



KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ



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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SVB-06/BOS /Zoology (UG) /20-21/ ೨೨೨

Date: 16 OCT 2020

NOTIFICATION

Sub: Regarding introduction of the syllabus of Zoology UG under C.B.C.S. w.e.f. the academic year 2020-21 & onwards.

- Ref: 1. UGC Letter DO No. 1-1/2016(SECY), dt. 10.08.2016.
2. Special BOS Res. No. 01, dt. 04.07.2020.
3. Special Faculty Res. No. 14, dt. 11.08.2020.
4. Special Academic Council Res. No. 39, dt. 21.08.2020.
5. Vice-Chancellor's order dated - 07-10-2020

Adverting to the above, it is hereby notified to the Principals of all constituent and affiliated degree colleges coming under the jurisdiction of Karnatak University, Dharwad that the Zoology UG syllabus for I to VI Semester which is annexed herewith in Annexure-A is introduced under C.B.C.S. from the academic year 2020-21 & onwards.

Hence, the contents of this notification may please be brought to the notice of the students and all the concerned. The prescribed C.B.C.S. syllabus may also be obtained through K.U.website (www.kud.ac.in).

Hanumanthappa K.T.
(Dr. Hanumantappa K.T)
REGISTRAR

To,

1. The Chairman, BOS Zoology (UG), Dept. of Zoology, K.U.Dharwad.
2. The Chairman, Dept. of Zoology, K.U.Dharwad.
3. The Principals of all the constituted and affiliated degree colleges under the jurisdiction of Karnatak University, Dharwad. (The same may be sent through e-mail)
4. The Registrar (Evaluation), K.U.Dharwad.

Copy fives to:

1. Dr. Ch.Ramesh, Dean, Faculty of Science & Tech., Dept. of Zoology, K.U.Dharwad.
2. The Director, IT Section, Examination Section, K.U.Dharwad for information and to upload on K.U.Website (www.kud.ac.in).

Copy to:

1. PS to Vice-Chancellor, K.U.Dharwad.
2. S.A. to Registrar, K.U.Dharwad.
3. O.S., Exam UG / Confl / QP / GAD Section, K.U.Dharwad.
4. The System Analyst, Computer Unit Exam Section, K.U.Dharwad.

KARNATAK UNIVERSITY, DHARWAD

**CBCS SYLLABUS
FOR
BACHELOR OF SCIENCE**

**ZOOLOGY
(I TO VI SEMESTERS)**

**FROM
2020-21 & ONWARDS**

PREAMBLE

Zoology is the study of animals as well as human beings. It comprises and deals with the study of the organisms; development, structure, classification, habits, habitats, distribution, physiology, biochemistry, genetics, evolution, etc. Many branches, specialization and fields of Zoology have contributed immensely to the progress of human welfare. The university has introduced the CBCS system, which gives an opportunity to the students to choose any field and acquire knowledge in the subject Zoology. The knowledge gained in the subject not only leads the students to pursue higher education and research, but also enables them to undertake self employment.

OBJECTIVES

The main purpose of B.Sc. Zoology course is to create knowledge among the students to know the importance of animals with emphasis on the following domains.

- To improve the knowledge on the systematic classification, physical structure, physiological reactions, biological functions, culture and maintenance of beneficial organisms, etc.
- To gain skill in microscopy, preparation of sample, observations of animal activities at molecular, structural and organisms level.
- To make the students to acquaint with estimations, analysis of molecules to carry out routine clinical analysis of any samples.
- To make the students to aware and emphasize the role of genes/chromosomes in inheritance and genetic diseases.
- To make them self employable and a good entrepreneur in due course.

For fulfillment of the above objectives, the following papers namely, non chordate, chordate, histology, evolution, paleontology, biostatistics, molecular cell biology, developmental biology, biochemistry, physiology, ethology, applied zoology, genetics, biotechnology, nanotechnology, ecology, zoogeography and wildlife biology have been introduced in the B.Sc. Zoology degree course.

OUTCOME OF THE COURSE

By learning Zoology subject with emphasis on above said different domains, the students will acquire the necessary knowledge and skills to pursue further studies and research in a wide range of subjects like, molecular biology, applied zoology, genetics, biotechnology, environmental biology, wildlife biology, ethology, etc. One can also make use of the knowledge to become a self entrepreneur using the economically important animals and their products.

