

Submitted by Chairman, Board of Studies (UG), Bachelor of Science, G. S. S College (Autonomous), Belagavi.

PREAMBLE

The learning outcomes-based curriculum framework for B. Sc. Degree in Zoology is structured to offer a broad outline within which a Zoology program could be developed. The Zoology course is upgraded keeping in mind the aspirations of students, changing nature of the subject as well as the learning environment. Courses within Zoology have been revisited to incorporate recent advancements, techniques to upgrade the skills of learners. The new structure is expected to enhance the level of understanding among students and maintain the standard of Zoology degrees/program. Effort has been made to integrate use of recent technology and use of MOOCs to assist teaching-learning process among students.

This framework permits the review of graduate attributes, qualification descriptors, program learning outcomes and course-level learning outcomes periodically. The framework offers flexibility and innovation in syllabi designing and in methods adopted for teaching- learning process and learning assessment. The major objective is to elevate the subject knowledge of the students, making them critical thinkers and able to solve problems and issues related to Zoology logically and efficiently. Overall, this course has been modified to upgrade skills related to biological science and provide our students a competitive edge in securing a career in academia, industry, pharmaceutical research and development in private as well as public sectors. This course serves as plethora of opportunities in different field's right from classical to applied Zoology. Zoology has been studied in an integrated and cross-disciplinary manner with a comprehensive understanding of all living systems, their relationship with the ecosystem and their application. The framework imbibes a Learning Outcome-based Curriculum Framework (LOCF) for its entire Under Graduate program in Zoology.

A comprehensive understanding and appreciation of the organism differences through ICT tools, MOOCs and welldesigned hands on practical exposures along with the field work and if the same principle is followed to understand different phyla through the ladder of evolution and compare cardinal features for classification involving both morphological and molecular tools, along with associated field and lab work, the final product would be better trained without rote learning. Syllabi required are to impart and assess the quality of critical thinking, analytical and scientific reasoning, reflective thinking, information and digital literacy, and problem-solving capacity.

Aim of program deals with the study of animal kingdom specially the structural diversity, biology, embryology, evolution, habits and distribution of animals, both living and extinct. As it covers a fascinating range of topics, the modern zoologists need to have insight into many disciplines.

The Zoology courses designed in terms of concepts, mechanisms, biological designs & functions and evolutionary significance. The students should do the dissertation/project work under practical of different courses, wherever possible.

Program Learning Outcome

Students enrolled in B.Sc. degree program in Zoology will study and acquire complete knowledge of disciplinary as well as allied biological sciences. At the end of graduation, they should possess expertise which will provide them competitive advantage in pursuing higher studies from India or abroad; and seek jobs in academia, research or industries.

Students should be able to identify, classify and differentiate diverse chordates and non-chordates based on their morphological, anatomical and systemic organization. They will also be able to describe economic, ecological and medical significance of various animals in human life. This will create a curiosity and awareness among them to explore the animal diversity and take up wildlife photography or wildlife exploration as a career option. The procedural knowledge about identifying and classifying animals will provide students professional advantages in teaching, research and taxonomist jobs in various government organizations; including Zoological Survey of India and National Parks/Sanctuaries.

Acquired practical skills in biotechnology, biostatistics, bioinformatics and molecular biology can be used to pursue career as a scientist in drug development industry in India or abroad.

Our students will be acquiring basic experimental skills in various techniques in the fields of genetics; molecular biology; biotechnology; qualitative and quantitative microscopy; enzymology and analytical biochemistry. These methodologies will provide an extra edge to our students, who wish to undertake higher studies. In-depth knowledge and understanding about comparative anatomy and developmental biology of various biological systems.



