UNIVERSITY OF NORTH BENGAL

Accredited by NAAC with grade "B++"

B.Sc. Zoology FOUR YEAR UNDERGRADUATE PROGRAM
(FYUGP)
w.e.f. 2023-2024

Course Curriculum for B.Sc. Zoology (Minor)

Under
THE NEW CURRICULUM AND CREDIT FRAMEWORK, 2022

समानो मन्त्रः समितिः समानी

B.Sc. Zoology
Minor

UNIVERSITY OF NORTH BENGAL
RAJA RAMMOHANPUR, DARJEELING
WEST BENGAL
PIN-734013

FYUGP COURSE STRUCTURE OF ZOOLOGY
(MINOR)

Semester	Major Courses (Credit)	Skill Enhancement Courses (Credit)	Minor Courses (Credit) #	Inter-disciplinary Courses (Credit)	Ability Enhancement Compulsory Courses (Credit)	Value Added Courses (Credit)	Semester-wise Credit
I	MAJ-1 (4)	SEC-1 Sericulture and Apiculture (3)	MIN-(A)-1 Animal Diversity (4)	MDC-1 (3) (Any-one from the list provided by the college)	AECC- MIL/ ALT. ENG.-1 (2)	VAC-Understanding India/Digital Marketing (4)	20
II	MAJ-2 (4)	SEC-2 Aquaculture & Fisheries and Poultry Farming (3)	MIN-(B)-1 Animal Diversity (4)	MDC-2 (3) (Any-one from the list provided by the college)	AECC-ENG.-1(2)	VAC-Environmental Education (4)	20
III	MAJ-3 (4) MAJ-4 (4) MAJ-5 (4)	SEC-3 Pest Management and Medical Diagnostics (3)	MIN-A-2 Cell Biology and Genetics(4)		AECC- MIL/ ALT. ENG.-2 (2)		21
IV	MAJ-6 (4) MAJ-7 (4) MAJ-8 (4)		MIN-B-2 Cell Biology and Genetics (4)	MDC-3 (3) (Any-one from the list provided by the college)	AECC-ENG.-2(2)		21
V	MAJ-9 (4) MAJ-10 (4) MAJ-11 (4) MAJ-12 (4)	Internship (2)	MIN-A-3 Molecular Biology and Physiology (4)				22
VI	MAJ-13 (4) MAJ-14 (4) MAJ-15 (4) MAJ-16 (4)		MIN-B-3 Molecular Biology and Physiology (4)				20
VII	MAJ-17 (4) MAJ-18 (4) MAJ-19 (4)		MIN-A-4 Economic Zoology(4)				16
VIII	MAJ-20 (4) MAJ-21 (4) MAJ- 22 (4) MAJ-23 (4) Research Project/Dissertation (12)		MIN-B-4 Economic Zoology(4)				20

Students have to opt for any two minor subjects as Minor A and Minor B, hence in a particular academic year students will complete a course offered in Zoology minor either in the even or the odd semester.

Semester I / Semester II

MINOR (A/B) 1: Animal Diversity (Paper Code: UZOOMIN11001 / UZOOMIN12001)
Paper Type: Theory + Practical Lab Based [TH+PLB] Credit: 4 (Theory 3+ Practical 1)
Class Hours: 75 (Theory 45 hrs. + Practical 30 hrs.)
Full Marks: 75 (Theory 40 + Practical 20 + Continuous evaluation 10 + Attendance 05)
Duration of end semester examination: (Theory 2 hrs. + Practical 2 hrs.)

Syllabus:

Theory	Class Hour(s)
A. Non-Chordates	
Unit I: Protista	**04**
• General characters and classification up to phyla. • Locomotory organelles in Protozoa (structure only). • Life cycle of *Plasmodium vivax.*	
Unit II: Porifera	**02**
• General characters and classification up to classes. • Canal system in *Sycon.*	
Unit III: Cnidaria and Ctenophora	**03**
• General characters and classification up to classes of Phylum Cnidaria. • General characters of Phylum Ctenophora. • Polymorphism in *Obelia.*	
Unit IV: Platyhelminthes and Nematoda	**05**
• General characters and classification up to classes. • Life cycle of *Taenia solium.* • Life cycle of *Ascaris lumbricoides.*	
Unit V: Annelida	**03**
• General characters and classification up to classes. • Coelom and metamerism in Annelida.	
Unit VI: Arthropoda	**04**
• General characters and classification up to classes. • Metamorphosis in lepidopteran insects.	
Unit VII: Mollusca	**03**
• General characters and classification up to classes. • Pearl culture.	
Unit VIII: Echinodermata	**03**
• General characters and classification up to classes. • Water vascular system in *Asterias.*	
Unit IX: Hemichordata	**01**
• Salient features.	

