

COURSE CURRICULUM FOR B. SC. (HONOURS) ZOOLOGY

NAME OF THE PROGRAMME: B. SC. (HONOURS) ZOOLOGY



JAGANNATH BAROOAH COLLEGE, JORHAT (ASSAM)

**SYLLABUS
UNDER CHOICE BASED CREDIT SYSTEM**

B. SC. (HONOURS) ZOOLOGY

Objective of the Programme:

- To provide quality education and in-depth knowledge in the field of Biological sciences especially of animal sciences.
- To inculcate the spirit of conservation of resources, biodiversity and their interaction with environment and love for nature.
- To provide quality education offering skill-based programme and motivate the students for self-employment.
- To conduct field studies and different projects of local as well as global interests.
- To enhance academic standards and quality of higher education system of our country.

Expected Outcome of the Course:

- More and more students will get admission in PG programs in higher institutes of learning.
- Interested students may take up entrepreneurship in biological sciences
- Successful students will have a broad knowledge on anatomy, physiology, ecology & biodiversity, genetics, biochemistry etc. which will be useful in their day to day life.

Course Structure-ZOOLOGY (Honours)

Sem.	Course No	Course Code	Course Title	Course Type	Marks Distribution				
					TH	TH IA	PR	PR IA	Total
1 st	C-01	ZOOC-101	Non-chordates I: Protista to Pseudo-coelomates	Theory (TH) + Practical (PR)	50	15	30	5	100
	C-02	ZOOC-102	Principles of Ecology	TH + PR	50	15	30	5	100
2 nd	C-03	ZOOC-201	Non-chordates II: Coelomates	TH + PR	50	15	30	5	100
	C-04	ZOOC-202	Cell Biology	TH + PR	50	15	30	5	100
3 rd	C-05	ZOOC-301	Diversity of Chordates	TH + PR	50	15	30	5	100
	C-06	ZOOC-302	Physiology: Controlling and Coordinating Systems	TH + PR	50	15	30	5	100
	C-07	ZOOC-303	Fundamentals of Biochemistry	TH + PR	50	15	30	5	100
	SEC-01	ZOOS-301	Research Methodology	PR			40	10	50
4 th	C-08	ZOOC-401	Comparative Anatomy of Vertebrates	TH + PR	50	15	30	5	100
	C-09	ZOOC-402	Physiology: Life Sustaining Systems	TH + PR	50	15	30	5	100
	C-10	ZOOC-403	Biochemistry of Metabolic Processes	TH + PR	50	15	30	5	100
	SEC-02	ZOOS-401	Aquarium Fish Keeping	PR			40	10	50
5 th	C-11	ZOOC-501	Molecular Biology	TH + PR	50	15	30	5	100
	C-12	ZOOC-502	Principles of Genetics	TH + PR	50	15	30	5	100
	DSE-01	ZOOD-501	Immunology	TH + PR	50	15	30	5	100
	DSE-02	ZOOD-502	Animal Biotechnology & Bioinformatics	TH + PR	50	15	30	5	100
6 th	C-13	ZOOC-601	Developmental Biology	TH + PR	50	15	30	5	100
	C-14	ZOOC-602	Evolutionary Biology	TH + PR	50	15	30	5	100
	DSE-03	ZOOD-601	Animal Behaviour & Chronobiology	TH + PR	50	15	30	5	100
	DSE-04	ZOOD-602	Wild life Conservation & Management	TH + PR	50	15	30	5	100
Generic Elective/Audit									
1 st	GE-01	ZOOA-101	Animal Diversity	TH + PR	50	15	30	5	100
2 nd	GE-02	ZOOA-201	Human Physiology	TH + PR	50	15	30	5	100
3 rd	GE-03	ZOOA-301	Environment & Public Health	TH + PR	50	15	30	5	100
4 th	GE-04	ZOOA-401	Food, Nutrition & Health	TH + PR	50	15	30	5	100

All SEC paper examinations will be practical based

**Detailed Syllabus for Core Course
B.Sc. (Honours) Zoology**

Semester-I

Course Title: NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

Course Code: ZOOC-101

Course No: C- 01

Credits: 06 (04-Theory, 02 Practical)

No. of Classes: 96 (48+48)

Total Marks-100

Theory Marks: 65

End Semester: 50

In Semester: 15

Practical Marks:35

End Semester: 30

In Semester: 05

Course Objective: Introduction to Invertebrates (Lower group): their taxonomy and life cycle

THEORY	(Credits 4)	Marks
Unit 1: Protista, Parazoa and Metazoa	15	16
General characteristics and Classification upto classes Study of <i>Euglena</i> , <i>Amoeba</i> and <i>Paramecium</i> . Life cycle and pathogenicity of <i>Plasmodium vivax</i> and <i>Entamoeba histolytica</i> Locomotion and Reproduction in Protista Evolution of symmetry and segmentation of Metazoa		
Unit 2: Porifera	6	6
General characteristics and Classification upto classes Canal system and spicules in sponges		
Unit 3: Cnidaria	9	10
General characteristics and Classification upto classes. Metagenesis in <i>Obelia</i> Polymorphism in Cnidaria. Corals and coral reefs		
Unit 4: Ctenophora	4	4
General characteristics and Evolutionary significance		
Unit 5: Platyhelminthes	8	8
General characteristics and Classification up to classes Life cycle and pathogenicity of <i>Fasciola hepatica</i> and <i>Taenia solium</i>		
Unit 6: Nematelminthes	6	6
General characteristics and Classification up to classes. Life cycle, and pathogenicity of <i>Ascaris lumbricoides</i> and <i>Wuchereria bancrofti</i> Parasitic adaptations in helminthes		