South Konkan Education Society's GOVINDRAM SEKSARIA SCIENCE COLLEGE (AUTONOMOUS) R.P.D. College Road, Tilakwadi, Belagavi-590006

Phone No: 0831-2485193 Website: www.gssbgm.edu.in E-mail: principal.gss@gmail.com E-mail: principal@gssbgm.edu.in

BOARD OF STUDIES IN ZOOLOGY (2024-25)

SI. No.	Name and Address	Designation
01.	Prof. Arvind A. Halgekar	
	Head, Department of Zoology, GSS College,	Chairman
	Belagavi, Karnataka	
	Contact No: 9448161539	
	Dr. Basavarai B. Goundadkar	
02.	Lecturer Department of Zoology GSS College	Member
	Belagavi, Karnataka	mennoen
	Contact No: 7411028558	
	Email: basavrajbg@gssbgm.edu.in	
03.	Dr. Amrapali P. Rajput	
	Lecturer, Department of Zoology, GSS College,	Member
	Contact No: 8277296550	
	Email: amrapali20@gmail.com	
	Prof Mansi M. Sawant	
04.	Lecturer Department of Zoology GSS College	Member
	Belagavi, Karnataka	mention
	Contact No:	
	Email:	
05.	Dr. Milind F. Nagannawar,	Member
	Assistant Professor,	(University Appointed)
	Dept. of Zoology, Arts, Science and Commerce	
	Contact No: 9901469392	
	Email-id: biomilind169@gmail.com	
06.	Dr. Milind Hujare,	Member
	Principal,	(Subject Expert outside the
	Padmabhushan Dr.Vasantraodada Patil	parent University)
	Manavidyalaya, Tasgaon Maharashtra- 416312	
	Contact No: (0230)2477849. 9890004144	
07.	Dr. Sandesh Jagdale,	Member
••••	Principal,	(Subject Expert outside the
	Dapoli Urban Bank Senior College, Dapoli,	parent University)
	Maharashtra-415712	
00	Email Id: Spjagdale@gmail.com	Member
08.	Contact No.	(Industry/ corporate sector/
	Email id:	allied areas)
09.	Prof. V. L. Patil,	Member
	Head, Dept. of Zoology, DMS, B. K. Science	(College Alumni)
	College, Belagavi, Karnataka	
	Contact No: 9448635192	
10	Prof S Y Prabhu	Member
10.	Vice-Chairman, SKE Society, GSS College.	(College Alumni)
	Belagavi, karnataka	(
	Contact No: 9845680553	
	Email id: prabhusy@yahoo.co.in	



South Konkan Education Society's GOVINDRAM SEKSARIA SCIENCE COLLEGE (AUTONOMOUS) R.P.D. College Road, Tilakwadi, Belagavi-590006

Phone No: 0831-2485193 Website: www.gssbgm.edu.in E-mail: principal.gss@gmail.com E-mail: principal@gssbgm.edu.in

DEPARTMENT OF ZOOLOGY

COURSE STRUCTURE FOR B. Sc. PROGRAMME

Semester	Subjects	Teaching	Duration	Marks		Credits	
		Hours/week	of	IA	Exam	Total	
			Exams				
1	Major1 Theory	04	03	20	80	100	03
	Major1 Practical	04	04	10	40	50	02
	Major2 Theory	04	03	20	80	100	03
	Major2 Practical	04	04	10	40	50	02
	Major3 Theory	04	03	20	80	100	03
	Major3 Practical	04	04	10	40	50	02
	Language1	04	03	20	80	100	04
	Language2	04	03	20	80	100	04
	Compulsory-1	02	02	10	40	50	02
2	Major1 Theory	04	03	20	80	100	03
	Major1 Practical	04	04	10	40	50	02
	Major2 Theory	04	03	20	80	100	03
	Major2 Practical	04	04	10	40	50	02
	Major3 Theory	04	03	20	80	100	03
	Major3 Practical	04	04	10	40	50	02
	Language1	04	03	20	80	100	04
	Language2	04	03	20	80	100	04
	Compulsory-2	02	02	10	40	50	02
Total							50

SEMESTER I (THEORY)

Course Outcomes (COs): At the end of the course the student should be able to understand.

- CO 1: Understand the diversity of non-chordates
- CO 2: Study the external and internal characters of non-chordates
- CO 3: Expose type, structural and functional organization of non-chordates
- CO 4: Group the animals on the basis of their morphological characteristics.

