

**GULBARGA UNIVERSITY  
GULBARGA**



***SYLLABUS***

*for*

***M.Sc.***

***ZOOLOGY***

(CHOICE BASED CREDIT BASED SYSTEM)

2017 ONWARDS

Proceedings of the Meeting of the Board of Studies in Zoology held on 08<sup>th</sup> March, 2017 to prepare Credit Based Choice Based Syllabus for M.Sc. Zoology Course for the Academic year 2017-18 onwards.

Members Present:

- |                            |                 |
|----------------------------|-----------------|
| 1. Prof. K.Vijaykumar      | Chairman, BOS   |
| 2. Dr.Murali Jadesh        | Member          |
| 3. Prof. B.B.Hosetti       | External Member |
| 4. Prof. M.Venkateshwerulu | External Member |
| 5. Prof. Jacob Dass P      | External Member |
| 6. Prof. P.M.Basha         | External Member |
| 7. Prof. S. Ramakrishna    | External Member |

1. The CBCS syllabus for the M.Sc. Zoology course was drafted after several deliberations and discussions during the meetings of the Departmental Council and placed in the Meeting of the Board of Studies in Zoology for approval and implementation from the academic year 2017-2018 and onwards (copy enclosed).
2. It was unanimously decided that the practical courses covering the theory papers mentioned in the scheme of teaching and examinations be evolved by the teacher(s) concerned during beginning of the every academic year.
3. Each candidate shall undertake compulsory “Animals in Nature” **Study Tour** covering different Institutions and natural biomes with a stress on Biodiversity study. The duration of this Tour shall be about 10 days. The Study Tour shall be undertaken during third Semester only and shall be completed within the two years period.

### Scheme of Teaching and Examination

Semester	Paper No & Title	Teaching Hrs / week	Exam. Hrs.	Examination	Internal Assessment	Credits
<i>II</i>	2.1: HC: Structure and function of Vertebrates	04	03	80	20	04
					20	04
	2.2: HCT: Developmental Biology	04	03	80	20	04
	2.1: SCT: Histology and Histochemistry Or Parasitology	04	03	80	20	04
	2.1: OET: Economic Zoology	04	03	80	20	04
	2.2: HCP: Practical based on 2.1	04	03	40	10	02
	2.3: HCP: Practical based on 2.2	04	03	40	10	02
	2.1: SCP: Practical based on 2.3	04	03	40	10	02
	2.1: OEP: Practical based on 2.1	04	03	40	10	02

**HC: Hard Core;      SC: Soft Core      OE: Open Elective**

**Paper: HCT 2.1**  
**STRUCTURE AND FUNCTIONS OF VERTEBRATES**

**Preamble:** Describing the diversity and features of various vertebrate groups, ranging from the oldest living fishes to the relatively more recent evolution of mammals, is the central theme of studying the subject involving anatomical systems including organs and tissues, as well as their function and differentiation in various vertebrate groups. The content of this paper deals about the evolution of vertebrate groups from the earliest extinct ancestors to current living vertebrates that enable adaptation to aquatic and terrestrial environments.

**Unit – I: Chordates, Proto chordates and Vertebrate Integument**

**64 hrs**

- 1.1 Characters and classification of proto-chordata, significance of protochordates in the evolution.
- 1.2 Origin of chordates and classification
- 1.3 Vertebrate integument, development, structure of skin in vertebrates.
- 1.4 Derivatives of Integument; glands, scales, horns, claws, hoofs, feathers & hair.

**Unit – II: Skeletal and Digestive system**

- 2.1 Comparative account of jaw suspension
- 2.2 Comparative account of vertebral column
- 2.3 Comparative account of girdles and limbs.
- 2.4 Anatomy of gut in relation to feeding habits- herbivores, carnivores and omnivores.

**Unit – III: Circulation and respiration**

- 3.1 Evolution of heart
- 3.2 Evolution of aortic arches and portal system
- 3.3 Respiratory organs in fishes and amphibians
- 3.4 Air sacs in birds

**Unit – IV: Nervous and Urino-genital systems**

- 4.1 Comparative anatomy of brain in relation to its function
- 4.2 Nerves - cranial, peripheral and autonomous nervous system
- 4.3 Sense organs, simple receptors, organs of olfaction and taste, Lateral line system and electric organs
- 4.4 Evolution of urino-genital system in vertebrate series.