Karnatak University, Dharwad
CBCS syllabus for Under Graduate Programme in Zoology (optional)
Effective from 2020-21

Sem	Theory / Practical	Subject Code	Total Teaching hours per week	Total Teaching hours per Semester	Duration of Exams	Internal Assessment Marks	Semester End Exam Marks	Total Marks	Credits
I	Theory	DSC ZOOT: 1.1	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC ZOOP: 1.1	04 hrs	60	03 hrs	10	40	50	02
I	Theory	DSC ZOOT: 2.1	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC ZOOP: 2.1	04 hrs	60	03 hrs	10	40	50	02
III	Theory	DSC ZOOT: 3.1	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC ZOOP: 3.1	04 hrs	60	03 hrs	10	40	50	02
IV	Theory	DSC ZOOT: 4.1	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC ZOOP: 4.1	04 hrs	60	03 hrs	10	40	50	02
V	Theory	DSE ZOOT: 5.1A OR ZOOT: 5.1B	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSE ZOOP: 5.1A OR ZOOP: 5.1B	04 hrs	60	03 hrs	10	40	50	02
	Theory	SEC-1 ZOOT: 5.2A	02 hrs	30	02 hrs	10	40	50	02
	Theory	SEC-2 ZOOT: 5.2B	02 hrs	30	02 hrs	10	40	50	02
VI	Theory	DSE ZOOT: 6.1A OR DSE ZOOT: 6.1B	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSE ZOOP: 6.1A OR ZOOP: 6.1B	04 hrs	60	03 hrs	10	40	50	02
	Theory	SEC-1 ZOOT: 6.2A	02 hrs	30	02 hrs	10	40	50	02
	Theory	SEC-2 ZOOT: 6.2B	02 hrs	30	02 hrs	10	40	50	02
Total						220	880	1100	44

Credit means the unit by which the course work is measured. One hour session of Lecture per week for 16 weeks amounts to 1 credit. Four hours session of Practicals per week for 16 weeks amounts to 2 credits per semester.

**I SEMESTER
PAPER DSCZOOT 1.1 : NON-CHORDATA**

Total Teaching Hours: 60 hrs

I INTRODUCTION Biodiversity and its importance, Principles of animal classification definition of species.	02 hrs
II KINGDOM PROTISTA (PROTOZOA) General characters and classification up to classes with suitable examples. Structure and life history of malarial parasite <i>Plasmodium vivax</i> .	06 hrs
III PORIFERA General characters and classification up to classes with suitable examples. Canal system in sponges.	05 hrs
IV CNIDARIA General characters and classification upto classes with suitable examples. Polymorphism in Cnidaria.	05 hrs
V PLATYHELMINTHES General characters and classification up to classes with suitable examples. Parasitic adaptation. Life history of <i>Fasciola hepatica</i> .	05 hrs
VI ASCHELMINTHES General characters and classification up to classes with suitable examples. Life history of <i>Ascaris and Wuchereria bancrofti</i> .	06 hrs
VII ANNELIDA General characters and classification upto classes with suitable examples. <i>Hirudinea</i> type study – Externals, setae, digestive system; circulatory system, nervous system, nephridia and reproductive system. Tubicolous polychaetes – <i>Sabella Chaetopterus</i> .	08 hrs
VIII IX ONYCHOPHORA Salient features of <i>Peripatus</i> and its systematic position	02 hrs
X ARTHROPODA General characters and classification up to classes with suitable examples. Collection and preservation methods of insects. Beneficial and harmful insects – Integrated Pest Management (IPM).	10 hrs
XI MOLLUSCA General Characters and classification upto classes with suitable examples. Foot and shell in mollusca.	06 hrs
XII ECHINODERMATA General Characters and classification upto classes with suitable examples. Water vascular system..	05 hrs

PRACTICAL DSCZOOP 1.1

1. Classification of each phylum upto classes with at least one suitable example.
2. Study of Leech/Cockroach- externals, digestive system, nervous system, Jaws, nephridia, ovary of Leech, Mouth parts, salivary glands, spermatheca of cockroach.
3. Mouth parts of insects permanent slides.
4. Study of protozoan culture/Vermiculture.
5. Collection and preservation methods of insects.
Collection methods: Hand picking, beating, aerial and aquatic nets, Burlese funnel and aspirator.
Trapping methods, types; light trap, sticky trap, pitfall Trap, bait, pheromone trap.
Preservation methods: Dry method (Pinning), Wet method (Liquid preservation) and microscopic preservation (Slide preservation).
Morphological Identification and Dissection of Insects:
Digestive, Circulatory, Nervous, excretory and Reproductive system.
6. Insect Culture: Media preparation for collection and culture. (*Drosophila*).
7. Field study.