CO 5: Understand the diversity and classification of Chordate and identification abilities of chordate diversity

Paper Title: Zoology- Animal Diversity	Marks: Th-80 + IA-20	
Paper Code: 24Z00101	Total hours: 60	
Teaching Hours: 4 Hours/Week Credits: 03		
UNIT-I		
Animal Diversity:		
Brief History and General Principles of Animal classified	cation. Prokaryotes and Eukaryotes.	
Phylum Protozoa-		03
General characters and classification up to classes	with one example for each class.	
 Locomotion in Protozoa 		
Type study: Paramecium (Reproduction)		
Phylum Porifera:		03
General characters and classification up to classes	s with one example for each class.	
Canal System in poriferans. Skeleton in Sponges - S	picules and spongin fibres.	
Iype study: Sycon (Reproduction)		
Phylum Coelenterata:	- with one commute forces had a	03
General characters and classification up to classe: Determine the classes of source and so	s with one example foreach class.	
Polymorphism, Corais- types of corais and coral reef Phylum Platybolminthese		02
Constant characters and classification up to classes	with one example foreach class	02
 General characters and classification up to classes Type study: Taepia (Tape worm), (Peproduction) 	with one example foreach class.	
Phylum Nemathelminthes:		02
General characters and classification up to classes	s with one example for each class	02
 Life history of Ascaris 		
General discussion of the above unit		01
UNIT-II		15 Hours
Phylum Annelida:		03
General characters and classification up to classes	with one example for eachclass.	
Metamerism in Annelida.	·	
 Type study: <i>Hirudinaria</i> (Leech) - (Reproduction) 		
Phylum Arthropoda:		04
General characters and classification up to classes	with one ex for each class.	
 Metamorphosis in Insects. 		
Life history of <i>P. americana</i>		
Phylum Mollusca:		02
General characters and classification up to classes	with one example for each class.	
Phylum Echinodermata:		03
General characters and classification up to classes	with one example for each class.	
Water-vascular system in Asteroidea		02
		03
Phylum Chordata:		
Characters of chordates. Differences between chorda	ates and non- chordates.	
Characters of Protochordata (Hemichordata, Urocho Canactel factures of Amerita and Orathester (America)	rdata, Cephalochordata)	04
General features of Agnatha and Ghathostomata. Cla classes	assilication of cyclostomes up to	

Pisces:	04
 General features and classification up to living orders. 	
Scales in fishes.	
Types of fins.	
Migration in Fishes	
Amphibia:	
 General features and classification up to living orders. 	
Parental care in amphibians.	
Neoteny in Amphibia	
General discussion of the above unit	03
UNIT-IV	15 Hours
Reptiles:	
 General features and Classification up to living orders. 	04
 Differences between poisonous and non-poisonous snakes. 	
Snake bite and treatment.	
Aves:	
 General features. Salient features of Passeriformes, Pisciformes, Columbiformes 	
 Flightless birds and their distribution, 	04
 Major types of beaks and feet. 	
Migration in birds.	
Flight adaptations in birds.	
Mammals:	04
 General characters. Salient features of Monotremes, Marsupialia, Insectivora, Rodentia, 	
Perissodactyla, Chirpotera, Edentata, Cetaceae and Primates with one example for each.	
 Dentition in mammals with examples and Evolution of molar tooth. 	
General discussion of the above unit	03

- 1. Agarwal V. P. and Dalela R. C. (1975): Textbook of Vertebrate Zoology. Jai Prakashnath Co.
- 2. Barnes, R.D. (1982): Invertebrate Zoology. Fifth edition
- 3. Barnes, R.D. (1982): Vertebrate Zoology. Fifth edition
- 4. 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
- 5. Barrington E. J. W. (1981): Invertebrate structure and Function. ELBS.
- 6. Dhami P.S.and Dhami J. K. (2000): Chordate Zoology. S. Chand & Co. Dhami P.S. and Dhami J. K. (2000): Invertebrate Zoology. S. Chand & Co.
- 7. Ekambaranatha Iyer M. and Anantakrishnan T. N. (1990): A manual of Zoology.Vol. I. Invertebrata (Part 1 & 2). S. Vishwanathan Pvt. Ltd.
- 8. Ekambaranatha Iyer M. and Anantakrishnan T. N. (1990): A manual of Zoology.Vol. II.Chordata S. Vishwanathan Pvt. Ltd.
- 9. Jordan E. L. and Verma P.S. (1976): Chordate Zoology. S. Chand & Co.
- 10. Jordan E. L.and Verma P.S. (1976): Invertebrate Zoology. S. Chand & Co.
- 11. Kotpal R. L. (1993): Protozoa- Echinodermata (all volumes). Rastogi Publ.Pough H (2004): Vertebrate life, VIII Edition, Pearson International.
- 12. Ruppert and Barnes, R.D. (2006): Invertebrate Zoology, VIII Edition. Holt SaundersInternational Edition.