**PRACTICALS: 2.1 HCP: Practical Based on 2.1.**

1. Cranial Nerves of Labeo (5<sup>th</sup> and 7<sup>th</sup> and 9<sup>th</sup> and 10<sup>th</sup> Weberian Oscicles)
2. Dissection & demonstration of Brain and Heart of Fish, Calotes, Chick and Rat
3. Demonstration of flight muscles and air sacs in birds.
4. Demonstration vascular and urinogenetal system of Rat.
5. Collect 10 vertebrates and submit in the examinations
6. Museum specimens (from each Class not less than 15 specimens).
7. Slides related to vertebrate parts.
8. Mounting of Amphioxus, Doliolum and Scales of fishes.
9. Sketelation system (Vertebra , limbs, Girdles)

**REFERENCE BOOKS:**

- |    |  |   |
|----|--|---|
| 1  | Vertebrate Zoology -----               | EL Jordan; P.S. Verma                     |
| 2  | A Text Book of Zoology Vol.II -----    | P.S. Dhami; Jk.Dhami.                     |
| 3  | A Text Book of Vertbrate zoology ----- | R.L.Kotpal.                               |
| 4` | Biology of Animals ---                 | Cleveland P. Hickman JR Larryds. Roberts. |

**Paper HCT 2.2**  
**DEVELOPMENTAL BIOLOGY**

**Preamble:** the study of the process by which animals and plants grow and develop. Developmental biology also encompasses the biology of regeneration, asexual reproduction and metamorphosis and in the growth and differentiation of stem cells in the adult organism.

**UNIT-I: Principles of Development in Biology**

**64 hrs**

- 1.1 Introduction to developmental Biology: stages of animal development, embryonic homologies, malformations and teratology.
- 1.2 Developmental patterns in unicellular protists and metazoa.
- 1.3 The developmental mechanics of cell specification.
- 1.4 Determining the function of genes during development.

**UNIT-II: Early Embryonic Development**

- 2.1 Introduction to embryonic development: structure of gametes, recognition of egg and sperm, acrosomal reaction.
- 2.2 The early development of snails, sea urchin, frog and chick
- 2.3 The genetics of axis specification in drosophila, organizer concept
- 2.4 Early mammalian development: mammalian anterior-posterior axis formation, dorsal-ventral and left-right axes in mammals.

**UNIT-III: Later Embryonic Development**

- 3.1 Tetrapod limb development.
- 3.2 Sex determination approaches in developmental biology.
- 3.3 Metamorphosis, regeneration and aging.
- 3.4 The development of blood cells: The stem cell concept, the pluripotential hematopoietic stem cells, blood and lymphocyte lineages, hematopoiesis.

**UNIT-IV: Ramifications of Developmental Biology**

- 4.1 Environmental regulation of animal development.
- 4.2 Hox genes: descent with modification.
- 4.3 Homologous pathways of development.
- 4.4 Teratogenesis: Introduction, principles and teratogenic agents.

### **PRACTICALS: 2.1 HCP: Practical Based on 2.1.**

1. Observation of living Chick embryo.
2. Dissection and Morphology Observation of the 4-14 somite chick embryo (24-34 hours).
3. Dissection and Morphology Observation of the 24-38 somite chick embryo (48-85 hours).
4. Culture of Early chick embryo *in vitro*.
5. Mounting of 72 and 96 hours chick embryo.
6. Chorio-Allantoic Membrane Grafting.
7. Various patterns of Cleavage and development in freshwater snail, frog and rat
8. Larval developmental stages of *Drosophila*.
9. Chromosome squash preparation from *Drosophila* larval salivary glands.
10. Patterns of regeneration in the Planarian/Regeneration in the tail of frog tadpoles.

#### **Reference Books:**

1. Gilbert, S.F. Developmental Biology. 10<sup>th</sup> Edition, Sinauer Associated Inc., Massachusetts
2. Balinsky, B.I. Introduction to Embryology. Saunders, Philadelphia
3. Berril, N.J. and Karp, G. Development Biology. McGraw Hill, New York
4. Hamburger V and Hamilton HL. Handbook of chick developmental stages. Saunders Publications. 1965.
5. Berril, N.J. and Karp, G. Development Biology. McGraw Hill, New York
6. Embryology-An Introduction to Developmental Biology—Stanley Shostak
7. Muthukaruppan and Pitchappan. Animal development – a laboratory guide. CoSIP-ULP Publications, India. First Edition, 1979.

