Sant Gadge Baba Amravati University Amravati

Syllabus Prescribed for 2022-23 UG Programme

B. Sc. Zoology

Faculty of Science and Technology

POs:

At the time of graduation, Students will be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs

By the end of the programme, Students would be able to

1. Develop a deeper sense with respect to phylum Protozoa to Echinodermata relation to taxonomy, classification, body organization and general characteristics this strengthens students' capability in basic zoology.
2. grasp various the Systematic positions from Protozoa to Echinodermata their pathogenicity and its epidemiology.
3. describe unique characters and recognize life functions of Protozoa, Porifera, Coelenterate, Helminthes, Arthropoda, Annelida, Mollusca and Echinodermata. Improve ability and apply Knowledge of Non-chordates for its execution in Agriculture especially with the phylum Arthropoda.
4. Implement an extensive idea about economic and ecological significance of various non-chordates phylum's in human life.

Employability Potential:

The B. Sc. Zoology is a walk for the Bachelor's entrant through the amazing diversity of living organism from simple to complex. BSc Zoology Programme scope is very rewarding owing to the relevancy of the course. B.Sc. Zoology employability can be found in both the private and public sectors.

The course makes a detail comparison of the systematic study of different taxa of Non-chordate. 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.

Zoology deals with the structure, embryology, evolution, classification, habits, and distribution of all animals, both living and extinct. If you are interested in making a career in Zoology then you need to deal with both the existing, dead and quite possible the extinct species of the animal kingdom.

A zoologist might even get to travel because the nature of his / her job. Channels like **National Geographic, Animal Planet, Discovery Channel** are in constant need of Zoologists for research and documentaries. Zoologists are also hired for zoos, wildlife services, botanical gardens, conservation organizations, national parks, nature reserves, universities, laboratories, aquariums, animal clinics, fisheries and aquaculture, museums, research, pharmaceutical Companies, veterinary hospitals, etc.

There are various sectors of employment in the field of Zoology. Here's the list of job profiles:

Jobs are available with a wide range of organisations in the public, private and not-for-profit sectors. Typical employers include:

- Zoos or wildlife parks and environmental protection agencies
- Government agencies and research institutions
- Medical research establishments and the National Health Service
- Environmental and animal charities
- Schools, colleges, science centres, libraries and museums
- Universities and research institutes
- Environmental consultancies
- Chemical, pharmaceutical and petroleum companies
- Aquaculture and animal nutrition companies.
- **Wildlife Biologist:** In the current scenario of global warming, mankind needs to pay attention to conserving the wildlife. Main concern of wildlife biologist are conservation and propagation of wildlife.
- **Community development organizations:** Ideal places to apply theoretical knowledge in real life settings. You can also join a number of organizations to pursue career in community development like:
    - Zoo Outreach Organization
    - Dr. Salim Ali School of Ecology
    - Indian Tiger Welfare Society
    - Wildlife Trust of India
    - Bombay Natural History Society (BNHS)
    - Protection Society of India
    - Ashoka Trust for Research in Ecology and the environment (ATREE) etc.
    - Central Zoo Authority (CZA)
    - Regional Resource Centers of Ministry of Environment and Forest Wildlife
    - Wildlife Information Liaison Development
    - Center for Science and Environment (CSE)
- **Indian Forest Services (IFoS):** A candidate can take IFoS exam conducted by Union Public Services Commission (UPSC). The upper age limit is relaxable up to 5 years for the candidates belonging to categories: Scheduled Caste/ Scheduled Tribe (SC /ST).

- **Research work:** If student is keen in research then he/she can apply for IISc., IISER, TIFR, NCBS, JNCASR, etc. for an Integrated MSc-PhD program or pursue advanced degree in wildlife biology or ecological sciences in various institutes.
- **Freelance consultant**: Student may also work as a freelance consultant in various research and development organizations.

This a great **career** interest for students, who are fascinated with nature and would not mind spending time understanding it. There are several specializations that the students pursuing the field can venture into.

Many research agencies recruit expert students for various research projects for environmental research, animal biodiversity research, conservation of wildlife, environmental management research and monitoring of ecosystems etc.

B.Sc. Zoology Student has ample opportunities as Zoology teacher, Lab Assistant, Conservationist, Wildlife biologist, Marine Biologist, Museum Curator, Taxonomist, forensic expert, Eco-toxicologist, Biomedical Scientist, Animal Care taker, Animal and wildlife Educator, Zoo Curator, Environmental Consultant, Zoo Educator, wildlife Rehabilitator, Medical Representative, Sustainability officer, etc.

Apart from the above, private business enterprise is also one of employability potential such as, Agro Business Industry (Fish, Farming , Sericulture, Apiculture, Prawn culture, pearl Culture, Lac Culture, etc.) Clinical Business Associate, Veterinary based small scale Industry (Goat farming, poultry), Nutrition specialist.

Some top organizations also employ B.Sc. Zoology students such as Wildlife Institute of India (NII), Zoological Survey of India (ZSI), National Institute of Oceanography (NIO),

State Forest Department, Centre Marine Fisheries Research Institute (CMFRI), Central Inland Fisheries Research Institute (CIFRI), Ministry of Environment and forest, Medical Laboratories, Agricultural firms Pharmaceutical Companies, etc.

