



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Zoology

Programme Name : B. Sc

Academic Year : 2022-23

List of Courses Focus on Employability/ Entrepreneurship/Skill

Sr. No.	Course Code	Name of the Course
01.	Minor course	Animal diversity of non-chordates (Protista to Pseudocoelomate)
02.	SEC	Aquaculture
03.	Minor course	Animal diversity of non-chordates (Coelomates)
04.	SEC	Apiculture
05.	VAC	Food nutrition and health

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Scheme and Syllabus

SCHEME AND SYLLABUS FOR

- UG Certificate in Zoology: 1 year
- UG Diploma in Zoology: 2 years
- UG Degree in Zoology: 3 years
- UG (honours with research) in Zoology: 04 years
- UG (honours) in Zoology: 04 years

Under

National Education Policy 2020

Department of Zoology, School Of Life Sciences
Guru Ghasidas Vishwavidyalaya, Bilaspur (CG)

2023-2024

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Scheme and Syllabus for UG Courses in Zoology

**Department of Zoology, School of Life Sciences,
Guru Ghasidas Vishwavidyalaya, Bilaspur**

Semester	Course	Name of course	Number of courses	Level	Credits	Total Credits
I	Major	Animal diversity of non chordates (Protozoa to Pteridophytes)	1	2	3	20
		Lab Course			1	
	Minor	Animal diversity of non chordates (Protozoa to Pteridophytes)	1	2	3	
		To be offer for students of other departments			1	
	Model	Elementary Biology -I To be offer for students of other disciplines (except Natural and Physical Sciences)	1	1	3	
	EDC	Aquaculture	1	1	2	
		To be offer for student of Zoology/other departments at university level			1	
VAC	History of Indian science (Understanding India)	2	1	2+2		
AEC	Language To be offered by Hindi/English Department for student of Zoology	1	1	2		
II	Major	Animal diversity of non chordates (Chordates)	1	2	3	20
		Lab Course			1	
	Minor	Animal diversity of non chordates (Chordates)	1	2	3	
		To be offer for student of other departments			1	
	Model	Elementary Biology -II To be offer for student of other disciplines (except Natural and Physical Sciences)	1	1	3	
	EDC	Apiculture	1	1	2	
		To be offer for student of Zoology/other departments at university level			1	
	VAC	Food nutrition and health (Health & wellness)	2	1	2+2	
		To be offer for student of Zoology/other departments at university level				
	AEC	Language To be offered by Hindi/English Department for student of Zoology	1	1	2	

The student must complete the 4 credit vocational course/Internship during summer term to get UG Certificate if he wishes to exit the program after first 2 semesters.



Major Course:

Semester	Major Course	Course Title	Credits
I	1	Animal diversity of non chordates (Protists to Pseudocoelomate)	Theory: 03 Practical: 01

About the course

The course is a walk for the Bachelor's entrant through the amazing diversity of living forms from simple to complex one. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to their grouping into taxa and clades.

Course outcomes

After successfully completing this course, the students will be able to:

1. Develop understanding on the diversity of life with regard to protists to pseudocoelomata.
2. Group animals on the basis of their morphological characteristics/ structures.
3. Develop critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.
4. Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/ cladistic tree.
5. Understand how morphological change due to change in environment helps drive evolution over a long period of time.

Course Outcomes and their mapping with Programme Outcomes

COs	POs						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	1	3	3	3	1	1
CO2	3	3	3	1	3	3	3	1	1
CO3	3	3	3	1	3	3	3	1	1
CO4	3	3	3	1	3	3	3		1
CO5	3	3	3	1	3	3	3		1

Weightage: 1- Slightly; 2- Moderately; 3- Strongly

Theory

Unit 1: Protista, Parazoa and Metazoa

14 Lecture

General characteristics and classification up to classes; Study of *Englena*, *Amoeba* and *Paramecium*; Life cycle and pathogenicity of *Plasmodium vivax* and *Entamoeba histolytica*; Locomotion and Reproduction in Protista; Types of symmetry.

Unit 2: Porifera

08 Lecture

General characteristics and classification up to classes; Type study of *Sycon*; Canal system and spicules in sponges.

Unit 3: Cnidaria

10 Lecture

General characteristics and classification up to classes; Type study of *Obelia*; Polymorphism in Cnidaria; Corals and coral reefs.



