; Detection Of mutations: CLB method, attached X method.	10
Unit 4: Sex Determination Chromosomal mechanisms of sex determination in <i>Drosophila</i> and Man	4
Unit 5: Extra-chromosomal Inheritance Criteria for extra-chromosomal inheritance, Antibiotic resistance in <i>Chlamydomonas</i> , Mitochondrial mutations in <i>Saccharomyces</i> , Infective Heredity in <i>Paramecium</i> and Maternal effects	6
Unit 6: Polygenic Inheritance Polygenic inheritance with suitable examples; simple numericals based on it.	3
Unit 7: Recombination in Bacteria and Viruses Conjugation, Transformation, Transduction, Complementation test in Bacteriophage	9
Unit 8: Transposable Genetic Elements Transposons in bacteria, Ac-Ds elements in maize and P elements in <i>Drosophila</i> , Transposons in humans	8

PRACTICALS

(CREDITS 2)

1. To study the Mendelian laws and gene interactions.
2. Chi-square analyses using seeds/beads/*Drosophila*.
3. Linkage maps based on data from conjugation, transformation and transduction.
4. Linkage maps based on data from *Drosophila* crosses.
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human inherited traits.

SUGGESTED READINGS

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings
- Russell, P. J. (2009). *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings
- 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
- Fletcher H. and Hickey I. (2015). *Genetics*. IV Edition. GS, Taylor and Francis Group, New York and London.

CORSE TYPE – DISCIPLINE SPECIFIC ELECTIVE (DSE-1)

AGROCHEMICALS AND PEST MANGEMENT

CORSE CODE: 1Y3ZOO503

THEORY

(CREDITS 4)

Unit 1:

10

Fundamentals of Pest Management Pest: Definition, pest resurgence, secondary pest outbreak, Economic injury level, Economic threshold; Types of pests according to damage (sub economic, occasional, perennial)

Unit 2:

8

Practical Approach to Pest Management General morphological features of different groups of insects; Study of biting and chewing, and piercing and sucking type of mouth parts; Integrated Pest Management: Cultural, biological, chemical, genetic control; Agrochemicals: Pesticides, brief history, nomenclature, mode of action of insecticides, tools and techniques for pesticide application, environmental issues; Measurement of insecticide toxicity by estimation of LD50 value of any one insect pest

Unit 3:

7

Study of Pest in Laboratory and Field Visit to agricultural field to study biology, damage and management practices of pests of agricultural crops (*Papilio demoleus*, *Helicoverpa armigera*, *Leptocorisa acuta*, *Leucinodes orbonalis*, *Epilachna vigintioctopunctata*); Rearing of any two important pests; one each from stored grain and agricultural crop in the laboratory and study their different stages.

COURSE TYPE- DISCIPLINE SPECIFIC ELECTIVE (DSE-1)

AGROCHEMICALS AND PEST MANAGEMENT

COURSE CODE: 1Y3ZOO503P

PRACTICALS

1. Trips – IARI fields, CWC, FCI, Stored grain institutes (any two)
2. Biological Agents; (Pathogens – NPV); Parasites (Trichogramma etc); Predators (Gambusia fish, lady bird beetle etc.) [Collection, preservations & Slide preparation]
3. Field Specimen – Infested plant/plant parts
4. Determination of LD50 or LC50 of insecticides based on the data provided
5. Instruments used in IPM
6. Bioefficacy of EPN
7. Dry Lab exercise for SIT efficacy

SUGGESTED READINGS

1. Pradhan, S. (1969). Insect Pests of Crops. National Book Trust, India Book House.
2. Atwal, A.S. (1993) Agricultural pest of India and South East Asia. Kalyani Pub., New Delhi.
3. Dennis, S. Hill. (2005) Agricultural Insect pests of the tropics and their management, Cambridge University press.
4. Pedigo L. P. (2002). Entomology and Pest Management, Prentice Hall Publication
5. Robert F. Norris, Edward P. Caswell-Chen and Marcos Kogan, Concepts of Integrated Pest Management, Prentice Hall of India.

THEORY

(Credits 4)

Unit 1: Introduction to Animal Behaviour

Origin and history of Ethology; Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of Behaviour methods and recording of a behavior

Unit 2: Patterns of Behaviour

Stereotyped Behaviours (Orientation, Reflexes); Individual Behavioural Patterns; Instinct vs. Learnt Behaviour; Associative learning, classical and Operant conditioning, Habituation, Imprinting.