Being Zoology is a basic Science, the demand of Zoology is increasing day by day. It provides a good career option to students. It provides wide horizon of knowledge with preview of employability potential. P.G. in Zoology provides services in various sectors like, Biological Medical, Agriculture as Zoologist, Assistant Professor, Ecologist, Entomologist, Herpetologist, Department of Fishery Zoo Keeper, Zoo Officer, Marine Scientist etc.

- The students can also work in forest department by qualifying Indian Forest Service examination. They can work in sample investigator for those derived from animals in different poaching and forest crime cases. They have opportunities like Wildlife Conservationist, Forest Ranger, Zoologist, Wildlife Educator, Naturalist, Field Officer, Biomedical Scientist, Toxicologist, Marine Scientist, Medical Coder etc.

They can opt to do research-based programs or study for competitive examinations like civil services besides doing a job in a zoology-related field. They can develop entrepreneurship in the different fields like Apiculture, Sericulture, Lac culture, Pisciculture, Aquaculture, Vermiculture, etc. They can contribute as a consultant in Environment impact assessment in different projects of Dam/Road/Rail track constructions etc.

Other than this, they can opt for post PG Studies M.Phil or Ph.D or can qualify competitive exam like NET/SET/GATE to join as an Assistant Professor or as a Researcher.

A Scholar Student can join services at Bhabha Atomic Research Centre (BARC), NCBS/TIFR, NIO/ZSI etc. as a scientist.

Programme : B.Sc : I- Zoology

Name of the programme: **B.Sc. I** Class : **Part I S**

Semester :**I** ,DSC -1-01S Subject Zoology

Name of the course (Paper): **Life and diversity of Animals (Non-chordata)**

Course Outcomes Code : COs-01

About the course

The course is a walk for the Bachelor's entrant through the amazing diversity of living organism from simple to complex. The course makes a detail comparison of the systematic study of different taxa of Non-chordate. 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.

COs:

Upon completion of this course successfully, students would be able to

1. Develop a deeper sense with respect to phylum Protozoa to Echinodermata relation to taxonomy, classification, body organization and general characteristics this strengthens students' capability in basic zoology.
2. grasp various the Systematic positions from Protozoa to Echinodermata their pathogenicity and its epidemiology.
3. describe unique characters and recognize life functions of Protozoa, Porifera, Coelenterate, Helminthes, Arthropoda, Annelida, Mollusca and Echinodermata.
4. Improve ability and apply Knowledge of Non-chordates for its execution in Agriculture especially with the phylum Arthropoda.
5. Implement an extensive idea about economic and ecological significance of various non-chordates phylum's in human life.

Unit I

12 L

1. Introduction and Classification to Non-Chordata
2. Phylum Protozoa: General characters
3. Type Study: Plasmodium vivax: structure, Life cycle
4. Parasitic Protozoan and human diseases: Malaria, Amoebiasis

Unit- II

12 L

1. Phylum Porifera: General characters
2. Type study: Scypha: Habits, Habitat and Distribution, Cell types, Spicules and Structure and significance of canal system.
3. Phylum Coelenterates: General characters
4. Type study: Metridium: Habits and Habitat, External features, Gastrovascular cavity, Mesenteries, Corals and coral reefs.

Unit III:

12 L

1. Phylum Platyhelminthes: General characters
2. Type study Fasciola hepatica: Habits and Habitat, External features, Excretory, Reproductive system and life cycle, disease and control.
3. Phylum Aschelminths: General Characters
4. Type study: Ascaris lumbricoides: Habits and Habitat, External features, Digestive, Excretory, Reproductive system and life cycle.

Unit IV:

12 L

1. Phylum Annelida: General characters
2. Type study: Leech: External features, Digestive, Reproductive system.
3. Phylum Arthropoda: General characters.
4. Type study Cockroach: Habits and Habitat, Digestive, Excretory, Respiratory system, Reproductive system.

Unit – V:

12 L

1. Phylum -Mollusca: General characters
2. Type study: Pila globose: Habit and habitat. External Features (Shell and body) Digestive system, Respiratory system, Reproductive system,
3. Phylum: Echinodermata: General characters,
4. Type study: Asterias, Habits and habitat. External Feature, Water vascular system

Unit: VI:

12 L

1. Phylum: Hemichordata : General characters, Body organisation of Balanoglossus, Affinities of Balanoglossus with Non-Chordata and Chordata.
2. Parasitic adaptation in Helminthes, Morphological and Physiological
3. Larval forms and their significance
4. Amphiblastula, Planula, Trochophore, Bipinnaria, Brachiolaria.

Unit VII:

20 M

Skills Enhancement Module (SEM)

1) Comparative study protozoan disease in the local area.

a) Procurement of resources such as reference books and data on protozoan disease in the local area.
b) Visiting local public health Centre to fetch data on protozoan Diseases.
c) Shortlisting most frequently occurring protozoan diseases in the area with the help of PHC authorities.
d) Preparing data to represent the status and severity of the diseases.
e) Submission of study report with proper inference and suggestion if available.