Note: Classification to be followed from “Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition”

NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

PRACTICALS

(Credits2)

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/micro photographs)
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

**Detailed Syllabus for Core Course
B.Sc. (Honours) Zoology**

Semester-I

Course Title: PRINCIPLES OF ECOLOGY

Course Code: ZOOC-102

Credits: 06 (04-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks:35

End Semester: 50

End Semester: 30

Course No: C- 02

No. of Classes: 96 (48+48)

In Semester: 15

In Semester: 05

Course Objective: Structure and dynamics of population, Community characteristics, Ecosystem and Wildlife biology.

THEORY

(Credits: 4) Marks

Unit 1: Introduction to Ecology

6 6

History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors

Unit2: Population

18 1

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.

Unit3: Community

10 1

Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example. Theories pertaining to climax community.

Unit4: Ecosystem

10 1

Types of ecosystems with one example in detail, Food chain: Detritus and grazing foodchains, Linear and Y-shaped foodchains, Foodweb, 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 5

Ecology in Wildlife Conservation and Management

PRINCIPLES OF ECOLOGY

PRACTICALS

(Credits2)

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/Wildlife 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 Press

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester-II

Course Title: NON-CHORDATES II: COELOMATES

Course Code: ZOOC-201

Credits: 06 (04-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks:35

End Semester: 50

End Semester: 30

Course No: C- 03

No. of Classes: 96 (48+48)

In Semester: 15

In Semester: 05

THEORY	(Credits 4)	Marks
Unit 1: Introduction to Coelomates	2	2
Evolution of coelom and metamerism		
Unit 2: Annelida	8	8
General characteristics and Classification upto classes Excretion in Annelida		
Unit 3: Arthropoda	14	15
General characteristics and Classification upto classes Vision and Respiration in Arthropoda Metamorphosis in Insects. Social life in bees and termites		
Unit 4: Onychophora	4	4
General characteristics and Evolutionary significance		
Unit 5: Mollusca	12	13
General characteristics and Classification upto classes. Respiration in Mollusca Torsion and detorsion in Gastropoda. Pearl formation in bivalves. Evolutionary significance of trochophore larva		
Unit 6: Echinodermata	8	8
General characteristics and Classification upto classes. Water-vascular system in Asterozoa. Larval forms in Echinodermata Affinities with Chordates		

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

NON- CHORDATES II: COELOMATES

PRACTICAL

(Credits2)

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*
Echinodermates – *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

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester-II

Course Title: CELL BIOLOGY

Course Code: ZOOC-202

Credits: 06 (04-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks: 35

End Semester: 50

End Semester: 30

Course No: C- 04

No. of Classes: 96 (48+48)

In Semester: 15

In Semester: 05

THEORY

Credit 4 Marks

Unit 1: Overview of Cells

3 3

Prokaryotic and Eukaryotic cells, Virus, Viroid's, Mycoplasma, Prions

Unit 2: Plasma Membrane

7 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

7 7

Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes

Unit 4: Mitochondria and Peroxisomes

8 9

Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis
Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis, Peroxisomes

Unit 5: Cytoskeleton

7 7

Structure and Functions: Microtubules, Microfilaments and Intermediate filaments

Unit 6: Nucleus

7 7

Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus
Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome)

Unit 7: Cell Division

5 5

Mitosis, Meiosis, Cell cycle and its regulation

Unit 8: Cell Signaling

4 5

GPCR and Role of second messenger (cAMP)

CELL BIOLOGY

PRACTICAL

(Credits2)

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 Mercurio-bromophenol 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, Lewis Julian, Raff Martin, Roberts Keith and Watson James (2008). *Molecular Biology of the Cell*, V Edition, Garland publishing Inc., New York and London.

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester-III

Course Title: DIVERSITY OF CHORDATA

Course Code: ZOOC-301

Course No: C- 05

Credits: 06 (04-Theory, 02 Practical)

No. of Classes: 96 (48+48)

Total Marks-100

Theory Marks: 65

End Semester: 50

In Semester: 15

Practical Marks:35

End Semester: 30

In Semester: 05

THEORY

(Credits 4) Marks

Unit 1: Introduction to Chordates

2 2

General characteristics and outline classification

Unit 2: Protochordata

6 7

General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

Unit 3: Origin of Chordata

2 2

Dipleurula concept and the Echinoderm theory of origin of chordates, Advanced features of vertebrates over Protochordata

Unit 4: Agnatha

2 2

General characteristics and classification of cyclostomes up to class

Unit 5: Pisces

6 6

General characteristics of Chondrichthye sand Osteichthyes, classification upto order Migration, Osmoregulation and Parental care in fishes

Unit 6: Amphibia

5 5

Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification upto order; Parental care in Amphibians

Unit 7: Reptilia

5 5

General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes

Unit 8: Aves

6 7

General characteristics and classification up to order Archaeopteryx-- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds.

Unit 9: Mammals

6 6

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages.