Unit 4: Platyhelminthes

10 Lecture

General characteristics and classification up to classes; Type study, larval forms and pathogenicity of *Fasciola hepatica*.

Unit 5: Nematelminthes

8 Lecture

General characteristics and classification up to classes; Type study of *Ascaris lumbricoides*; Life cycle and pathogenicity of *Wuchereria bancrofti*; Parasitic adaptations in helminthes.

Practical

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

Suggested readings:

1. Ruppert and Barnes (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes RSK, Calow P, Olive PJW, Golding DW and Spicer JJ (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science.
3. Barrington EJW (1979). Invertebrate Structure and Functions, II Edition, E.L.B.S. and Nelson



Major Courses:

Semester	Major Course	Course Title	Credits
II	2	Animal diversity of non chordates (Coelomates)	Theory: 03 Practical: 01

About the course

To discuss representative lineages of the protostome coelomates, including molluscs, annelids and arthropods. Students will know how are these groups of animals similar? What morphological and developmental patterns do they have in common? How do they differ? They will know the importance of segmentation in the annelids. Students will come to know why the animals in Phylum Arthropods are thought to be so successful.

Course Outcomes

1. Compare the two groups (Acoelomate and Coelomates) of animals with true coeloms.
2. Compare the differences in development seen in these two groups.
3. Compare the protostomes and deuterostomes.
4. Explain the characteristics of arthropods that have made them successful.
5. Review the diversity of arthropod groups, including trends in arthropod evolution.

Course Outcomes and their mapping with Programme Outcomes

COs	POs						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	1	3	3	3	1	1
CO2	3	3	3	1	3	3	3	1	1
CO3	3	3	3	1	3	3	3	1	1
CO4	3	3	3	1	3	3	3		1
CO5	3	3	3	1	3	3	3		1

Weightage: 1- Slightly; 2- Moderately; 3- Strongly

Theory

Unit 1: Introduction to Coelomates and Annelids

12 Lecture

Evolution of coelom and metamerism. General characteristics and Classification up to classes; Type study of *Pheretima*; Metamerism in Annelids.

Unit 2: Arthropoda

15 Lecture

General characteristics and Classification up to classes; Type study of *Periplaneta*; Vision and Respiration in Arthropods; Larval forms in Arthropods; Metamorphosis in Insects; Social life in bees.

Unit 3: Onychophora

03 Lecture

General characteristics and Evolutionary significance with special reference to *Peripatus*.

Unit 4: Mollusca

12 Lecture

General characteristics and Classification up to classes; Type study of *Pila*; Respiration in Mollusca; Torsion and detorsion in Gastropoda; Pearl formation in bivalves; Evolutionary significance of trochophore larva.



Unit 5: Echinodermata

10 Lecture

General characteristics and Classification up to classes; Type study of *Asterias*; Water-vascular system in Asteroidea; Larval forms in Echinodermata; Affinities with Chordates.

Practical

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

Suggested readings:

1. Ruppert and Barnes (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes RSK, Calow P, Olive PJW, Golding DW and Spicer JJ (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science.
3. Barrington EFW (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson.
4. Nigam (1997). Biology of Chordates, S. Chand.
5. Kotpal, Modern text book of Zoology: Vertebrates, Rastogi Publication.



Skill Enhancement Course (SEC):

Semester	SEC	Course Title	Credits
I	SEC-I	Aquaculture	Theory: 02 Practical: 01

About the course

This course will give the students an understanding of the principles of aquaculture, including production systems, water quality, nutrition, spawning, larval culture and culture methodologies with special reference to fish and prawn. The course will include an opportunity to conduct hands-on activities related to culture and husbandry of animals.

Course outcomes

After completing this course the learners will be able to

1. Understand the aquaculture systems
2. Understand pond management to increase fish production
3. Understand fish breeding and health management
4. Understand the environmental impacts on aquaculture

Course Outcomes and their mapping with Programme Outcomes

COs	POs						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	1	3	2	1	2	-	-	1
CO2	3	1	3	1	1	2	1	1	2
CO3	3	3	2	2	2	3	1	1	2
CO4	3	1	3	1	2	3	-	1	2

Weightage: 1- Slightly; 2- Moderately; 3- Strongly

Theory

Unit 1: Freshwater aquaculture systems

08 Lecture

Aquaculture concept, Culture systems: Freshwater prawn culture, fish culture in paddy fields, Culture of Catfishes, Composite fish culture: Techniques of composite culture, Composite fish farming in India, Mariculture: Brackish water prawn culture, Mussel culture, Culture of aquatic weeds.