2) Study of hotspots regarding coral reefs from the Indian subcontinents

a) Use of resources such as books and web to familiarise with corals, their various types and diversity and making writeup on it.
b) Getting acquainted with the importance of coral reefs and their role in oceans.
c) Making datasheet of few of the aquatic faunal species dependant to a large degree on coral reefs for their survival. Make an account on relationship of coral reefs with other faunal species with suitable example.
d) Study of Economic importance of coral reefs to humans and current coral reef status throughout the Indian subcontinent.
e) Submission of study report taking above mentioned points into consideration with the help of available resources.

3) Types of worm disease and control.

a) Study of various worm diseases through Reference books and Internet and making list of frequently found worm diseases and getting acquainted with various modes of worm infections.
b) Getting help from local Medical services such as Primary Health Centres and Practicing medicos to get an idea about status of worm diseases in the local area.
c) Make a note on various treatments for worm infections, availability of treatments in the local area and methods to curb spreading of these infections.
d) With the help of Public health Government authorities in your area make a report on their plan to prevent worm diseases and submit the study report covering all above mentioned points.

4) Diversity of Annelida in the local area.

a) With the help of Internet and Books make list of locally occurring annelids. Procure pocket field guide to help identification of species.
b) Getting familiarised with Procedure to Survey and study the diversity of annelids through various resources.
c) Survey of Local area to select suitable spot to study and record various annelids.
d) Take a record photo shot (if possible) and identify the species of annelid with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
e) Make list of various species and their abundance in the area and submit study report taking above mentioned points into the consideration.

5) Collection of diversified Mollusc from the local water resources.

a) Get acquainted with mollusc with the help of available material and procure primary equipment for its collection.
b) In the suitable season survey the area to record and collect various molluscans from the nearby vicinity and make note of G.P.S location data, season, and type of habitat from where the mollusc is collected.
c) With the help of identification guide, identify the samples and take photographs of the specimen for the report.
d) Make list of various species and their abundance in the area and submit detailed study report taking above mentioned points into the consideration.

6) Economic importance of culture of Mollusca

a) Use of resources such as books and web to familiarise with Molluscans, their various types and diversity.
b) Get familiarised with the significance of molluscans and Economic importance them with reference to human context.
c) Procure information about sites of aquaculture and species of molluscan that are commercially grown in plants in india.
d) Mention current scenario and future of molluscan aquaculture by use of available resources.
e) Submission of study report taking above mentioned points into consideration with the help of available resources.

7) Survey of Malarial infection from local region.

a) With the help of available study resources get familiarised with causal animal of malaria, its vector and its life cycle. Make a list of commonly occurring parasite species in your local area.
b) With the help of Primary Health Centre procure malarial infection incidences data.
c) Tabulate and represent data of available years and derive inference if the severity and occurrences of malarial infections is increasing or decreasing.
d) By contacting Public health governmental organisations procure information on various steps employed to restrict the spread of malarial infections.
e) Submit study report taking all the above points into consideration and also include suggestions if any.

8) Survey the impact of amoebiasis infection in local population.

a) With the help of various resources like Books and internet, understand and note down epidemiology of the disease and its status in your surrounding area.
b) Procure information from PHC's about occurrences of the disease, its season wise frequency, commonly infected sex, age group, disease prone areas of local population.
c) Inquire and enlist current plan of action of PHO's to contain the spread of infection.
d) With the help of detailed data set and draw inference about its impact on public health and submit it in study report. Mention suggestions, if any.

9) Photographic collection of spiders web from the local area.

a) With the help of Internet and Books make list of locally occurring spiders. Procure pocket field guide to help identification of species also get acquainted with webs of different spider species.
b) Get familiarised with Procedure to Survey and study the diversity of Arachnida through various resources.
c) Survey of Local area to select suitable spot to study and record various Arachnids.
d) Take a record photo shot of spider and its web and identify the species of Spider with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
e) Make list of various species and their abundance in the area and submit study report taking above mentioned points into the consideration.

10) Study of varieties of odonates surrounding area.

a) With the help of Internet and Books make list of locally occurring Odonates. Procure pocket field guide to help identification of species.
b) Get familiarised with Procedure to Survey and study the diversity of Odonata through various resources.
c) Survey of Local area to select suitable spot to study and record various Odonates.
d) Take a record photo shot and identify the species of with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
e) Make list of various species and their abundance in the area and submit study report taking above mentioned points into the consideration.

11) Photographic collection of aquatic and terrestrial hemipterans.

a) Make list of locally available hemipterans with the help of available resources.
b) Familiarise with the life cycle and season of abundance hemipterans in the region.
c) Take a record photo shot and identify the species of with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
d) Submit recorded data and photographs accompanied with proper identification.

12) Photographic collection of colourful beetles and bugs from the local region.

a) Make list of locally available Coleopterans with the help of available resources.
b) Familiarise with the life cycle and season of abundance of coleopterans in the region.
c) Take a record photo shot and identify the species of with the help of available field guide. Take note of details such as G.P.S location, season, type of habitat etc.
d) Submit recorded data and photographs accompanied with proper identification.

13) Types of honey bees and their culture.

a) Procurement of resources such as reference books and data on honey bees and their culture.
b) Visiting nearby apiculture plant Centre to fetch data about honey bees.
c) Listing various species of honey bees and their attributes in regard to honey production quality and quantity.
d) Preparing data to represent the survey and status of apiculture in your local area.
e) Submission of study report with proper inference and suggestion if available.