Unit 10: Zoogeography

8 8

Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different realms

DIVERSITY OF CHORDATA

PRACTICAL

(Credits2)

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*, *Myxus*, *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 *Myxus*, pecten from Fowl head Dissection of Fowl head (Dissections and mounts subject to permission)

Powerpoint 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 Hall grimsson B. (2008). *Strickberger's Evolution*. IV Edition. JonesandBartlettPublishersInc.

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester-III

Course Title: ANIMAL PHYSIOLOGY: CONTROLLING & COORDINATING SYSTEMS

Course Code: ZOOC-302

Course No: C- 06

Credits: 06 (04-Theory, 02 Practical)

No. of Classes: 96 (48+48)

Total Marks-100

Theory Marks: 65

End Semester: 50

In Semester: 15

Practical Marks: 35

End Semester: 30

In Semester: 05

Course Objective: To provide basics about Anatomy and functions of bodily systems.

THEORY

	(Credit 4)	Marks
Unit 1: Tissues	5	5
Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue		
Unit 2: Bone and Cartilage	4	4
Structure and types of bones and cartilages, Ossification, bone growth and resorption		
Unit 3: Nervous System	7	8
Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibres; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc; Physiology of hearing and vision.		
Unit 4: Muscle	9	9
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		
Unit 5: Reproductive System	8	8
Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methods of contraception in male and female		
Unit 6: Endocrine System	15	16
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 hormone 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		

ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

PRACTICALS (Credits 2)

Marks : 30

- *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. Herculon 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.
- Arey, L.B. (1974). Human Histology. IV Edition. W.B. Saunders.

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester-III

Course Title: FUNDAMENTALS OF BIOCHEMISTRY

Course Code: ZOOC- 303

Credits: 06 (04-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks:35

Course No: C- 07

No. of Classes: 96 (48+48)

End Semester: 50

End Semester: 30

In Semester: 15

In Semester: 05

Course objective: To provide knowledge of Chemistry of biomolecules and Enzymes of living system.

THEORY (CREDITS 4)

Credit Marks: 50

Unit 1: Carbohydrates

6 7

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

Unit 2: Lipids

6 6

Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Triacylglycerols, Phospholipids, Glycolipids, Steroids

Unit 3: Proteins

12 12

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

10 10

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 and Hyper-chromaticity of DNA

Unit 5: Enzymes

14 15

Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalysed 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

FUNDAMENTALS OF BIOCHEMISTRY

PRACTICAL (CREDITS 2)

Marks: 30

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.

Scheme of the Practical:

Time: 4 Hours

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.

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester-IV

Course Title: COMPARATIVE ANATOMY OF VERTEBRATES

Course Code: ZOOC-401

Course No: C- 08

Credits: 06 (04-Theory, 02 Practical)

No. of Classes: 96 (48+48)

Total Marks-100

Theory Marks: 65

End Semester: 50

In Semester: 15

Practical Marks:35

End Semester: 30

In Semester: 05

Course objective: Anatomical features of selected systems in vertebrates with special reference to mammals.

THEORY	(CREDITS 4) Marks: 50	
Unit 1: Integumentary System	7	7
Structure, functions and derivatives of integument		
Unit 2: Skeletal System	5	6
Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches		
Unit 3: Digestive System	6	6
Alimentary canal and associated glands, dentition		
Unit 4: Respiratory System	6	6
Skin, gills, lungs and air sacs; Accessory respiratory organs		
Unit 5: Circulatory System	7	7
General plan of circulation, evolution of heart and aortic arches		
Unit 6: Urinogenital System	6	6
Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri		
Unit 7: Nervous System	6	6
Comparative account of brain Autonomic nervous system, Spinal cord, Cranial nerves in mammals		
Unit 8: Sense Organs	5	6
Classification of receptors Brief account of visual and auditory receptors in man		

COMPARATIVE ANATOMY OF VERTEBRATES

PRACTICAL (CREDITS 2)

Marks: 30

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)

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester-IV

Course Title: ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

Course Code: ZOOC- 402

Course No: C- 09

Credits: 06 (04-Theory, 02 Practical)

No. of Classes: 96 (48+48)

Total Marks-100

Theory Marks: 65

End Semester: 50

In Semester: 15

Practical Marks: 35

End Semester: 30

In Semester: 05

Course Objective: To know about Anatomy and functions of bodily systems.

THEORY	(Credits 4)	Marks: 50
Unit 1: Physiology of Digestion	11	12
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	10	10
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	7	8
Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance		
Unit 4: Blood	10	10
Components of blood and their functions; Structure and functions of haemoglobin Haemostasis: Blood clotting system, Kallikrein-Kininogen system, Complement system& Fibrinolytic system, Hemopoiesis, Blood groups: Rh factor, ABO and MN		
Unit 5: Physiology of Heart	10	10
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		

ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

PRACTICALS (CREDITS 2)

Marks: 30

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
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)

Scheme of the Practical: Time: 4 Hours

SUGGESTED READINGS

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Herculourt 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.
- Arey, L.B. (1974). Human Histology. IV Edition. W.B. Saunders
- Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, Mcgraw Hills

**Detailed Syllabus for Core Course
B.Sc. (Honours) Zoology**

Semester-IV

Course Title: BIOCHEMISTRY OF METABOLIC PROCESSES

Course Code: ZOOC-403

Course No: C- 10

Credits: 06 (04-Theory, 02 Practical)

No. of Classes: 96 (48+48)

Total Marks-100

Theory Marks: 65

End Semester: 50

In Semester: 15

Practical Marks:35

End Semester: 30

In Semester: 05

Course Objective: Metabolic processes in Carbohydrate, Lipid and Proteins. ATP synthesis.