Unit 2: Preparation and management of fish culture ponds

08 Lecture

Fish culture ponds, Pond management: Fish toxicants, Predatory and Weed fishes and their control, Aquatic insects and their control, Fish manures, Water quality, Culture: Pond culture, Monoculture, Monosex culture, Supplementary feeding, Harvesting: Fishing techniques, preservation & processing of fish.

Unit 3: Fish breeding, Transportation and Pathology

09 Lecture

Fish breeding: Natural and artificial, Fish transportation: Methods for packaging and transport of fish, Transport of fish seed and Brood fish, Causes of mortality in transport, Use of chemicals in live fish transport: Anesthetic drugs, Antiseptics and Antibiotics, Fish diseases: Bacterial, fungal, protozoan and helminth diseases, Non parasitic diseases.

Unit 4: Technologies in Fisheries development

10 Lecture

Pearl culture: Introduction, Pearl producing mollusks, pearl formation, collection of oysters, Rearing of oysters, insertion of nucleus, harvesting of pearls, composition & quality of pearl.



Recirculation technology. Geographic Information System (GIS) technology. Passive Acoustics in fisheries. Use of Information Communication Technology (ICT) in fishes: production aspects, marketing aspects.

Practical

1. Estimation of dissolved oxygen
2. Determination of pH of water samples
3. Measuring turbidity using a secchi disk
4. Measuring salinity of water
5. Total alkalinity measurement in natural waters
6. Phytoplankton analysis
7. Measurement of productivity
8. Study of major carps
9. Study of prawn species
10. Study of pearl oysters

Suggested readings:

1. Jhingran, V. G. (1963) Fish and fisheries of India, Hindustan pub. corp. New Delhi.
2. Hute, M. and Kahn, H. (2000) Textbook of fish culture, Blackwell Scientific Publication, Australia.
3. Srinivasulu, M., Reddy, K.R.S., Rao, S. (1999) Text book of Aquaculture, Discovery Publishing House New Delhi.
4. Yawn Malta, Fisheries & Aquaculture Biotechnology (2011) Campus Books International, Prahalad street, Ansari Road, Durga Ganj, New Delhi.



Skill Enhancement Course (SEC):

Semester	SEC	Course Title	Credits
II	SEC-2	Apiculture	Theory: 02 Practical: 01

About the course

This course tells the students what tools and equipment will be needed, the main activities in the beekeeping year, the laws and by laws governing keeping bees; discover the principles of sustainable beekeeping and how these principles can guide your beekeeping into an enduring practice.

Course outcomes

Upon successful completion of this course, the student should be able to:

1. Understand about bees and colony organization
2. Understand about beekeeping as a highly profitable occupation
3. Understand bee keeping technology and bee products
4. Understand about National Institutes and their contribution in beekeeping

Course Outcomes and their mapping with Programme Outcomes

COs	POs						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	1	3	3	3	1	1
CO2	3	3	3	1	3	3	3	1	1
CO3	3	3	3	1	3	3	3	1	1
CO4	3	3	3	1	3	3	3		1

Weightage: 1- Slightly; 2- Moderately; 3- Strongly

Theory

Unit 1: Introduction to Apiculture

08 Lectures

History of Bees and Beekeeping. Bee species: Types of Bees. Morphology Caste system. Colony organization. Bee flora, Foraging.

Unit 2: Bee keeping as an occupation

08 Lectures

Extent of Beekeeping India. Limitations on the development of beekeeping. Advantages of extensive Beekeeping. Beekeeping equipments: Rearing appliances and initiation into keeping a colony. The future of beekeeping.

Unit 3: The first step in beekeeping

10 Lectures

Apiary site. Purchase and Establishment of a bee colony. Management and manipulation of bee colony. Bee products: Honey, Bees wax, Pollens, Royal Jelly, Propolis and Bee venom. Taking care of bee diseases and enemies.