Practical : Life and diversity of Animals (Non-chordata)

Practical : Two practical per week and each of 03 periods duration> The examination shall be of 04 hours duration and of 50 marks

I-Life and diversity of Animals (Non-chordata)
COs:

Upon completion of this course successfully, students would be able to perform/demonstrate

1. Observation, classification upto classes and sketching of the following animals (Specimens and models)
   - Phylum : Protozoa: Plasmodium trophozoite, Euglena, Entamoeba histolytica
   - Phylum : Porifera : Sycon, bath sponge, Euplectela
   - Phylum :Coelenterata : Obelia, Aurelia, Tubipora,
   - Phylum : Helmenthis : Taenia, Ascaris (male and female)
   - Phylum Annelida : Neris, Earthworm, Leech,
   - Phylum :Arthropoda : Prawn, Aranea,scolopendra, julus, moth, mosquito
   - Phylum : Mollusca : Chiton, Pila, Dentalium, Unio, Octopus
   - Phylum : Echinodermata :Antodon, holothuria, seastar, Brittle star
   - Phylum : Hemichordata : Balonaglossus

2. **Study of permanent slides**
   L.S. of Sycon, nematocyst, Ascaris egg, T.S Ascaris through Testis and ovaries, T.S. Leech through Crop, Compound eye of Insect, Radula of Pila, Gill lamella, Osphradium of Pila, Scolex and gravid proglottid of Taenia

3. **Anatomical Study through computer aided techniques, Video clipping, models, photographs and other available resources**

   a. Leech/Earthworm: Alimentary canal, reproductive system, Nervous system,

   b. Grasshopper/ Cockroach; Digestive system, Nervous system, Reproductive system,

   c. Culture of Hydra and Volvox (to be given to all students)

4. **Mounting**
   a. Mosquito (culex and Anopheles) : Wings ,legs, mouthparts
   b. House fly; Mouth pars, legs, wings
   c. Paramecium and volvox

Distribution of Marks during Practical Examination: Time : 4 hrs.

i) Identification and comments on spots (1-8) 4 specimens, 4 slides 12 Marks
ii) Labelling of Anatomical diagrams provided (Two) 10 Marks
iii) Permanent stained micro preparation 08 Marks
iv) Study tour diary - …… 04 Marks
v) Permanent stained micro preparation Submitted by examinee ….. 04 Marks
vi) Certified class record - …… 05 Marks
vii) Check list of 20 locally available invertebrate fauna…… 02 Marks
viii) Viva- voce …….. 05 Marks
Total: - …. 50 Marks

Note:

1) One or two short excursion/study tours are compulsory for observation of animals in their natural habitat. 2) Candidates shall be required to produce at the practical examination the following.

- Practical record book duly signed by the teacher in charge and Certified by the Head of the department as bona fide work of the Candidate.
- Five permanent stained micro preparations.
- Study tour report and field diary duly signed by the teacher.

Reference Books Recommended (All latest editions):

1) Hickman, C.P. Jr.F.M. Hickman and L.S.Roberts, Integrated principles of Zoology Mosby College publication St.Louis.
2) Ayyar, E.K. and T.N.Ananthakrishnan, Manual of Zoology Vol.I (Invertebrata), Part-I & II S. Viswanathan (Printers and Publishes) Pvt. Ltd. Madras.
3) Jordan, E.L. and P.S.Verma Invertebrate Zoology, S.Chand and Co., Ltd. Ram Nagar, New Delhi.
4) Parker and Haswell, Text book of Zoology, Vol. I (Invertebrata), A.Z.T.B.S. Publishers and Distributors, New Delhi –110051.
5) Waterman, Allyn J. etal., Chordate structure and Function, Mac Millan and Co Newyork.
6) S.N.Prasad : Text Book of Invertebrate Zoology.
7) Vishwanathan : Invertebrate Zoology.
8) Majpuria : Invertebrate Zoology
9) Dhami and Dhami : Non-chordate Zoology.
10) Baini Prasad: Indian Zoological memoir. Pila.
11) R.L.Kotpal : Modern Text Book of Invertebrate Zoology.
12) Malviya M.K. Invertebrate Zoology, by Rajdhool publications.
13) S.S.Lal, Practical Zoology, Invertebrate.
14) Bhamrah H.S.and Kavita Juneja A text book of Invertebrate Zoology, Anmol Publication Pvt. Ltd,. New Delhi.
15) Verma and Agarwal Practical Zoology, Invertebrate
16) - Barnes R.D. Invertebrate Zoology -(W.B. Saunders Co.)
17) P.G.Puranik and Thakur, Invertebrate Zoology.

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Syllabus Prescribed for 2022-23 UG Programme

Programme : B.Sc-I : Zoology

There shall be the following paper and practical for B.Sc. Part-I and Semester II examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory sessions and 25 practical sessions during the complete semester). There shall be one compulsory theory paper of 3 hours duration, as stated below and a practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

Name of the programme: **B.Sc. I**
Class : **Part II S**

Semester :**II** ,DSC-2-02S
Subject Zoology

Name of the course (Paper): **Life and diversity of Animals (Chordata) and concept of Evolution**

Course Outcomes Code : COs-02

Max Marks : 80

About the course

The course is a walk for the Bachelor's entrant through the amazing diversity of living organism from simple to complex. The course makes a details comparison of the systematic study of different taxa of Non-chordate. 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 an anatomy which led to their grouping into taxa and clades.