THEORY

(CREDITS 4) Marks: 50

Unit 1: Overview of Metabolism

8 10

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

Unit 2: Carbohydrate Metabolism

12 12

Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis

Unit 3: Lipid Metabolism

10 10

β -oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis

Unit 4: Protein Metabolism

10 10

Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids

Unit 5: Oxidative Phosphorylation

8 8

Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System

BIOCHEMISTRY OF METABOLIC PROCESS

PRACTICAL (CREDITS 2)

Marks: 30

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.

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester-V

Course Title: MOLECULAR BIOLOGY

Course Code: ZOOC-501

Credits: 06 (04-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks:35

End Semester: 50

End Semester: 30

Course No: C- 11

No. of Classes: 96 (48+48)

In Semester: 15

In Semester: 05

Course objective:The objective of the course is to impart basic knowledge of the structure and function of the macromolecules, Protein synthesis, DNA repair mechanism, Gene regulation.

THEORY	(CREDITS 4) Marks: 50	
Unit 1: Nucleic Acids	4	4
Salient features of DNA and RNA; Watson and Crick model of DNA		
Unit 2: DNA Replication	9	10
DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres		
Unit 3: Transcription	7	7
RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors		
Unit 4: Translation	9	10
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		
Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA	6	6
Structure of globin mRNA; Split genes: concept of introns and exons, basic concept of RNA splicing, and RNA editing, Processing of tRNA		
Unit 6: Gene Regulation	7	7
Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from lac operon and trp operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting		
Unit 7: DNA Repair Mechanisms	3	3
Pyrimidine dimerization and mismatch repair		
Unit 8: Regulatory RNAs	3	3
Ribo-switches, RNA interference, miRNA, siRNA		

MOLECULAR BIOLOGY

PRACTICAL

(CREDITS 2)

Marks: 30

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 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. Detailed Syllabus for Core Course.

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester- V

Course Title: PRINCIPLES OF GENETICS

Course Code: ZOOC-502

Credits: 06 (04-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks:35

End Semester: 50

End Semester: 30

Course No: C- 12

No. of Classes: 96 (48+48)

In Semester: 15

In Semester: 05

Course objective: To give knowledge to the target students about the Genetic inheritance and gene interaction in Mendelian and post-Mendelian perspective, Mutation, Linkage, Crossing over, Chromosome mapping.

THEORY

(CREDITS 4) Marks: 50

Unit 1: Mendelian Genetics and its Extension

6

6

Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex influenced and sex-limited characters inheritance.

Unit 2: Linkage, Crossing Over and Chromosomal Mapping

9

10

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.

Unit 3: Mutations

8

8

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.

Unit 4: Sex Determination

4

4

Chromosomal mechanisms of sex determination in Drosophila and Man

Unit 5: Extra-chromosomal Inheritance

5

6

Criteria for extra-chromosomal inheritance, Antibiotic resistance in Chlamydomonas, Mitochondrial mutations in Saccharomyces, Infective heredity in Paramecium and Maternal effects

Unit 6: Polygenic Inheritance

3

3

Polygenic inheritance with suitable examples; simple numericals based on it.

Unit 7: Recombination in Bacteria and Viruses

7

7

Conjugation, Transformation, Transduction, Complementation test in Bacteriophage

Unit 8: Transposable Genetic Elements

6

6

Concept of transposable elements in maize with example in human.

PRINCIPLES OF GENETICS

PRACTICALS

(CREDITS 2)

Marks: 30

1. To study the Mendelian laws and gene interactions using suitable experimental materials.
2. Chi-square analyses using seeds/beads/Drosophila.
3. Linkage maps based on data from Drosophila crosses.
4. Study of human karyotype with the help of slide
5. 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.

Detailed Syllabus for Core Course

B.Sc. (Honours) Zoology

Semester- V

Course Title: IMMUNOLOGY

Course Code: ZOOD - 501

Credits: 06 (04-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks: 35

Course No: C- DSE - 01

No. of Classes: 96 (48+48)

End Semester: 50

End Semester: 30

In Semester: 15

In Semester: 05

Course Objective: The course deals with various types of immunity, antibodies, antigens, Complement system, Vaccines etc.

THEORY	(Credits 4)	Marks – 50
Unit 1: Overview of Immune System	7	7
Historical perspective of Immunology, Early theories of Immunology, Cells and organs of the Immune system		
Unit 2: Innate and Adaptive Immunity	8	8
Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral), Passive: Artificial and natural Immunity, Active: Artificial and natural Immunity, Immune dysfunctions (brief account of autoimmunity with reference to Rheumatoid Arthritis and tolerance, AIDS).		
Unit 3: Antigens	7	8
Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes		
Unit 4: Immunoglobulins	7	8
Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions, Immunoassays (ELISA and RIA), Polyclonal sera, Hybridoma technology: Monoclonal antibodies in therapeutics and diagnosis		
Unit 5: Major Histocompatibility Complex	5	5
Structure and functions of MHC molecules. Endogenous and exogenous pathways of antigen processing and presentation		
Unit 6: Cytokines	4	4
Properties and functions of cytokines, Therapeutics Cytokines		
Unit 7: Complement System	3	3
Components and pathways of complement activation.		
Unit 8: Hypersensitivity	3	3
Gell and Coombs' classification and brief description of various types of hypersensitivities		
Unit 9: Vaccines	4	4
Various types of vaccines.		

