

Zoology

CBCS Undergraduate **2015** Zoology

SCHEME AND SYLLABUS FOR CHOICE BASED CREDIT SYSTEM FOR B.Sc. HONOURS ZOOLOGY

Semester	Core Course(14)	Ability Enhancement Compulsory Course (2)	Skill Enhancement Course SEC (2)	Discipline Specific Elective DCE (4)	Generic Elective GE (4)
I	Non-chordates I: Protista to Pseudocoelomates	English Communication			GE-1
	Principles of Ecology				
II	Non-chordates II: Coelomates	Environmental Science			GE-2
	Cell Biology				
III	Diversity of Chordates		SEC -1		GE-3
	Physiology: Controlling and Coordinating Systems				
	Fundamentals of Biochemistry				
IV	Comparative Anatomy of Vertebrates		SEC -2		GE-4
	Physiology: Life Sustaining Systems				
	Biochemistry of Metabolic Processes				
	Molecular Biology			DSE-1	
	Principles of Genetics			DSE-2	
	Developmental Biology			DSE -3	
	Evolutionary Biology			DSE-4	

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Semester	Course Opted	Course Name	Credits
I	Ability Enhancement Compulsory Course-I	English communications/ Environmental Science	2
	Core course-I	Non-chordates I: Protista to Pseudocoelomates	4
	Core Course-I Practical		2
	Core course-II	Principles of Ecology	4
	Core Course-II Practical		2
	Generic Elective -1	GE-1	4
	Generic Elective -1 Practical/Tutorial		2
II	Ability Enhancement Compulsory Course-II	Englishcommunications/ EnvironmentalScience	2
	Core course-III	Non-chordates II: Coelomates	4
	Core Course-III Practical		2
	Core course-IV	Cell Biology	4
	Core Course-IV Practical		2
	Generic Elective -2	GE-2	4
	Generic Elective -2 Practical		2
III	Core course-V	Diversity of chordates	4
	Core Course-V Practical		2
	Core course-VI	Physiology: Controlling and Coordinating systems	4
	Core Course-VI Practical		2
	Core course-VII	Fundamentals of Biochemistry	4
	Core Course-VII Practical		2
	Skill Enhancement Course-1	SEC-1	4
	Generic Elective -3	GE-3	4
	Generic Elective -3 Practical		2
IV	Core course-VIII	Comparative anatomy of vertebrates	4
	Course-VIII Practical		2
	Core course-IX	Physiology: Life Sustaining Systems	4
	Course-IX Practical		2
	Core course-X	Biochemistry of Metabolic Processes	4
	Core Course- X Practical		2
	Skill Enhancement Course-2	SEC-2	4
	Generic Elective -4	GE-4	4
	Generic Elective -4 Practical		2
V	Core course-XI	Molecular Biology	4
	Core Course-XI Practical		2
	Core course-XII	Principles of Genetics	4
	Core Course-XII Practical		2

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Semester	Course Opted	Course Name	Credits
	Discipline Specific Elective -1	DSE-1	4
	Discipline Specific Elective -1 Practical		2
	Discipline Specific Elective -2	DSE-2	4
	Discipline Specific Elective- 2 Practical/Tutorial		2
VI	Core course-XIII	Developmental Biology	4
	Core Course-XIII Practical/Tutorial		2
	Core course-XIV	Evolutionary Biology	4
	Core Course-XIV Practical/Tutorial		2
	Discipline Centric Elective -3	DSE-3	4
	Discipline Centric Elective -3 Practical/Tutorial		2
	Discipline Centric Elective-4	DSE-4	4
	Discipline Centric Elective -1 Practical/Tutorial		2
Total: 140			

CORE COURSES	
CC I	Non-chordates I: Protista to Pseudocoelomates
CC II	Perspectives in Ecology
CC III	Non-chordates II: Coelomates
CC IV	Cell Biology
CC V	Diversity of Chordates
CC VI	Physiology: Controlling and Coordinating Systems
CC VII	Fundamentals of Biochemistry
CC VIII	Comparative Anatomy of Vertebrates
CC IX	Physiology: Life Sustaining Systems
CC X	Biochemistry of Metabolic Processes
CC XI	Molecular Biology
CC XII	Principles of Genetics
CC XIII	Developmental Biology
CC XIV	Evolutionary Biology