COs:
Upon completion of this course successfully, students would be able to

1. know what the chordates are.
2. Learn about the different phylum of chordates.
3. confidently explain the general characters and classification of Protochordates upto class Mammalia.
4. understand the level of organization in chordate.
5. explain the origin and evolutionary relationship in different subphylums of chordates.
6. describe specific features of Protochordates upto class Mammalia.
7. recognize and differentiate life functions of Protochordates upto class Mammalia.
8. understand Migration in fishes and birds , parental care in Amphibians and Poisonous and non-poisonous snakes.
9. explain the adaptations in Birds and Mammals.

Unit – I:

Phylum Chordata

12 L

1. Origin of Chordata
2. Protochordates: Type study: Amphioxus, Habits and habitat, External characters, Digestive system and feeding, Excretory organs, gonads, Affinities of Amphioxus. Affinities of Agnatha.
3. Series: Pisces: Type study: *Scoliodon sorrakawah* (Dog fish) Habits and habitat, External characters, Respiratory system, respiratory organ and mechanism of respiration, circulatory system, structure and working of heart, Lateral line receptors. Migration in fishes-types causes and significance.

Unit: II

12 L

1. **Class Amphibia**: Type study: *Rana tigrina:* Habits and habitat, Respiratory organ, Circulatory system, structure of heart, major arteries an vein, Urinogenital system. Parental care in Amphibia.
2. **Class Reptilia**: Type study: *Calotes versicolor*- Habits and habitat, Circulatory system, Structure of heart, major arteries and veins. Types of Snake venom and anti-venom.

Unit: III

12L

1. **Class Aves**: Type study: Pigeon -*Columba livia,* Habits and habitat, external characters, Respiratory system, Urinogenital system, flight adaptation, Migration in birds.
2. Class: Mammalia: Primitive mammals: Salient features of Prototheria and Metatheria, Aquatic mammals, Flying mammals. Adaptive radiation in Mammals.

Unit: IV

12L

1. Evolution meaning and scope
2. Indirect evidences of evolution: Evidences of organic evolution-morphological and anatomical, physiological and biochemical, embryological.
3. Direct evidences of evolution: Paleontological evidences: Fossil and fossilization: petrified fossils dead and preserve bodies and moulds, trails and foot prints, condition for fossilization. Radioactive carbon dating of fossils. Living fossil. Importance of fossil record. Evidences from connecting links – Peripatus and Archaeopteryx.

Unit: V

12 L

1. Evolutionary Processes: Natural selection: Darwinism and Lamarckism
2. Speciation- definition of speciation-Allopatric and Sympatric speciation.
3. Modern concept of organic evolution -Neo-Darwinism. Population Genetic: Hardy - Weinberg equilibrium, Gens pool, Gene frequency, Genetic drift, Convergent, Divergent and parallel evolution, Coevolution.

Unit VI:

12L

1. Evolution of Man-brief accounts of Parapithecus, Dryopithecus, Parapithecus, Australopithecus, Homoerectus, Neanderthal man, Cro-magnon man and modern man. Evolution of heart and aortic arches
2. Animal adaptation: Desert, Aquatic and Terrestrial.

Unit VII:

Skill Enhancement Module—(SEM) **20 M**

Upon completion of this course successfully, students would be able to perform/demonstrate

1. **Study on edible fishes from the local region.**
   - Select local spots.
   - Find various water reservoirs from selected areas.
   - Choke out a plan to visit.
   - Observed edible fishes and their photographic records.
   - Prepare the data in a scientific way and submit.

2. **Case study of diversity in frogs from surrounding areas.**
   - Select a different location from the surrounding area.
   - Search for varieties of frog by observing in the particular area.
   - Take photographic records and classify accordingly.
   - Comparative study of their occurrence in different locations.
   - Prapare a scientific data and submit.

3. **Survey of Photographic evidence of parental care in frogs in monsoon.**
   - Study is carried out during monsoon season only.
   - Focus selective location where the possibility of frog nesting occurs.
   - Multiple visits during June to September to get expected results.
   - Prepare data with photographic evidence and submit.

4. **Survey the diversity of snakes in the surrounding area.**

* Visit a locally working snake rescue team.
* Involved in their rescue operation in the surrounding area.
* After a multiple visit, prepare data with snake photographs and classify accordingly.
* Prepare Survey report and submit it.

5. **Survey of Migratory birds in the forest /Grassland/Field.**

* Find out a list of migratory birds and visit the selected area from the books and other bird organizations
* Decide multiple visits to the selected area.
* Prepare a list of observation and Photographic records.
* Compare this list with actual records which are mentioned in books and other reservoirs.
* Submit a final report of the bird survey.

6. Case Study of migratory wetland birds from local reservoirs.

* Download a list or read a list of migratory wetland birds from IUCN red data list or renown books.
* Select reservoir for case study from the surrounding area.
* Visit during migration period i.e. September to may.
* Try to take a photograph of migratory bird species from the different reservoirs.
* Prepare the data with a basic classification and a few characters with photographs and submit.