IMMUNOLOGY

PRACTICAL

(Credits 2)

Marks: 30

- 1*Demonstration of lymphoid organs.
2. Histological study of spleen, thymus and lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells.
4. Ouchterlony's double immuno-diffusion method.
5. ABO blood group determination.
6. Demonstration of -
 - a. ELISA
 - b. Immunoelectrophoresis

* The experiments can be performed depending upon usage of animals in UG courses.

SUGGESTED READINGS

- Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition. W.H. Freeman and Company.
- David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, VII Edition, Mosby, Elsevier Publication.
- Abbas, K. Abul and Lichtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders publication.

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester- V

Course Title: ANIMAL BIOTECHNOLOGY & BIOINFORMATICS

Course Code: ZOOD- 502

Course No: DSE - 02

Credits: 06 (04-Theory, 02 Practical)

No. of Classes: 96 (48+48)

Total Marks-100

Theory Marks: 65

End Semester: 50

In Semester: 15

Practical Marks:35

End Semester: 30

In Semester: 05

Course Objective: The objective of the course is to give the students the knowledge of modern biological techniques

THEORY

	(Credits 4)	Marks - 50
Unit 1: Introduction	5	5
Concept and scope of biotechnology		
Unit 2: Molecular Techniques in Gene manipulation	16	18
Cloning Principle		
Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, BAC, YAC, and Expression vectors (characteristics)		
Restriction enzymes: Type II – Blunt end cutter and sticky end cutter		
Transformation techniques: Calcium chloride method and electroporation.		
Construction of genomic and cDNA libraries and screening by blue white colony selection method		
Blotting techniques - Southern, Northern and Western blotting;		
DNA sequencing: Sanger dideoxy sequencing method		
Polymerase Chain Reaction,		
DNA Finger Printing		
Unit 3: Genetically Modified Organisms	12	12
Production of transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection		
Applications of transgenic animals		
Production of transgenic plants: Agrobacterium mediated transformation. Applications of transgenic plants		
Unit 4: Fundamentals of Bioinformatics	8	8
Introduction to biological databases; Primary, secondary and composite databases; Nucleic acid databases (GenBank, DDBJ, EMBL and NDB); Protein databases (PIR, SWISSPROT, TrEMBL, PDB); Metabolic pathway database (KEGG); Small molecule databases (PubChem). Data mining and data mining tools (ENTREZ)		
Unit 5: Basic concept of sequencing alignment	7	7
Scoring Matrices (PAM, BLOSUM), Methods of Alignment (Dot matrix, Dynamic Programming), BLAST and FASTA; Local and global alignment, pair wise and multiple sequence alignments; Similarity, identity and homology of sequences. Phylogenetic analysis: Basic concept, Steps in evaluation of phylogeny and constructing phylogenetic tree.		

ANIMAL BIOTECHNOLOGY

PRACTICAL

(Credits 2)

Marks: 30

1. Genomic DNA isolation from E. coli / Animal tissue.
2. Restriction digestion of plasmid DNA/ gDNA
3. To study following techniques through photographs:
 - a) Southern Blotting
 - b) DNA Sequencing (Sanger's Method)
 - c) PCR
 - d) DNA fingerprinting
4. Accessing biological database
5. Creation of databases
6. Retrieval of nucleotide and protein sequences from databases
7. To perform pair-wise alignment of sequences (BLAST) and interpret the outcome
8. Translate a nucleotide sequence and select the correct reading frame of the polypeptide from the output sequence
9. To learn graphical representation of statistical data with the help of computers (e.g., MS Excel)
10. Project report based on theory.

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.

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester- VI

Course Title: DEVELOPMENTAL BIOLOGY

Course Code: ZOOC-601

Credits: 06 (04-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks:35

End Semester: 50

End Semester: 30

Course No: C- 13

No. of Classes: 96 (48+48)

In Semester: 15

In Semester: 05

Course objective: To provide knowledge about the gradual emergence of form and structure of embryo. The essence of embryonic development is change transition from one stage to another.

THEORY

(Credit 4) Marks: 50

Unit 1: Introduction

4 6

Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation, Differentiation and growth, Differential gene expression, Ageing: Concepts and Theories. Cytoplasmic determinants and asymmetric cell division

Unit 2: Early Embryonic Development

20 20

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 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

8 8

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 8

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

DEVELOPMENTAL BIOLOGY

PRACTICALS

(CREDITS 2)

Marks: 30

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

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester-VI

Course Title: EVOLUTIONARY BIOLOGY

Course Code: ZOOC-602

Credits: 06 (04-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks:35

End Semester: 50

End Semester: 30

Course No: C- 14

No. of Classes: 96 (48+48)

In Semester: 15

In Semester: 05

Course Objective: To provide basic concept about the present biodiversity and present genetic variance on the earth.