**SCT 2.3 (I)**  
**HISTOLOGY AND HISTOCHEMISTRY**

Preamble: Histology and Histochemistry is to teach the chemical, physical and biological principles of fixation, staining and histochemistry. Hence it aims to educate the bench students to understand the principles underlying the protocols. Histological studies may be conducted using tissue culture, where live human or animal cells are isolated and maintained in an artificial environment for various research projects. The ability to visualize or differentially identify microscopic structures is frequently enhanced through the use of histological stains. Histology is an essential tool of biology and medicine.

**Unit 1:**

**64rs**

- 1.1 Bone development, growth, calcification, remodeling and healing of fracture
- 1.2 Thick and thin skin – structure and functions.
- 1.3 Blood – Red Blood corpuscles, white blood corpuscles, platelets and haemopoiesis or Blood cell development.
- 1.4 Histological structure and functions of lymph node, tonsil, thymus and spleen

**Unit 2:**

- 2.1 Muscular system – structure of smooth Muscle
- 2.2 Skeletal and cardiac muscle fibers
- 2.3 Muscle tendon attachment and intercalated disc
- 2.4 Nervous system – organization, function and classification of nerve fibers. Neuron types, Sense organs – structure and functions of eye, ear, and nose.

**Unit 3:**

- 3.1 Reproductive system – Histological structure and functions of the ovary, uterus, oviduct, vagina and mammary gland
- 3.2 Histological structure and function of the testes, vas deferens, epididymus, cowpers gland and seminal vesicle.
- 3.3 Endocrine glands – structure and functions of pituitary,
- 3.4 Structure and functions of adrenal and pineal gland.

**Unit 4: Histochemistry:**

- 4.1 Histochemical localization of proteins
- 4.2 Histochemical localization of lipids
- 4.3 Histochemical localization of carbohydrates and PAS reaction and the factors affecting the rate of reaction
- 4.4 Histochemical localization of Nucleic acids.

**REFERECNE BOOKS:**

1. Berne. R.N. and Levy. M.N. 1996 Principles of physiology (Mosby year book)



2. Bloom and Fawcett. D. 1972 Text book of histology 10<sup>th</sup> ed.
3. David H.C. 1987 Histology 9<sup>th</sup> ed. (Horper International Pub)
4. Histochemical, (Harper and Row: London and John Weatherwill Inc. Tokyo Incl Mission: USA)
5. McManus J.F.A. and Mowry R.W. 1960 Staining methods.
6. Pearse A G E 1968 Histochemistry Vol.1 & 2 (Churchill Livingstone: London)

**PRACTICALS: 2.1 SCP: Practical Based on 2.1.**

1. Sectioning and staining of mammalian tissues for histological and histochemical Studies – Intestine, Liver, Kidney, Ovary and Testes
2. Histology of following tissues: 1) Foetal skin 2) Tongue-filiform, fungiform, circumvallate and foliate papillae. Taste buds, 3) Salivary gland 4) Hyaline cartilage 5) Spleen 6) Thymus 7) Adrenal 8) Trachae 9) Cowper's gland 10) Vagina 11) Lymph gland 12) Thyroid 13) lood cells 14) Seminal vesicles 15) Retina
3. Histochemical detection of proteins by mercury bromophenol blue.
4. Histochemical detection of lipids by Sudan Black B.
5. Histochemical detection of carbohydrates by periodic acid Schiff's reagent
6. Histochemical detection of DNA in tissues by Feulgen.

**Paper SCT 2.1 (II)**  
**PARASITOLOGY**

**Preamble:** Parasitology is the study of parasites, their hosts, and the relationship between them. As a biological discipline, the scope of parasitology is not determined by the organism or environment in question, but by their way of life. The parasites of man have been classified and described under the following headings: Geographical distribution, habitat, morphology and life cycle, pathogenicity and clinical features, diagnosis, treatment and prophylaxis.

**Unit I:**

**64 hrs**

- 1.1** Introduction and scope
- 1.2** Concepts of Parasitism, Classification, Distribution and types of parasites. Origin and evolution of parasites.
- 1.3** Parasitic diseases of human importance: structure, Life cycle, mode of transmission, pathogenicity and control of protozoan parasites : trichomonas, leishmania, trypanosoma, plasmodium, toxoplasma.
- 1.4** Parasites of Nematoda: Ascaris, Ancylostoma, Strongyloides, Trichuris, Enterobius, Waucheraria, Loa. Trematoda : Schistosoma, Fasciola. Cestoda : Taenia, Echinococcus, Hymenopilis.