7. Prepare a model on the evolution of man.

* Find out the latest information from the internet and recent books on evolution of man.
* Collect a photographic record and their history and related information.
* Prepare a model with photographic records and basic information like evidential proof,period of occurrence, characters etc.
* Submit this model.

REFERENCE BOOKS:

1. Integrated Principles of Zoology, 7th Edition, Hickman, C.P. Jr.,F.M.Hickman and L.S. Roberts, 1984. Times Mirror/Mosby College Publication. St. Louis. 1065 pp.
2. A life of Vertebrate – K.Z.Young, ELBS Oxford University Press.
3. A Text Book of Chordates – H.S.Bharmah and Kavita Juneja.
4. Modern Text Book of Zoology Vertebrate – R.L.Kotpal, Rastogi Publication Meerut.
5. A Text Book of Chordates – A .Thangamani, S, Prasannakumas, L.M.Narayanan and
6. Arunmugam Saras Publication, Nagercoil.
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Biology, Evolution & Ecology –S. Chand Publications.

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25. Zoology for Degree Students, Prof.Dr.V.K.Agrawal.

Practical:-
Two practical per week of 3 periods duration. Examination shall be of 5 Hrs duration and of 50 marks.

COs:

Upon completion of this course successfully, students would be able to demonstrate/perform/accomplish the following

1. General characters and classification of Phylum Chordata:
2. General characters and Classification up to orders of the following chordates or as per the availability in the laboratory from the major orders, (Specimens or Models):
Protochordata: Herdmania, Doliolum Salpa, Amphioxus.
Agnatha: Petromyzon, Myxine.
Pisces: Scoliodon, Torpedo, Acipenser, Exocoetus. Hippocampus
Amphibia: Ichthyophis, Salamander, Bufo, Hyla.
Reptilia: Varanus, Phrynosoma, Chameleon, Cobra, krait, Russell's viper, Typhlops, Hydrophis
Aves: Duck, Woodpecker, Kingfisher, Parrot.
Mammalia: Mongoose, Squirrel. Manis. Bat., monkey,
B) Dissections:
1. Dissection - afferent and efferent branchial vessels, cranial nerves, internal ear of scoliodon.
2. Dissection - Digestive system, Arterial system, venous system, reproductive system of rat.
3. Permanent micro-preparations .a. Fish scales. b. Ampullae of Lorenzini. c. Eyeball muscles.
4. Observations of air bladder in air breathing fishes.
C) Osteology. Rabbit, Varanus (excluding loose bones of skull).
D) Evolution:
1. Study of fossils, including living fossils.
2. Study of Evidences of evolution.
i) Analogous and Homologous organs.
4. Study of Mesozoic Reptiles (By Models/Charts).
5. Mimicry, coloration in animals.
6. Beak and Leg modifications with reference to: Parrot, Woodpecker, Kingfisher, Heron, Duck, Sparrow/Pigeon Hawk/Kite, Owl.

E) Histological Slides :- Amphioxus, Frog, Rat
Slides :
T.S, Oral hood, Pharynx, Tail
T.S. lung, Stomoch, Kidney, T.S. Intestine,
T.S. Liver, Pancrease, Ovary, Testies, Pituitary,
Thyroid, Adrenal

DISTRIBUTION OF MARKS FOR PRACTICAL EXAMINATION.

1. Dissection: -	10
2. Permanent stained micro preparation.	05
3. Spotting. (Specimens, Slides, bones, fossil)	10
4. Practical on evolution -	10
5. Class record	05
6. Viva - Voce	05
7. Submission of study tour report.	05

Total Marks: 50

Course- Zoology
General Interest Course (GIC)

Title: Snake Identification their Rescue & Snake Bite Management

Course Duration :

15 hours

Email- profpraveenjoshi@gmail.com

Credit : 01

Course Information:

The importance of snakes in nature is extraordinary. They play an important role in the food chain. The snakes are found in all habitats like villages, towns, farms and forests but in villages and cities people are often bitten by snakes and die prematurely but these are due to poisonous snakes but among the diversity very few snakes are poisonous but people unaware of the facts. Most of the time non-venomous snakes bite and they do not cause death but lack of information creates fear and kills snakes. The snake maintains the balance of the environment by controlling the population of many species such as rodents, mice, small mammals, birds and reptiles. In this course students will be given complete information about the species of snakes commonly found in Vidarbha, their habitat, predators, behaviors, snake bites and its causes and remedies as well as beliefs about snakes and superstitions and their importance in nature. Students can effectively spread awareness about snakes in the society through this medium.

Course Outcome:

Every student participating in the course will get to know about the different species of snakes in Vidarbha. The student can easily identify venomous and non-venomous snakes. It will be possible to differentiate between venomous and non-venomous snake bites. Participate in a rescue operation with volunteers from a snake rescue organization. Understand how to catch them. Students confidently told about the habitat of snakes, their role in nature and why it is important to save snakes. Visiting hospitals for people who have been bitten by snakes will help them to understand the difference between the bites of different venomous snakes. Awareness can be created by taking active part in future campaigns on the importance of snakes for the environment.