THEORY	(Credit 4)	Marks: 50
Unit 1: Life's Beginnings: Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes	6	6
Unit 2: Historical review of evolutionary concept: Lamarckism, Darwinism, Neo-Darwinism	4	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	8	8
Unit 4: Sources of variations: Heritable variations and their role in evolution	8	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	10	12
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	5	5
Unit 7: Extinctions, Back ground and mass extinctions (causes and effects), detailed example of K-T extinction	2	2
Unit 8: Origin and evolution of man, Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to Homo sapiens, molecular analysis of human origin.	5	5

EVOLUTIONARY BIOLOGY

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

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

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester-VI

Course Title: ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

Course Code: ZOOD- 601

Credits: 06 (04-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks:35

Course No: DSE - 03

No. of Classes: 96 (48+48)

End Semester: 50

End Semester: 30

In Semester: 15

In Semester: 05

Course Objective: The various types of behaviour or the responses to environment & stimuli of different organisms along with human being.

THEORY	(Credits 4)	Marks: 50
Unit 1: Introduction to Animal Behaviour	7	8
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 behaviour		
Unit 2: Patterns of Behaviour	7	8
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	10	10
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	8	8
Historical developments in chronobiology; Adaptive significance of biological clocks		
Unit 5: Biological Rhythm	10	10
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 6: Biological Clocks	6	6
Relevance of biological clocks; Chrono-pharmacology, Chrono-medicine, Chronotherapy.		

ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

PRACTICAL

(Credits 2)

Marks: 30

1. To study nests and nesting habits of the birds and social insects.
2. To study geotaxis behaviour in earthworm.
3. To study the photo taxis behaviour in insect larvae.
4. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.
5. Study and actogram construction of locomotor activity of suitable animal models.
6. 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's and Noble Inc. New York, USA
- The Clock that times us. 1982. Moore Ed et al.
- Biological Rhythms: Vinod Kumar (2002) Narosa Publishing.

Detailed Syllabus for Core Course B.Sc. (Honours) Zoology

Semester-VI

Course Title: WILD LIFE CONSERVATION AND MANAGEMENT

Course Code: ZOOD- 602

Course No: DSE - 04

Credits: 06 (04-Theory, 02 Practical)

No. of Classes: 96 (48+48)

Total Marks-100

Theory Marks: 65

End Semester: 50

In Semester: 15

Practical Marks:35

End Semester: 30

In Semester: 05

Course Objective: The objective of the course is to know about various conservation strategies of wild life and its management

THEORY

(CREDITS 4) Marks

Unit 1: Introduction to Wild Life

8 8

Values of wild life - positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.

Unit 2: Evaluation and management of wild life

10 12

Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Sign survey and census method of wild life; Standard evaluation procedures: remote sensing and GIS.

Unit 3: Management of habitats

6 6

Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitat.

Unit 4: Management planning of wild life in protected areas

8 8

Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Concept of climax persistence.

Unit 5: Management of excess population

8 8

Bio- telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal

Unit 6: Protected areas

8 8

National parks & sanctuaries, Community reserve; important features of protected areas in India; Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve.

WILD LIFE CONSERVATION AND MANAGEMENT

PRACTICALS

Credit 2

Marks: 30

1. Identification of threatened flora, mammalian fauna, avian fauna, herpeto-fauna (at least five sp. from each).
2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)
3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.
4. Demonstration of different field techniques for flora and fauna
5. PCQ, Ten tree method, Circular, Square & rectangular plots, Parker's 2 Step and other methods for ground cover assessment, Tree canopy cover assessment, Shrub cover assessment.
6. Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences)

SUGGESTED READINGS

- Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.
- Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflict or Coexistence? Cambridge University.
- Bookhout, T.A. (1996). Research and Management techniques for Wildlife and Habitats, 5th edition. The Wildlife Society, Allen Press.
- Sutherland, W.J. (2000). The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
- Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

Detailed Syllabus for Skill Enhancement Course
Sub: Zoology

Semester-III

Course Title: RESEARCH METHODOLOGY

Course Code: ZOOS-301

Credits: 02

Total Marks-50

Theory Marks: 15

Practical Marks: 25

Course No: SEC- 01

No. of Classes: 24

In Semester: 10

Course objective: Define and explain the concept of scientific research, Identify and explain the features and applications of different research methods, Steps in conducting a research, Applications and exercises.

	Marks
Unit1: Foundations of Research	6
Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied	
Unit2: Research Design	15
Mean, Median, Mode, MD, SD, Correlation, Regression, Multi variate analysis, Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs	
Unit3: Data Collection, Analysis and Report Writing	12
Observation and Collection of Data - Methods of data collection-Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis writing, Preparation of Tables and Bibliography. Data Presentation using digital technology	
Unit 4: Ethical Issues	7
Intellectual property Rights, Commercialization, Copyright, Royalty, Patent law, Plagiarism, Citation, Acknowledgement	

SUGGESTED READINGS

- Anthony, M, Graziano, A.M. and Raulin, M.L. 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
- Walliman, N. 2011. Research Methods- The Basics. Taylor and Francis, London, New York.
- Wadhwa, B.L.: Law Relating to Patents, Trade Marks, Copyright Designs and Geographical Indications, 2002, Universal Law publishing
- C.R. Kothari: Research Methodology, New Age International, 2009
- Coley, S.M. and Scheinberg, C.A. 1990, "Proposal writing". Stage Publications.