SEMESTER I (PRACTICAL)

Course Outcomes (COs): At the end of the course the student should be able to:

- CO 1: Understand basics of classification of non-chordates.
- CO 2: Learn and understand the internal systems of non-chordates.
- CO 3: Develop the skills to identify different classes and species of animals.
- CO 5: Enhancement of basic laboratory skill like keen observation and drawing.
- CO 6: Understand the basic concept, diversity and classification of Chordates
- CO 7: Demonstrate identification abilities of chordate diversity
- CO 8: Understand the external morphology in chordates.

Paper Title: Animal Diversity- Practical	Marks: Th-40+IA-10
Paper Code : 24ZOO102	Total hours: 60
Teaching Hours: 4 Hours/Week	Credits : 02

S.NO.	LAB COURSE CONTENT	Hours	
	LIST OF EXPERIMENTS		
1.	Study of Amoeba, Euglena, Paramecium (Any Protozoan culture)	04	
	Study of Sycon, Hyalonema		
2.	Study of Obelia, Physalia, Aurelia, Metridium	04	
3.	Study of Planaria, Liverfluke, Taenia solium,	04	
4.	Study of Male and female Ascaris lumbricoides, Hook worm, Wuchereria bancrofti	04	
	Study of Nereis, Pheretima, Hirudinaria		
5.	Study of Palaemon, Cancer, Limulus, Apis.	04	
6.	Study of Chiton, Dentalium, Pila, Unio, Loligo, Sepia	04	
7.	Study of Asterias, Ophiura, Echinus, Cucumaria and Antedon	04	
8.	Study of Protochordates: Balanoglossus, Herdmania, Branchiostoma	04	
9.	Study of Fishes: Torpedo, Labeo, Catla, Circinus mrigala, Anguilla	04	
10.	Study of Amphibians: Ichthyophis, Tiger Salamandar, Bufo, Hyla	04	
11.	Study of Reptiles: Chelone, Chamaeleon, Draco, Viper, Naja	04	
12.	Study of Birds: Duck, Cuccoo, Wood pecker, Kingfisher, Owl, Peacock	04	
	Study of Mammals: Duck billed platypus, Manis, Bat, Loris		
13.	(Collect the dead worms from vermicompost pits of farmers and preserve)	04	
	Mounting of setae, blood glands and Nephridia, Nervous system, digestive system		
	of Earthworm		
14.	Wounting of mouth parts of noneybee, cockroach, housefly, mosquitoes	04	
15.	Mounting of brain in fowl / rat (collect dead fowl / rat heads and preserve)	04	
16.	Study tour / field visit: Compulsory tour / visit to understand fauna diversity		

- 1. Ruppert and Barnes, R.D. (2006): Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
- 2. 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.
- 3. Young, J. Z. (2004): The Life of Vertebrates. III Edition. Oxford university press.
- 4. Pough H (2006): Vertebrate life, VIII Edition, Pearson International.
- 5. Hall B.K. and Hallgrimsson B. (2008): Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
- 6. P. S. Dhami and J. K Dhami (2000): Practical Zoology S. Chand and Co, New Delhi

SEMESTER II (THEORY)

Course Outcomes (COs): At the end of the course the student should be able to:

- CO 1: Study the comparative anatomy and internal systems of vertebrates
 - CO 2: Understand the process of gametogenesis,
 - CO 3: Understand the process of fertilization, and types of eggs and placenta
 - CO 3: Study the development of frog at different stages
 - CO 4: Study the development of Chick at different stages
 - CO 5: Understand human embryonic development