Facility provided by the Institution:

First of all, cooperate with the local organization working on snakes. Make available books on snakes to the students through the college library. Provide information about snakes with the help of photos and videos with the help of projector. With the help of children working in the organization, go to different habitats and give information about catching snakes. Visit a snakebite victim at a local government hospital. Create awareness about snake bites in the future, how to prevent snake bite accidents.

Course Syllabus

Unit 1 10 L

- General information of world wide diversity of snakes.
- Diversity of snakes in India, Maharashtra and Vidarbha region.
- Identification of poisonous and non-poisonous snakes in Vidarbha.
- Participating in snake rescue operation and developing skill handling and capturing of snakes under the guidance of authorized snake catchers.
- Arrange field visits to know about different habitats of snakes.

Unit 2 10 L

- Role of snakes in the environment.
- Snakes are important creature in the food chain.
- Methods to avoid the snake bite.
- Identification of different poisonous snake bites and non-poisonous snake bite.
- Primary steps after snake bite.
- Volunteers in snake bite operation.

- Participating while arranging rallies, lectures and seminars in public places in creating an awareness of saving snakes and saving nature.

Evaluation Methods:

1. Submit Project based on Local diversity of snakes. ---------- 10 marks

2. Deliver a seminar on any topic based on syllabus. ---------- 10 marks

3. Participation certificate in a snake rescue team by the local snake organization.—5 Marks

4. Member of awareness program which will be run by the organization for saving snakes.- 5 Marks

Bibliography:-

1. Venomous Bites from Non Venomous snakes:A Critical Analysis of Risk By,D.A.Warrel,Daniel E.Keyler Julian White and Scott
2. Guideline for the management of snakes bites World Health Organization Regional Office South East Asia.
3. Snakes of the world-A catalogue of living and extinct species by Van Wallach,Kenneth L. Williams and Jeff Boundy-Google Book.Dec-1995.
4. Snakes of India-Romulus Whitakar and Ashok Captain
5. Common Indian Snakes- Romulus Whitakar
6. Snakes of Maharashtra- Neelamkumar Khaire
7. Reptiles and Amphibians of India: J. C. Daniel
8. Uncover a Cobra: Van Wallach.
9. Reptiles By: J.Z.Young
10. Vertebrates Zoology: P. S. Verma, S. Chand Pub. N. Delhi
11. Vertebrates Zoology: R. L. Kotpal, Rastogi Pub. N. Delhi

Course- Zoology

General Interest Course (GIC)

Title: Basic Course in Ornithology

Course Duration : 15 hours

Credit : 01

Course Outcome:

The student who has taken admission in this course will get basic knowledge of bird species from all over the world as well as complete information about bird species found in Maharashtra and Vidarbha. Course students will get an in-depth knowledge of various bird species in nature, their functions, their major habitats, bird-specific habitat. Students may have the opportunity to work on various research projects run by international or national bird organizations. Students can set up their own bird tour company, organize small bird tours at famous bird sanctuaries in India, pursue their hobbies and earn money through the tour. Students can put up an exhibition of selected photographs of the birds they photograph while going birding each day. This will make people aware of the local bird diversity and at the same time help encourage other students who are interested in the field. Students can also earn money by selling selected photos displayed in the exhibition.

Course Information:

This course is mainly based on Birds which is an indicator of a healthy environment, an important component of the food chain, attracting everyone with its appearance and sound. This is made especially for people who love birds and nature. The main objective of this course is to give the students an in-depth knowledge of the bird world of Vidarbha as well as to introduce the bird diversity of the world and the bird world of Maharashtra. Students need to be informed that birds play an important role in the environment. It is important to show how the extinction of bird species will adversely affect nature. It is important to explain the potential threats to habitat and the steps that need to be taken to address the rapidly declining number of bird species and the extinction of many species. Students will be informed about the number of migratory birds that come to Vidarbha from all over the world. Students will be given full information about the category they fall under as per IUCN. The benefits of bird watching for the environment, physical and mental health will be explained. It will be informed that many job opportunities are available due to this course. Students will also learn about the close relationship between birds and tourism so that we can start our own business in this field.

Facility provided by the Institution:

The Institute will make available the required books for this course in the Library. Provide an up-to-date classroom with projectors, computer systems and important study materials. In addition to regular teachers, guest lectures will be provided by expert teachers of related subjects. Programs such as workshops, seminars, group discussion field visits of experienced people who have been working in this field for many years will always be conducted. A study tour of the relevant subject will be organized by the college during the course. Students who have taken admission in the course will be given an opportunity to participate in their various activities by collaborating with an organization working in the field of birds.

Course Syllabus

Unit 1 10 L

- To introduce Bird diversity of the Indian subcontinent.
- Basic information about Bird Diversity of India, Maharashtra and Vidarbha region.
- Species based categorization (Prey birds, Passerine and waders).
- Diversity of residential birds of Vidarbha.
- Migratory birds visited the Vidarbha region.
- Rare birds are recorded as per IUCN in the Vidarbha region.

Unit 2 10 L

- Important bird watching tips and materials needed for bird watching.
- Benefits of Bird watching.
- Role of birds in the environment.
- Identification and census methods of birds.
- Reason for decline in population of birds in Vidarbha region.
- Steps involved in their habitat management and conservation.
- Birds and Tourism.