B. Chordates	
Unit I: Protochordata	**01**
• Salient features of Urochordata and Cephalochordata.	
Unit II: Chordata	**01**
• Salient features.	
Unit III: Pisces	**03**
• General characters and classification up to classes. • Migration of fish.	
Unit IV: Amphibia	**03**
• General characters and classification up to extant orders. • Parental care in Amphibia.	
Unit V: Reptilia	**03**
• General characters and classification up to extant orders. • Differences between poisonous and non-poisonous snakes.	
Unit VI: Aves	**03**
• General characters and classification up to sub-classes. • Flight adaptation in birds.	
Unit VII: Mammals	**03**
• General characters and classification up to infra-classes. • Adaptive radiation in mammals.	

Note: *Outline classification of the Kingdom Protista up to Phyla to be followed from Levine et al. (1980) and that of other non-chordate Phyla up to classes to be followed from "Ruppert, Fox and Barnes (2003). Invertebrate Zoology: A Functional Evolutionary Approach". VII Edition or from Brusca, R.C and Brusca, G. J (2003): Invertebrate (2nd ed.) Sinauer Associates Inc., Publishers Sunderland. Classification of Pisces to be followed from Romer (1959)/ Berg (1940), for Amphibia to be followed from Duellman & Trueb (1986)/ Young (1981), for Reptilia, Aves & Mammals to be followed from Young (1981).*

Practical	**30 Hours**
❖ Spot identification: • Non-Chordates: *Euglena, Paramoecium, Sycon, Physalia, Metridium, Taenia, Ascaris, Nereis*, leech, *Peripatus, Limulus*, hermit crab, *Daphnia*, millipede, centipede, cockroach, *Chiton, Octopus,* starfish and *Balanoglossus.* • Chordates: *Ascidia, Herdmania, Branchiostoma, Scoliodon, Labeo, Hippocampus, Tylototriton, Draco, Naja, Viper*, any three common birds (crow, duck, owl), squirrel and bat. ❖ Temporary mounts of: • *Cyclops, Daphnia, Mysis.* • Unstained mounts of cycloid and ctenoid scales. ❖ Submission of a report on the prevalence of insect or avian fauna in the college campus/your locality.	

Note: *In case of unavailability of preserved specimens/slides, departments can use photographs for the study of museum specimens and permanent slides.*

Evaluation Structure for end semester practical examination:

1. Spot dentification: 4 specimens (2 non chordates and 2 chordates)/each 2 marks (Identification = ½, Systematic position (as per theory syllabus)= ½, Characters = 1) Total = 8 marks

2. Mounting: Any one (2 marks)

3. Submission of project: 6 marks

4. Laboratory Note Book: 2 marks (Based on the neatness, inclusiveness, overall presentation and regularity)

5. Viva-Voce: 2 marks (Testing of Knowledge in the said Course)

Suggested Readings

1. Barnes, R.S.K., Calow, P.P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2009). The Invertebrates: A Synthesis. III Edition, John Wiley & Sons.
2. Berg, L.S. (1940). Classification of fishes both recent and fossil. Trudy Zoologischeskogo Instituta. 5:85-517.
3. Brusca, R.C. and Brusca, G.J. (2003). Invertebrate. II Edition, Sinauer Associates Inc., Sunderland.
4. Duellman, W.E. and Trueb, L. (1986). Biology of Amphibians. Mc. Graw Hill Books Company.
5. Kardong, K.V. (2002). Vertebrates: Comparative Anatomy, Function, Evolution. III Edition, McGraw-Hill.
6. Levine, N. D., J. O. Corliss, F. E.G. Cox, G. Deroux, J. Grain, B. M. Honigberg, G. F. Leedale, et al. 1980. "A Newly Revised Classification of the Protozoa." *The Journal of Protozoology.* 27 (1): 37–58.
7. Parker, T.J. and Haswell, W.A. (1972). A text book of Zoology, Vol–I & II. VII edition, Marshall and Williams (eds.), Mcmillan Press ltd.
8. Pechenik, J.A. (2015). Biology of the Invertebrates. VII Edition, McGraw-Hill Education.
9. Romer, A.S. (1959). The Vertebrate Story. University of Chicago Press.
10. Ruppert, E.E., Fox, R.S., Barnes, R.D. (2003). Invertebrate Zoology: A Functional Evolutionary Approach. VII Edition, Cengage Learning, India.
11. Young, J. Z. (1981). The Life of Vertebrates. III Edition, ELBS, Oxford.
12. Young, J.Z. (2004). The Life of Vertebrates. III Edition (Indian Edition), Oxford University press.