**Detailed Syllabus for Skill Enhancement Course
Sub: Zoology**

Semester-IV

Course Title: AQUARIUM FISHKEEPING

Course Code: ZOOS-401

Credits: 02

Total Marks-50

Theory Marks: 15

Practical Marks: 25

Course No: SEC- 02

No. of Classes: 24

In Semester: 10

Course code: ZOOS-401

Course objective: Main objective of the course is to Construction and maintenance of Aquarium, and to know about the Biology of Aquarium fishes.

Unit 1: Introduction to Aquarium Fish Keeping

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

Unit2: 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

Unit3: Food and feeding of Aquarium fishes

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

Unit4: Fish Transportation

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

Unit5: Maintenance of Aquarium

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

PRACTICAL

Project report on field visit to a fish farm for observing local Ornamental fish and their transport

Detailed Syllabus for Audit Courses

Sub: Zoology

Semester-I

Course Title: ANIMAL DIVERSITY

Course Code: ZOOA-101

Credits: 05 (03-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks: 35

End Semester: 50

End Semester: 30

Course No: GE- 01

No. of Classes: 84 (36+48)

In Semester: 15

In Semester: 05

Course objective: Provide the concepts of Invertebrates and Vertebrates.

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

PRACTICAL

(CREDITS: 2)

1. Study of following specimens:

Non Chordates: *Euglena, Noctiluca, Paramecium, Sycon, Physalia, Tubipora, Metridium, Taenia, Ascaris, Nereis, Aphrodite, Leech, Peripatus, Limulus, Hermit crab, Daphnia, Millipede, Centipede, Beetle, Chiton, Dentalium, Octopus, Asterias, and Antedon.*

Chordates: *Balanoglossus, Amphioxus, Petromyzon, Pristis, Hippocampus, Labeo, Ichthyophis, Uraeotyphlus, Salamander, Rhacophorus Draco, Uromastix, Naja, Viper, model of Archaeopteryx, any three common birds-(Crow, duck, Owl), Squirrel and Bat.*

2. Study of following Permanent Slides:

Cross section of *Sycon*, Sea anemone and *Ascaris* (male and female). T.S. of Earthworm passing through pharynx, gizzard, and typhlosolar intestine. *Bipinnaria* and *Pluteus* larva.

3. Temporary mounts of

- Septal & pharyngeal nephridia of earthworm.
- Unstained mounts of Placoid, cycloid and ctenoid scales.

4. Dissection of

- Digestive and nervous system of Cockroach.
- Urinogenital system of Rat

SUGGESTED BOOKS

- Barnes, R.D. (1992). *Invertebrate Zoology*. Saunders College Pub. USA.
- Ruppert, Fox and Barnes (2006) *Invertebrate Zoology. A functional Evolutionary Approach* 7th Edition, Thomson Books/Cole
- Campbell & Reece (2005). *Biology*, Pearson Education, (Singapore) Pvt. Ltd.
- Kardong, K.V. (2002). *Vertebrates Comparative Anatomy. Function and Evolution*. Tata McGraw Hill Publishing Company. New Delhi.
- Raven, P.H. and Johnson, G.B. (2004). *Biology*, 6th edition, Tata McGraw Hill Publications. New Delhi.

Detailed Syllabus for Audit Courses
Sub: Zoology

Semester-II

Course Title: HUMAN PHYSIOLOGY

Course Code: ZOOA-201

Credits: 05 (03-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks: 35

End Semester: 50

End Semester: 30

Course No: GE- 02

No. of Classes: 84 (36+48)

In Semester: 15

In Semester: 05

Course Objective: Aim to provide knowledge about Anatomy and functions of bodily systems.

THEORY	(CREDITS 3)	Marks
Unit 1: Digestion and Absorption of Food Structure and function of digestive glands; Digestion and absorption of carbohydrates, fats and proteins; Nervous and hormonal control of digestion (<i>in brief</i>)	7	10
Unit 2: Functioning of Excitable Tissue (Nerve and Muscle) Structure of neuron, Propagation of nerve impulse (myelinated and non-myelinated nerve fibre); Structure of skeletal muscle, Mechanism of muscle contraction (Sliding filament theory), Neuromuscular junction	5	8
Unit 3: Respiratory Physiology Ventilation, External and internal Respiration, Transport of oxygen and carbon di-oxide in blood, Factors affecting transport of gases.	5	6
Unit 4: Renal Physiology Functional anatomy of kidney, Mechanism and regulation of urine formation,	4	6
Unit 5: Cardiovascular Physiology Structure of heart, Coordination of heartbeat, Cardiac cycle, ECG	7	8
Unit 6: Endocrine and Reproductive Physiology Structure and function of endocrine glands (pituitary, thyroid, parathyroid, pancreas, adrenal, ovaries, and testes), Brief account of spermatogenesis and oogenesis, Menstrual cycle.	8	12

HUMAN PHYSIOLOGY

PRACTICAL

(CREDITS2)

1. Preparation of temporary mounts: Neurons and Bloodfilm.
2. Preparation of haemin and haemochromogen crystals.
3. Estimation of haemoglobin using Sahli's haemoglobinometer.
4. Examination of permanent histological sections of mammalian oesophagus, stomach, duodenum, rectum, lung, kidney, thyroid, pancreas, adrenal, testis, ovary.