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DISCIPLINE SPECIFIC ELECTIVE COURSES	
DSE 1	Agrochemicals and Pest Management
DSE 2	Animal Behaviour and Chronobiology
DSE 3	Animal Biotechnology
DSE 4	Basics of Neuroscience
DSE 5	Biology of Insecta ✓
DSE 6	Computational Biology
DSE 7	Endocrinology ✓
DSE 8	Fish and Fisheries ✓
DSE 9	Immunology
DSE 10	Parasitology ✓
DSE 11	Reproductive Biology
DSE 12	Wild Life Conservation and Management
GENERIC ELECTIVE COURSES	
GE 1	Animal Cell Biotechnology
GE 2	Animal Diversity ✓ I
GE 3	Aquatic Biology
GE 4	Environment and Public Health
GE 5	Exploring the Brain: Structure and Function
GE 6	Food, Nutrition and Health II
GE 7	Human Physiology ✓ III
GE 8	Insect Vectors and Diseases ✓ IV
SKILL ENHANCEMENT COURSES	
SEC 1	Apiculture ✓
SEC 2	Aquarium Fish Keeping
SEC 3	Medical Diagnostics
SEC 4	Research Methodology

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SEC 5	Sericulture ✓
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CELL BIOLOGY

(Credits 3)

PRACTICAL

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.

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CORE COURSE I
NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

THEORY	(Credits 4)
Unit 1: Protista, Parazoa and Metazoa General characteristics and Classification up to 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	19
Unit 2: Porifera General characteristics and Classification up to classes Canal system and spicules in sponges	7
Unit 3: Cnidaria General characteristics and Classification up to classes Metagenesis in <i>Obelia</i> Polymorphism in Cnidaria Corals and coral reefs	12
Unit 4: Ctenophora General characteristics and Evolutionary significance	4
Unit 5: Platyhelminthes General characteristics and Classification up to classes Life cycle and pathogenicity of <i>Fasciola hepatica</i> and <i>Taenia solium</i>	10
Unit 6: Nematelminthes 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	8

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

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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. Dissections 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.

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CORE COURSE II
PRINCIPLES OF ECOLOGY

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	

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CORE COURSE IV
CELL BIOLOGY

THEORY	(Credits 4)
Unit 1: Overview of Cells ✓	3
Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions	
Unit 2: Plasma Membrane M	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 E	10
Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes	
Unit 4: Mitochondria and Peroxisomes A	8
Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis Peroxisomes	
Unit 5: Cytoskeleton M	8
Structure and Functions: Microtubules, Microfilaments and Intermediate filaments	
Unit 6: Nucleus E	12
Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus Chromatin: Euchromatin and Heterochromatin 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)	

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GE 2 ✓

ANIMAL DIVERSITY

THEORY

(CREDITS 4)

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

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CORE COURSE III
NON-CHORDATES II: COELOMATES

THEORY	(Credits 4)
Unit 1: Introduction to Coelomates ✓	2
Evolution of coelom and metamerism	
Unit 2: Annelida EM	10
General characteristics and Classification up to classes	
Excretion in Annelida	
Unit 3: Arthropoda AE	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 AA	
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 A	12
General characteristics and Classification up to 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"

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NON-CHORDATES II: COELOMATES

PRACTICAL

(Credits 2)

- Study of following specimens:
 - Annelids - *Aphrodite*, *Nereis*, *Heteronereis*, *Sabella*, *Serpula*, *Chaetopterus*, *Pheretima*, *Tirudinaria*
 - Arthropods - *Limulus*, *Palaemon*, *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*
- Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm
- T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm
- Mount of mouth parts and dissection of digestive system and nervous system of *Periplaneta**
- 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. (2007) *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, F. & J. W. and Nelson

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PRINCIPLES OF ECOLOGY**PRACTICALS**

(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

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NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

(Credits 2)

PRACTICALS

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"

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- 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). *Invertebrates: A New Synthesis*, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.I. B and Nelson

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