Unit 3: Social and Sexual Behaviour

Social Behaviour: Concept of Society; Communication and the senses; Altruism; Insects' society with Honey bee as example; Foraging in honey Bee and advantages of the waggle dance.
Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Sexual conflict in parental care.

Unit 4: Introduction to Chronobiology

Historical developments in chronobiology; Biological oscillation: the Concept of Average, amplitude, phase and period. Adaptive significance of Biological clocks

Unit 5: Biological Rhythm

Types and characteristics of biological rhythms: Short- and Long- term Rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms; Concept of Synchronization and masking; Photic and non-photic zeitgebers; Circannual Rhythms; Photoperiod and regulation seasonal reproduction of vertebrates; Role of melatonin.

Unit 8: Biological Clocks

Relevance of biological clocks; Chronopharmacology, Chronomedicine, Chronotherapy.

ANIMAL BEHAVIOUR AND CHRONOBILOGY

COURSE CODE: 1Y3ZOO504P

PRACTICAL

(Credits 2)

1. To study nests and nesting habits of the birds and social insects.
2. To study the behavioural responses of wood lice to dry and humid Conditions.
3. To study geotaxis behaviour in earthworm.
4. To study the phototaxis behaviour in insect larvae.
5. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park To study behavioural activities of animals and prepare a short report.
6. Study and actogram construction of locomotor activity of suitable Animal models.
7. Study of circadian functions in humans (daily eating, sleep and Temperature patterns).

SUGGESTED READINGS

- David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
- Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge, University Press, UK.
- John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
- Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
- Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
- Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.)R.D. Lewis. (3rdEd) 2002 Baren and Noble Inc. New York, USA
- Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

B.SC ZOOLOGY HONS. SIXTH SEMESTER
CORE COURSE –XIII DEVELOPMENTAL BIOLOGY
COURSE CODE: 1Y3ZOO601

THEORY

(CREDITS 2)

Unit 1: Introduction

4

Historical perspective and basic concepts: Phases of development, Cell-Cell Interaction, Pattern formation, Differentiation and growth, Differential gene Expression, Cytoplasmic determinants and asymmetric cell division

Unit 2: Early Embryonic Development

28

Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg Membranes; Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy; Planes and patterns of cleavage; Types of Blastula; Fate maps (including Techniques); early development of frog and chick up To gastrulation; embryonic induction and organizers

Unit 3: Late Embryonic Development

8

Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of Embryo in humans, Placenta (Structure, types and functions of placenta)

Unit 4: Post Embryonic Development

12

Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, epimorphosis, morphallaxis and Compensatory regeneration (with one example each); Ageing: Concepts and Theories

Unit 5: Implications of Developmental Biology

8

Teratogenesis: Teratogenic agents and their effects on embryonic Development; *In vitro* fertilization, Stem cell (ESC), Amniocentesis

CORE COURSE – XIII PRACTICAL DEVELOPMENTAL BIOLOGY

COURSE CODE: 1Y3ZOO601P

PRACTICALS-XIII

(CREDITS 2)

1. Study of whole mounts and sections of developmental stages of frog through Permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, Tadpole (external and internal gill stages)
2. Study of whole mounts of developmental stages of chick through permanent Slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 Hours of incubation (Hamilton and Hamburger stages)
3. Study of the developmental stages and life cycle of *Drosophila* from stock Culture
4. Study of different sections of placenta (photomicrograph/ slides)
5. Project report on *Drosophila* culture/chick embryo development

SUGGESTED READINGS

- Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA
- Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press
- Carlson, R. F. Patten's Foundations of Embryology
- Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill Publishers
- Lewis Wolpert (2002). Principles of Development. II Edition, Oxford University Press