**Unit II: Ectoparasites :**

- 2.1** Habitat, Life cycle, Pathogenicity and Prevention of fleas
- 2.2** Habitat, Life cycle, Pathogenicity and Prevention of mites
- 2.3** Habitat, Life cycle, Pathogenicity and Prevention of ticks and lice
- 2.4** Habitat, Life cycle, Pathogenicity and Prevention of mosquitoes and house flies

**Unit III: Host- Parasitic Relationship**

- 3.1** Cellular, Physiological, Immunological, Molecular, Social, Behavioural aspects,
- 3.2** Larval migrants.
- 3.3** Types, ecobiology, Chemical cues with suitable examples.
- 3.4**

**Unit IV: Bacterial Infection**

- 4.1** Cholera, Tuberculosis. Diphtheria, anthrax
- 4.2** Typhoid, Tetanus, Leprosy.
- 4.3** Viral Infection: Rabies, Dengue fever, Japanese encephalitis
- 4.4** KFD, Hepatitis, Poliomyelitis.

**Practicals on A: 2.1 SCP: Practical Based on 2.1.**

- 1. Culturing an insect parasitoid and studying their infection on an insect host.
- 2. Staining blood films for the study of protozoa (especially malarial parasite).
- 3. Collection of the specimen for the study of parasites.
- 4. Preparation of permanent slides of the hard parts of insects.

5. Study of vectors of diseases and mouth parts:  
a) Mosquitos b) Flea c) Ticks d) Housefly
6. Slides and specimens: pathogens of human Malaria, Filariasis, Leishmaniasis, Trypanosoma, Ascaris etc.
7. Preparation of human blood film and study of different types of cells  
a) Counting the RBCs. b) Counting the WBCs. c) Differential count of WBCs

#### **REFERENCE BOOKS:**

1. Smyth, J.D 2000. Animal Parasitology, Cambridge low Edition.U.K.
2. Arira, D.R. And Arora,B. 2001. Medical parasitology. 1<sup>st</sup> Edition. Satish kumar jain for CBS Publisher ad Distributors, New Delhi.
3. Chatterjee, K.D. 2001. Parasitology (Protozoology and Helminthology). 12<sup>th</sup> Edition. Chatterjee Medical Publishers, Calcutta.
4. Thomas C. Cheng. 1999. General Parasitology. 2<sup>nd</sup> Edition. Academic Press, California.
5. Solti,R.C.1999. Medical Zoology. Shoban Lal Nagin Chand & Co. Jalandhar. India.
6. Roberts L.S. and Janovy J. Foundations of Parasitology, McGraw-Hill Publishers, New York, USA.
7. Modern Parasitology: A Textbook of Parasitology, FEG Cox., Wiley-Blackwell, U. K.

## Paper OET 2.1

### ECONOMIC ZOOLOGY

**Preamble:** Economic Zoology deals with animal world that is associated with the economy, health, and welfare of humans. Actually, animal world is related to economy by all means that we can count. The economic value of an animal is generally accepted as the amount of money people are willing to pay for it. In the modern world, perhaps it is the most popular way to accept as a profession to earn money either by by-products of animals or by selling meat as a diet. Keeping in mind the multidisciplinary nature of economic zoology, the biology of some of the common disease-causing organisms and bionomics of the arthropod vectors which are intimately associated with the diseases have been incorporated along with the main topics like sericulture, lac culture, apiculture, poultry, fisheries, and so on.

#### Unit 1: Aquaculture

64 hrs

- 1.1 Introduction: Definition, scope and status of aquaculture.  
Techniques of culturing fishes: Carps (Indian major & minor carps), Trouts, Catfishes, Ornamental fishes, Shell fishes (Prawns, Pearl oysters).
- 1.2 Fish seed technology: natural collection, bundh breeding, induced breeding, seed transportation. Aquaculture systems: Inland farms, tanks, pens and cages, feeding habits and food utilization, energy requirements, sources and metabolism, live foods, artificial feeds.
- 1.3 Fishes diseases and their control: Protozoa, fungal, bacterial, viral, environmental and nutritional, algal toxins, vitamin deficiency diseases. Fishing, control of weeds, pests and predators.
- 1.4 Farm management and economics: Concepts, economic principles of farm, management of Hatcheries, Nurseries, Rearing ponds, and Stocking ponds.

#### Unit I: Apiculture:

- 2.1 Scope and its importance. Classification and morphology of honey bees, species and races of honey bees, tribal life and bee hunting. sex separation, comb building, orientation of comb, communication, collection of propolis and water.
- 2.2 Entomophily: Bee plants, floral design, colour, smell, pollen and nectar production and composition. Pollen calendar. Relationship between floral design and mouth parts of honey bees. Pollen and nectar collection.