SUGGESTED READINGS

- Tortora, G.J. and Derrickson, B.H. (2009). *Principles of Anatomy and Physiology*, XII Edition, John Wiley and Sons, Inc.
- Widmaier, E.P., Raff, H. and Strang, K.T. (2008). *Vander's Human Physiology*, XI Edition, McGrawHill.

Detailed Syllabus for Audit Courses

Sub: Zoology

Semester-III

Course Title: ENVIRONMENT AND PUBLIC HEALTH

Course Code: ZOOA-301

Credits: 05 (03-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks:35

Course No: GE- 03

No. of Classes: 84 (36+48)

End Semester: 50

End Semester: 30

In Semester: 15

In Semester: 05

Course Objective: To provide basic insight on Factors affecting environment, environmental disasters and human diseases

THEORY

(Credits 3) Marks: 50

UNIT I: Introduction

6 10

Sources of Environmental hazards, hazard identification and accounting, fate of toxic and persistent substances in the environment.

UNIT II: Climate Change

6 8

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

Unit III Pollution

8 10

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

Unit IV: Waste Management Technologies

10 14

Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical 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 V: Diseases

6 8

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

PRACTICAL

(Credits 2)

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

SUGGESTED BOOKS

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

Detailed Syllabus for Audit Courses

Sub: Zoology

Semester-IV

Course Title: FOOD, NUTRITION AND HEALTH

Course Code: ZOOA-401

Credits: 05 (03-Theory, 02 Practical)

Total Marks-100

Theory Marks: 65

Practical Marks:35

End Semester: 50

End Semester: 30

Course No: GE- 04

No. of Classes: 84 (36+48)

In Semester: 15

In Semester: 05

Course Objective: Aim to provide knowledge of Components and nutrients in different food, nutritional biochemistry, diseases: nutritional deficiency, life style related; food and water borne infections and food hygiene

THEORY

(Credits 3) Marks: 50

Unit 1: Basic concept of food and nutrition

6

8

Food Components and food-nutrients. Concept of a balanced diet, nutrient needs and dietary pattern for various groups- adults, pregnant and nursing mothers, infants, school children, adolescents and elderly

Unit 2: Nutritional Biochemistry:

12

16

Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role. Vitamins- Fat-soluble and Water-soluble vitamins- their dietary source and importance. Minerals- Iron, calcium, phosphorus, iodine, selenium and zinc: their biological functions

Unit 3: Health

10

14

Introduction to health- Definition and concept of health. Major nutritional Deficiency diseases- Protein Energy Malnutrition (kwashiorkor and marasmus), Vitamin A deficiency disorders, Iron deficiency disorders, Iodine deficiency disorders- their causes, symptoms, treatment, prevention and government programmes, if any. Life style related diseases- hypertension, diabetes mellitus, and obesity- their causes and prevention through dietary and lifestyle modifications. Social health problems- smoking, alcoholism, drug dependence and Acquired Immuno-deficiency Syndrome (AIDS) - their causes, treatment and prevention. Common ailments- cold, cough, and fevers, their causes and treatment

Unit 4: Food hygiene:

8

12

Potable water- sources and methods of purification at domestic level Food and Water borne infections: Bacterial infection: Cholera, typhoid fever, dysentery; Viral infection: Hepatitis, Poliomyelitis, Protozoan infection: amoebiasis, giardiasis; Parasitic infection: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention Brief account of food spoilage: Causes of food spoilage and their preventive measures

PRACTICAL

(Credits 2)

1. To detect adulteration in a) Ghee b) Sugars c) Tea leaves and d) Turmeric
2. Estimation of Lactose in milk
3. Ascorbic acid estimation in food by titrimetry
4. Estimation of Calcium in foods by titrimetry
5. Study of the stored grain pests from slides/ photograph (*Sitophilus oryzae*, *Trogoderma granarium*, *Callosobruchus chinensis* and *Tribolium castaneum*): their identification, habitat and food sources, damage caused and control. Preparation of temporary mounts of the above stored grain pests.
6. Project- Undertake computer aided diet analysis and nutrition counselling for different age groups.

OR Identify nutrient rich sources of foods (fruits and vegetables), their seasonal availability and price

OR Study of nutrition labelling on selected foods

SUGGESTED BOOKS

1. Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; 2007; New Age International Publishers
2. Srilakshmi B. Nutrition Science; 2002; New Age International (P) Ltd.
3. Srilakshmi B. Food Science; Fourth Ed; 2007; New Age International (P) Ltd.
4. Swaminathan M. Handbook of Foods and Nutrition; Fifth Ed; 1986; BAPPCO.
5. Bamji MS, Rao NP, and Reddy V. Text Book of Human Nutrition; 2009; Oxford & IBH Publishing Co. Pvt Ltd.
6. Wardlaw GM, Hampl JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill.
7. Lakra P, Singh MD. Textbook of Nutrition and Health; First Ed; 2008; Academic Excellence.
8. Manay MS, Shadaksharaswamy. Food-Facts and Principles; 1998; New Age International (P) Ltd.
9. Gibney et al. Public Health Nutrition; 2004; Blackwell Publishing