CORE COURSE –XIV EVOLUTIONARY BIOLOGY

COURSE CODE: 1Y3ZOO602

THEORY	(CREDITS 4)
Unit 1: Life's Beginnings: Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes	7
Unit 2: Historical review of evolutionary concept: Lamarckism, Darwinism, Neo-Darwinism	4
Unit 3: Evidences of Evolution: Fossil record (types of fossils, transitional forms, geological Time scale, evolution of horse, Molecular (universality of genetic code and protein synthesising machinery, three domains of life, neutral theory of molecular evolution, Molecular clock example of globin gene family, rRNA/cyt c	10
Unit 4: Sources of variations: Heritable variations and their role in evolution	8
Unit 5: Population genetics: Hardy-Weinberg Law (statement and derivation of equation, Application of law to human Population); Evolutionary forces upsetting H-W Equilibrium; Natural selection (concept of fitness, selection coefficient, derivation of one Unit of selection for a dominant allele, genetic load, mechanism of working, types of Selection, density-dependent selection, heterozygous superiority, kin selection, adaptive Resemblances, sexual selection. Genetic Drift (mechanism, founder's effect, bottleneck Phenomenon; Role of Migration and Mutation in changing allele frequencies	13
Unit 6: Product of evolution: Micro evolutionary changes (inter-population variations, clines, Races, Species concept, Isolating mechanisms, modes of speciation—allopatric, Sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches	7
Unit 7: Extinctions, Back ground and mass extinctions (causes and effects), detailed example of K-T extinction	2
Unit 8: Origin and evolution of man, unique hominin characteristics contrasted with primate Characteristics, primate phylogeny from <i>Dryopithecus</i> leading to <i>Homo sapiens</i> , Molecular analysis of human origin	6
Unit 9: Phylogenetic trees, multiple sequence alignment, construction of phylogenetic trees, Interpretation of trees	2

PRACTICALS

(CREDITS 2)

1. Study of fossils from models/ pictures
2. Study of homology and analogy from suitable specimens
3. Study and verification of Hardy-Weinberg Law by chi square analysis
4. Demonstration of role of natural selection and genetic drift in changing allele Frequencies using simulation studies
5. Graphical representation and interpretation of data of height/ weight of a sample Of 100 humans in relation to their age and sex.
6. Construction of phylogenetic trees with the help of bioinformatics tools (Clustal X, Phylip, NJ) and its interpretation.

SUGGESTED READINGS

- Ridley, M (2004) Evolution III Edition Blackwell publishing
- Hall, B.K. and Hallgrimson, B (2008). Evolution IV Edition. Jones and Barlett Publishers.
- Campbell, N.A. and Reece J.B (2011). Biology. IX Edition. Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
- Snustad. S Principles of Genetics.
- Pevsner, J (2009). Bioinformatics and Functional Genomics. II Edition Wiley-Blackwell

COURSE TYPE- DISCIPLINE SPECIFIC ELECTIVE (DSE-3)

ANIMAL BIOTECHNOLOGY

COURSE CODE: 1Y3ZOO603

THEORY

(Credits 4)

Unit 1. Introduction

8

Concept and scope of biotechnology

Unit 2. Molecular Techniques in Gene manipulation

24

Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage,

M13, BAC, YAC, MAC and Expression vectors (characteristics).

Restriction enzymes: Nomenclature, detailed study of Type II.

Transformation techniques: Calcium chloride method and electroporation.

Construction of genomic and cDNA libraries and screening by colony and

Plaque hybridization

Southern, Northern and Western blotting

DNA sequencing: Sanger method

Polymerase Chain Reaction, DNA Finger Printing and DNA micro array

Unit 3. Genetically Modified Organisms

18

Production of cloned and transgenic animals: Nuclear Transplantation,

Retroviral Method, DNA microinjection

Applications of transgenic animals: Production of pharmaceuticals,

Production of donor organs, knock out mice.

Production of transgenic plants: *Agrobacterium* mediated transformation.

Applications of transgenic plants: insect and herbicide resistant plants.

Unit 4. Culture Techniques and Applications

10

Animal cell culture, expressing cloned genes in mammalian cells, Molecular

Diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia)

Recombinant DNA in medicines: Recombinant insulin and human growth

Hormone, Gene therapy

PRACTICAL

(Credits 2)

1. Genomic DNA isolation from *E. coli*
2. Plasmid DNA isolation (pUC 18/19) from *E. coli*
3. Restriction digestion of plasmid DNA.
4. Construction of circular and linear restriction map from the data Provided.
5. Calculation of transformation efficiency from the data provided..
6. To study following techniques through photographs
 - a. Southern Blotting
 - b. Northern Blotting
 - c. Western Blotting
 - d. DNA Sequencing (Sanger's Method)
 - e. PCR
 - f. DNA fingerprinting
7. Project report on animal cell culture