Evaluation Methods:

1. Visit local birding spots and submit a diversity survey report. --------- 10 M
2. Deliver a seminar on any one of the topics from the syllabus. ---------- 05 M
3. An exhibition of photographs of various species of birds taken during the Bird Survey should be displayed in the college. ---------- 10 M
4. Volunteer for a few days with an organization working in the various issues like field of bird species diversity, destroy habitat and needs of conservation and submit its certificate.—05 M

Bibliography:-

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Bibby C.J., N.D. Burgess & D.A. Hill (1992). Bird Census Techniques. Academic Press, London, 67–84 pp.
Daniels, R.J.R. (1997). A Field Guide to the Birds of South-Western India. New Delhi: Oxford University Press, 217pp.
Grimmett, R., C. Inskipp & T. Inskipp, Birds of the Indian Subcontinent. Oxford University Press, New Delhi. 2012; 528pp.
IUCN - ENVIS Center, IUCN Red List of Threatened Species.2018; IUCN category. Kazmierczak, K. (2000). A Field Guide to the Birds of the Indian Subcontinent. A & C Black Publishers Ltd., Pica press, 352pp.
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Kumar, A., J.P. Sati, P.C. Tak & J.R.B. Alfred . Handbook on Indian Wetland Birds and their Conservation.
Zoological Survey of India. 2005; 218pp.
Grewal B., Harvey B. and Pfister O.Birds of India. Periplus Editions (HK) Ltd. 2011; 512 pp
Steward R.E. Jr., (1999). Technical aspects of wetlands: Wetlands as bird habitat. United States Geologic Water Supply Paper, pp. 24-25

Course- Zoology
General Interest Course (GIC)

TITLE - ENVIRONMENTAL ISSUES AND ITS AWARENESS

Course Duration – 15 Hours

Total Credits – 1

Course Information:

This credit course benefits students to perceive how their decisions and actions affect the environment. It augments their knowledge and skills necessary to address complex environmental issues. Also, it helps to chalk out strategies to keep our environment healthy and sustainable for the future.

This course empowers students to make connections and apply their learning in the real world. It helps pupils to see the interconnectedness of social, ecological, economic, cultural, and political issues. This course encourages students to investigate multiple facets of environmental issues to comprehend the situation as a whole. It promotes tolerance of different points of view and different cultures.

By exposing students to nature and allowing them to learn outside, this course nurtures sensitivity, appreciation, and respect for the environment.

Course outcomes:

- Students will understand current environmental scenario with clearer concepts in mind.
- Students will have Ability to demonstrate understanding of the environmental processes and will possess knowledge of the changing climate.
- Students will have Ability to comprehend to structure and functions of ecosystem.

- Students will know how to identify and quantify the magnitude and intensity of Environmental pollution problems.
- Student will have Ability to demonstrate understanding Environmental Laws and policies in India.
- Student will appreciate the ecosystem responses to climate change and how environmental crisis will greatly impact both current and future generations of humans and all other species.

Facility provided by the Institution:

- Institute will provide necessary equipment's for practical sessions.
- Institute will arrange guest lectures of eminent personnel in the field, so as to give better depth and understanding of the subject.
- Institute will arrange field visits to various Industries to show and assess their commitment to save environment.
- Institute will provide various e-learning resources for better understanding of the subject.
- Library facility and reference books will be made available to the students enrolling for the course.

Course Syllabus

UNIT I -Introduction to environmental studies. 10 L

- Definition, scope and importance.
- Need for public awareness.
- Environmental ethics: Issues and possible solutions.
- From Unsustainable to Sustainable development
- Water conservation, rain water harvesting, watershed management
- Climate change, global warming, acid rain, ozone layer depletion.

UNIT II - Natural resources 10 L

- Natural resources and associated problems. Types of resources.
- Forest resources: Use and over exploitation, deforestation.
- Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
- Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act.
- Wildlife Protection Act. Forest Conservation Act.

Evaluation Methods

- Presentation on any one suitable topic from syllabus at the end of course. 10 M
- Submission of Dissertation on topic which includes at least one Case Study. 10 M
- Submission of Excursion tour Report / Submission of Report on Industrial Visit.05 M
- Certificate from any Environment Cause related NGO / GO / NSS Unit (From College) for Spending Not less than 10 Hrs for any Environmental Cause. 05 M

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4. Environmental Science, Danial Botkin and Edward Keller. New York: John Wiley & Sons (1997).
5. Environmental Biology by Verma and Agrawal.
6. Ecology and Environment- P. D. Sharma, Rastogi Publ.
7. Environmental Science. Van Cunninghnn, Tata McGraw Hill Pub.
8. Environmental Pollution Control Engineering – C.S. Rao. New Age International Publication.
9. Waste Water Treatment, M. N. Rao, and A. K. Datta (1987), Oxford and IBH Publ. Co". Pvt. Ltd. 345 p. Townsend C., Harper J., and Michael Begon,
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11. Handbook of Environmental Laws, Rules. R. K. Trivedi, [Guidelines]. Compliances and Standards, Vol. I and II. Enviro Media.
12. Introduction to Air Pollution, R. K. Trivedi, and P. K. Goel, Techno-Science Publications.
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