Semester III / Semester IV

MINOR-(A/B) 2: Cell Biology and Genetics (Paper Code: UZOOMIN23002 / UZOOMIN24002)
Paper Type: Theory + Practical Lab Based [TH+PLB]
Credit: 4 (Theory 3+ Practical 1)
Class Hours: 75 hrs. (Theory 45 hrs. + Practical 30 hrs.)
Full Marks: 75 (Theory 40 + Practical 20 + Continuous evaluation 10 + Attendance 05)
Duration of end semester examination: (Theory 2 hrs. + Practical 2 hrs.)

Syllabus:

Theory	Class Hour(s)
A. Cell Biology	
Unit I: Plasma membrane	**02**
• Structure of plasma membrane: Fluid mosaic model. • Transport across the membrane: Active and Passive transport (Brief idea with examples).	
Unit II: Nucleus	**03**
• Structure and function. • Types of chromatins.	
Unit III: Cell organelles	**08**
• Mitochondria: Structural organization and function. • Endoplasmic Reticulum: Structure and function of RER and SER. • Golgi Apparatus: Organization and function. • Centrosome: Organization and function.	
Unit IV: Cell Division	**05**
• Cell cycle: Phases. • Mitosis: Process and significance. • Meiosis: Process and significance.	
Unit V: Cell Signaling	**05**
• Basic concept of cell signaling • G-protein cell signaling mediated by glucagon	
B. Genetics	
Unit I: Elements of heredity and variation	**03**
• Mendel and his experiments • Principles of segregation and independent assortment • Test cross	
Unit II: Extension of Mendelism:	**05**
• Incomplete dominance and Co-dominance • Multiple Allelism (with reference to human blood group) • Sex-linked, sex-influenced and sex-limited inheritance	
Unit III: Cytoplasmic inheritance	**03**
• Criteria for extra chromosomal inheritance, • Kappa particle in *Paramoecium*	
Unit IV: Linkage	**03**
• Linkage and Crossing Over • Molecular mechanism of crossing over (Holliday model),	
Unit V: Mutation	**05**
• Types of gene mutations (Classification) • Types of chromosomal aberrations (Classification with one suitable example of each)	
Unit VI: Sex determination	**03**
• Mechanisms of sex determination in *Drosophila* (Genic Balance Theory) • Sex determination in Human	

Practical	**30 Hours**

- Study of microscope: Simple and Compound.
- Study of cell: Preparation of temporary mount of human buccal epithelial cells.
- Study of different stages of meiosis by permanent slide
- Identification of chromosomal aberration of humans using prepared karyotype (Down Syndrome, Edward Syndrome, Patau Syndrome, Cri-du-chat syndrome, Turner syndrome, Klinefelter syndrome)
- Chi-square test (Goodness of fit)

Evaluation Structure for end semester practical examination:

1. Spot identification: 3 stages of meiosis (3 x 2 = 6 marks)
2. Identification of one chromosomal aberration with reason using prepared karyotype (photograph): 3 marks
3. Problem on chi-square test: 7 marks
4. Laboratory Note Book: 2 marks (Based on neatness, inclusiveness, overall presentation, and regularity)
5. Viva-Voce: 2 marks (Testing of Knowledge in the said Course)

Suggested Readings

1. Karp, G. (2009). Cell and Molecular Biology: Concepts and Experiments. VI Edition John Wiley and Sons. Inc.
2. 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.
3. Powar C B. (2019): Cell Biology, III Edition, Himalaya Publication, Meerut
4. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons, Inc.
5. Klug, W.S., Cummings, M.R., Spencer, C.A., Palladino M.A., Killian D. Concepts of Genetics. 11th edition (2019) Pearson
6. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings
7. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. 28.
8. Gardner, J.E., Principles of genetics,8th Edition(2015)