SUGGESTED READINGS

- Brown, T.A. (1998). *Molecular Biology Labfax II: Gene Cloning and DNA Analysis*. II Edition, Academic Press, California, USA.
- Glick, B.R. and Pasternak, J.J. (2009). *Molecular Biotechnology - Principles and Applications of Recombinant DNA*. IV Edition, ASM press, Washington, USA.
- Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). *An Introduction to Genetic Analysis*. IX Edition. Freeman and Co., N.Y., USA.
- Snustad, D.P. and Simmons, M.J. (2009). *Principles of Genetics*. V Edition, John Wiley and Sons Inc.
- Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). *Recombinant DNA- Genes and Genomes- A Short Course*. III Edition, Freeman and Co., N.Y. USA.
- Beauchamp, T.I. and Childress, J.F. (2008). *Principles of Biomedical Ethics*. VI Edition, Oxford University Press.

COURSE TYPE- DISCIPLINE SPECIFIC ELECTIVE (DSE-4)

BASICS OF NEUROSCIENCE

COURSE CODE: 1Y3ZOO604

THEORY (Credits 4)

Unit 1: Introduction to Neuroscience	6
Origins of Neuroscience; Neuroanatomy, Neurophysiology, and Systems Neurobiology	
UNIT 2: The Nervous system-An Introduction	14
Introduction to the structure and function of the nervous system: Cellular Components: Neurons; Neuroglia; Neuron doctrine; the prototypical neuron – Axons and dendrites as unique structural components of neurons. The ionic Bases of resting membrane potential; the action potential- its generation and Properties; The action potential conduction.	
UNIT 3: Cellular and Molecular Neurobiology	14
Molecular and cellular approaches used to study the CNS at the level of Single molecules, Synapse: Synaptic transmission, Types of synapses; Synaptic function; Principles of chemical synaptic transmission; Principles of Synaptic integration; EPSPs and IPSPs. Ion channels, neural transmission,	
Unit 4. Neurotransmitters	10
Different types of neurotransmitters– catecholamines, amino acidergic and peptidergic neurotransmitters; Transmitter gated channels; G-protein coupled Receptors and effectors, neurotransmitter receptors; Ionotropic and Metabotropic receptors.	
UNIT 5: Neurobiology and Neuropharmacology of Behaviour	16
The principles of signal transduction and information processing in the Vertebrate central nervous system, and the relationship of functional Properties of neural systems with perception and behavior; sensory systems, Molecular basis of behavior including learning and memory. Molecular Pathogenesis of pain and neurodegenerative diseases such as Parkinson’s, Alzheimer’s, psychological disorders, addiction, etc.	

COURSE TYPE- DISCIPLINE SPECIFIC ELECTIVE (DSE-4) PRACTICAL

BASICS OF NEUROSCIENCE

COURSE CODE: 1Y3ZOO604P

PRACTICAL

(CREDITS 2)

1. Dissection and study of Drosophila nervous system using GFP reporter.
2. Observation and quantitation of Drosophila photoreceptor neurons in Healthy and diseased condition.
3. Nerve Cell preparation from the spinal cord.
4. Study of neurons and/ or myelin by Nissl, Giemsa or Luxol Fast Blue staining.
5. Study of olfaction in Drosophila.
6. Study of novelty, anxiety and spatial learning in mice.

SUGGESTED READINGS

- Neuroscience: Exploring the brain by Mark F. Baer; Barry W. Connors. 2015
- From Molecules to Networks: An Introduction to Cellular and Molecular Neuroscience by John H. Byrne. Ruth Heidelberg and M. Neal Waxham
- Neuroscience-Eds. Dale Purves et. al. (3rd Edn)-Sinauer Associates, Inc.-2004
- Principles of Neural Science-4th Edn-Eds. Kandel, Schwartz and Jessell- McGraw-Hill Companies-2000
- Nerve Cells and Animal Behaviour-2nd Edn-Peter J Simmons and David Young-CUP-2003
- Essential Psychopharmacology- Neuroscientific Basis and Practical Applications- 2nd Edn.-Stephan M. Stahl-CUP-2000
- Phantoms in the Brain - Vilayanur S. Ramachandran and Sandra Blakeslee-1998
- The Human Brain Book - Rita Carter-2009.