Unit 4: Beekeeping techniques and Apiary management

09 Lectures

Routine and Seasonal management, Migratory beekeeping, Harvesting and marketing of bee products. Important Institutions pertinent to Apiculture: National Bee Board, Bee research and Training Institute, Apiaries. Economics and extension of Bee keeping.



Practical

1. Study of different species of honey bee
2. Study of various host flowers of honey bee
3. Study of various caste of honey bee
4. Study of life cycle of honey bee
5. Study of Movable hive (Newton's hive) for apiculture
6. Study of various appliances used in apiculture
7. Study of foraging legs of honey bee
8. Preparation of temporary mount of mouth parts of honey bee
9. Preparation of temporary mount of sting apparatus of honey bee
10. Study of various diseases of honey bee affecting apiculture

Suggested reading:

1. Abrol, D. P. (1997) Bees and Beekeeping. Kalyani Publisher, New Delhi.
2. Abrol, D. P. (2010) A Comprehensive guide to Bees and Beekeeping. Scientific Publisher, New Delhi.
3. Withhead, S. B. (2010) Honey bees and their management Axis books Publisher, Jodhpur.
4. Nagaraja, N. and Rajagopal, D. (2013) Honey bees: Diseases, Parasites, Pests, Predator and their management. M.J.P Publisher, Chennai.
5. Dharamsing and Singh, D. P. A Handbook of Beekeeping. Agrobios India (Publisher), Jodhpur.



Value Added Courses:

Semester	VAC	Course Title	Credits
I	VAC-II	Food, Nutrition and Health	Theory: 02

About the course

The course covers the basic concepts of balanced diet for people of different ages besides focusing on the consequences of malnutrition and the deficiency diseases and the diseases caused due to poor hygiene.

Course outcomes

1. Imparting the basic concept of food and nutrition including the concept of a balanced diet, nutrient needs, and dietary patterns for various groups.
2. Understanding the biochemistry of major food components and the effects of their deficiency on health and evaluating the effectiveness of nutrition interventions when dealing with certain health problems.
3. Understanding the importance of lifestyle-related diseases, their causes, and prevention through dietary and lifestyle modifications.
4. Understand the importance of food and water safety and methods associated with the preservation of food and purification of contaminated water and make students aware of food, nutrition, and health needs.

Course Outcomes and their mapping with Programme Outcomes

COs	POs						PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	1	-	3	-	3	-	1
CO2	2	3	-	1	2	-	2	2	1
CO3	1	2	1	1	2	2	2	1	-
CO4	2	1	1	2	2	1	1	2	1

Weightage: 1- Slightly; 2- Moderately; 3- Strongly

Theory

Unit 1: Nutrition and dietary nutrients

08 Lectures

Basic concept of Food: Components and nutrients. Concept of balanced diet, nutrient requirements and dietary pattern for different groups viz., adults, pregnant and nursing mothers, infants, school children, adolescents and elderly people.

Unit 2: Macro nutrients and micronutrients

09 Lectures

Nutritional Biochemistry: Macromolecules: Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role. Micronutrients: Vitamins- Water-soluble and Fat-soluble vitamins- their sources and importance. Important minerals viz., Iron, Calcium, Phosphorus, Iodine, Selenium and Zinc: their biological functions.

Unit 3: Malnutrition and nutrient deficiency diseases

10 Lectures

Definition and concept of health: Common nutritional deficiency diseases- Protein Malnutrition (e.g., Kwashiorkor and Marasmus), Vitamin A deficiency, Iron deficiency and Iodine deficiency disorders- their symptoms, treatment, prevention and government initiatives, if any. Life style dependent diseases- hypertension, diabetes mellitus, and obesity- their causes and prevention. Social health problems-



smoking, alcoholism, narcotics. Acquired Immuno Deficiency Syndrome (AIDS): causes, treatment and prevention. Other ailments viz., cold, cough, and fever, their causes and treatment.

Unit 4: Diseases caused by macroorganisms

10 Lectures

Food hygiene: Potable water- sources and methods of purification at domestic level. Food and Water-borne infections: Bacterial diseases: cholera, dysentery, typhoid fever, viral diseases: Hepatitis, Poliomyelitis etc., Protozoan diseases: amoebiasis, giardiasis, Parasitic diseases: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention. Causes of food spoilage and its prevention.

Suggested readings:

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

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