Paper Title: Comparative Anatomy and Developmental Biology	Marks: Th-80 + IA-20		
Paper Code: 24ZOO201 Tot		l hours: 60	
Teaching Hours: 4 Hours/Week Cred		: 03	
UNIT-I		15 Hours	
Integument: Fishes, Amphibian, Reptilian, Aves and Mammalia		04	
 Skeletal System (Girdles): Pectoral girdle and pelvic girdle in Frog, Varant and Rat 	ıs, Fowl	04	
 Digestive System: Brief account of alimentary canal (digestive tract) of difference vertebrates Fish, Frog, Varanus, Fowl and Rat (with special mention to herbiand carnivorous) 	ent vorous	04	
General discussion of the above unit		03	
UNIT-II		15 Hours	
• Respiratory System: Brief account of gills, lungs, trachea and air sacs in ver	tebrates	04	
Circulatory System: Comparative account of heart in different vertebrates (F	⁻ ish, Frog,	04	
Varanus, Fowl and Rat)			
• Nervous System: Comparative account of brain in different vertebrates (Fish, Frog,		04	
Varanus, Fowl and Rat)			
General discussion of the above unit			
UNIT-III			
• Early Embryonic Development: Gametogenesis (spermatogenesis and		04	
oogenesis),			
Fertilization		04	
Types of Eggs and Patterns of Cleavage,		02	
Placenta types,structure and functions		02	
General discussion of the above unit		03	
UNIT-IV	1	5 Hours	
• Early Development: Frog development up to Gastrulation.		04	
Organizer phenomenon.			
• Development of chick: (Fertilization, structure of egg, cleavage, blastulation	n) chick	04	
embryo.			
Human Development – up to implantation		04	
General discussion of the above unit		03	

- 1. Comparative anatomy of vertebrates By R. K. Saxena
- 2. Comparative Anatomy by Aurora M. Sebastiani and Dale W. Fishbeck
- Developmental biology By Rastogi & Jayraj. Kedarnath Ramnath publishers, meerut.
 Introduction to Embryology B I Ballinsky Publisher: Thomson
- 5. Learning Patten's foundation of Embryology Bruce M Carlson Publisher: McGraw HillEducation Principles of Embryology Waddington C H Publisher: Macmillan, New York.
- 6. Developmental Biology Scott F Gilbert. Publisher: Sinauer Associates Inc., U.S
- 7. Developmental Biology -a modern Synthesis By K Vasudev Rao.
- 8. Embryology By Mohan Arora. Himalaya Publishing House Pvt. Ltd, New Delhi.
- Embryology Constructing the Organism Scott F Gilbert. Publisher: Sinauer AssociatesInc., U.S. 9.
- 10. Elements of Developmental Biology Dr P.C. Jain Vishal Publishing Co. New DelhiVertebrate Embryology N N Majumdar Publisher: McGraw-Hill Education

SEMESTER II (PRACTICAL)

Course Outcomes (COs): At the end of the course the student should be able to:

- CO 1: Understand the skeletal system
 - CO 2: Study the comparative anatomy of girdles in vertebrates
 - CO 3: Study the comparative account of heart, brain, skin and digestive system in different vertebrates

CO 4: Understand the development and embryology in vertebrates

Paper Title: Comparative Anatomy and Developmental Biology- Practical	Marks: Th-40+IA-10
Paper Code : 24ZOO202	Total hours: 60
Teaching Hours: 4 Hours/Week	Credits : 02

S.NO.	LAB COURSE CONTENT	Hours
	LIST OF EXPERIMENTS	
1.	Osteology: Disarticulated, appendicular, vertebral and articular skeleton of frog and rabbit	12
2.	Comparative study of girdles: Pectoral girdle and pelvic girdle in Frog, Varanus, Fowl and Rat	08
3.	Comparative account of heart in different vertebrates	4
4.	Comparative account of skin in Shark, Frog, Varanus, Pigeon and Rat.	4
5.	Comparative account of brain in different vertebrates	4
6.	Embryology: Study of developmental stages – Whole mounts and sections using permanent slides: cleavage stages, blastula, gastrula in frog	8
7.	Chick embryo mounting -24 hour, 36 hour, 48 hour, 72 hours	4
10.	Revision	4
11.	Test	4

- 1. Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function andEvolution*. IV Edition. McGraw-HilHigher Education.
- 2. Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of theVertebrates*. IXEdition. The McGraw-Hill Companies.
- 3. Hilderbr and, M and Gaslow G.E. Analysis of Vertebrate Structure, John WileyandSons.
- 4. Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.
- 5. Gilbert, S. F. (2006). Developmental Biology, VIII Edition, SinauerAssociates, Inc., Publishers, Sunderland, Massachusetts, USA.
- 6. Balinsky, B.I. (2008). An introduction to Embryology, International ThomsonComputer Press.
- 7. Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.