- 2.3 Honey and its chemical composition, medicinal importance.
- 2.4 **Beekeeping and management:** Rearing of honey bees, equipments, comb foundation, queen rearing(rearing techniques, feed contents, feeding and economics of queen rearing, requeening, bee nursing, honey and wax extraction. economic importance of honey, wax, bee pollination, pollen and Venom.

#### **Unit I. Sericulture:**

- 3.1 Components, origin and development of the art and science of sericulture. Global silk production, quality and quantity of silk produced in India, economics of silk production, foreign exchange.
- 3.2 Classification, systematic position of sericigenous insects. Salient features of Saturnidae and Bombycidae. Races of mulberry silkworms, classification based on voltinism, moulting and geographic origin.
- 3.3 Morphology and life cycle of *Bombyx mori*. Structure and functions of Silk glands. Silkworm rearing: Building, equipments, disinfection, environmental factors, spacing, feeding and bed cleaning. Modern rearing technology: Seed cocoons, preservation, grainage activity, LSPs, egg production, incubation, artificial hatching, seed organisation and seed area and bivoltine rearing.
- 3.4 Silkworm Pathology: Protozoan, Fungal, Viral and Bacterial diseases and their control measures. Silkworm pests and Predators: Uzi fly, Dermestid beetle, ants, lizard, birds and monkey. Lac insects: external morphology, culture, economic importance

#### **Unit IV: Poultry:**

- 4.1. Introduction to poultry and their economic value
- 4.2. Breeding techniques of poultry breeds viz. white leghorn, jungle fowl, giriraj, turkey bird and duck
- 4.3. Housing techniques: diseases of poultry
- 4.4. Marketing of poultry products eg. Eggs, meat and poultry waste

#### **REFERENCE BOOKS:**

1. Hickling, C.E. 1962. Fish and fish culture. Faber and Faber, London.
2. Jhingran, V.G. 1977. Fish and Fisheries of India. Hindustan Publ., New Delhi.
3. Scnmitz, R.J. 1996. Introduction to Freshwater Biology. Gulf Publishing Company, New Delhi.
4. T.V.R. Pillay 'Principles and practice of Aquaculture. 2nd edition, Fishing News books.

5. R.K.Rath. 'Fresh water aquaculture'. 2nd Edition. Scientific Publishers. Handbook of Fisheries and Aquaculture, Indian Council of Agricultural Research, ICAR, (2006), DIPA, New Delhi, INDIA.
6. Srivastava., 1979. Applied Entomology. Vol II.
7. Singh .S., 1962. Beekeeping in India. ICAR. New Delhi.India.
8. Snodgrass,R.E. 1956. Anatomy of the Honeybee. Cornell Univ. Press. Ithaca. New York.
9. Winston, M. 1984. The Biology of the Honeybee. Harvard. Uni. Press. London. UK.
10. Tazima. Y. 1958. Silkworm egg. CSB Publication, Bombay.
11. Yashimoro Tanaka. 1964. Sericology, CSB Publication, Bombay.
12. Tanaka, Y. 1953. "Genetics of the silkworm, Bombyx mori" – advances in genetics, Demerec.M. (Ed), Vol.5, Academic press, New York.
13. Tazima, Y. !964. " The genetics of the Silkworm". Logos Press Ltd., London.

## **PRACTICALS 2.1 HCP: Practical Based on2.1.**

### **AQUACULTURE AND POULTRY**

1. Physico- chemical parameters of freshwater bodies.
2. Study of morphometric characters of Indian major carps.
  - a) Diversity of fishes.
  - b) Biological analysis of water and estimation of primary productivity.
  - c) Collection of phytoplankton and zooplankton from natural resources and their identification.
5. Length-weight relationship and condition factor determination.
6. Experiments on chemoreception using different attractants and repellents.
7. Toxicity testing with zooplankton/fish.
8. Study of feeding habits of fishes by gut content analysis.
9. Visit to freshwater/ marine fish farms.
10. Visit to poultry to study housing techniques, poultry breeds and diseases.

### **APICULTURE AND SERICULTURE**

1. Study of morphology of honey bee and cast system.
2. Mounting of mouth parts, stinging apparatus of honey bee.
3. Study of digestive system of honeybee.
4. Study of structure of honey comb.
5. Study of bee plants.
6. Estimation of leaf protein by Lowry's method.
7. Study of morphology of lifecycle of B.mori
8. Study of digestive and silk gland of B. mori
9. Study of cocoons and food plants of silkworm.