SCHEME OF PRACTICAL EXAMINATION

1. Explain the system in	10
2. Protozoan culture/ Rectal parasites /nephredia/ovary/jaw/mouthparts/ salivary glands/Spermatheca	05
3. Identifications (A to E)	10
4. Field Study Report	06
5. Viva	04
6. Journal	05
Total	40

II SEMESTER
PAPER DSCZOOT 2.1 : CHORDATA

Total Teaching Hours:60hrs

I INTRODUCTION	05 hrs
General characters of the phylum and classification up to sub phyla. Hemichordata, Urochordata, Cephalochordata with suitable examples. Retrogressive metamorphosis in Urochordates.	
II VERTEBRATA	02 hrs
General characters of vertebrates and outline classification.	
III CYCLOSTOMATA	02 hrs
General organization and distribution.	
IV PISCES	06 hrs
Chondrichthies: General Characters with suitable examples. Osteichthyes: General Characters with examples. Fish migration, types of scales and fins.	
V AMPHIBIA	04 hrs
General characters and classification up to orders with suitable examples.	
VI REPTILIA	05 hrs
General characters and classification up to orders (living reptiles only) with suitable examples. Poisonous and non-poisonous snakes of India and types of venom.	
VII AVES	09 hrs
General characters and classification. Distinctive features of archaeornithes and neornithes with reference to palaeognathae (flightless birds), Impennae and Neognathae, giving suitable examples. Flight adaptations, beak and foot modifications.	
VIII MAMMALIA	15 hrs
General characters and classification up to orders. Distinctive features of prototheria and metatheria with examples (with special emphasis on monotremes and marsupials). Important characters of primates, Chiroptera, Cetacea, Perissodactyla, Artiodactyla, Carnivora, Rodentia, Lagomorpha and Pholidota with examples. Rat as type study – (muscular system excluded)	
IX OSTEOLOGY	08 hrs
Study of endoskeleton of <i>Frog</i> and <i>Rabbit</i> .	
X COMPARATIVE ANATOMY	04 hrs
Comparative account of Heart, brain.	

PRACTICAL DSCZOOT 2.1

1. Classification up to orders with at least one suitable example.
2. Study of Local fish/rat/chick (anyone) externals, Digestive system, Circulatory system, Urinogenital system and brain
3. Endoskeleton of *frog* and *rabbit*
4. Comparative anatomy of heart and brain.

FIELD ORIENTED PROJECTS:

1. Field Study is compulsory
2. Visit to Zoo/forest/sanctuaries/ national park/ surrounding area to study the animal diversity related to project i.e., study the fishes, amphibians, reptiles, birds and mammals.

SCHEME OF PRACTICAL EXAMINATION

1. Explain the system in	06
2. Comparative anatomy (anyone)	05
3. Osteology (any two)	06
4. Identify and comment on A to D	08
5. Field study trip	06
6. Viva	04
7. Journal	05
Total 40	

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SCHEME OF THEORY EXAMINATION QUESTION PAPER

B.Sc. Degree Examination Month/Year

Semester

Zoology (CBCS System)

PAPER; DSCZOOT 1.1 Name of the paper

Time: Three Hours

Maximum: 80 Marks

Instruction to Candidate

- a. Answer all the questions.
- b. Draw a neat labelled diagram wherever necessary.

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I. Answer any TEN of the following in 3-4 sentences each: **10X2 = 20**

1-12 Questions

II. Answer any SIX of the following in 10-15 sentences each : **6X5 = 30**

13-20 Questions

III. Answer the following **3X10 = 30**

21. a OR b

22. a OR b

23. a OR b

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Suggested Readings:

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. Dhama P.S. and Dhama J. K. (2000): Chordate Zoology. S. Chand & Co. Dhama P.S. and Dhama J. K. (2000): Invertebrate Zoology. S. Chand & Co.
7. Ekambaranatha Iyer M. and Anantkrishnan T. N. (1990): A manual of Zoology. Vol. I. Invertebrata (Part 1 &2). S. Vishwanathan Pvt. Ltd.
8. Ekambaranatha Iyer M. and Anantkrishnan 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. Jordan E. L. and Verma P.S. (1976): Invertebrate Zoology. S. Chand & Co.
10. Kotpal R. L. (1993): Protozoa- Echinodermata (all volumes). Rastogi Publ. Pough H (2004): Vertebrate life, VIII Edition, Pearson International.
11. Ruppert and Barnes, R.D. (2006): Invertebrate Zoology, VIII Edition. Holt Saunders International

III SEMESTER

PAPER DSCZOOT 3.1: HISTOLOGY, EVOLUTION, PALEONTOLOGY AND BIOSTATISTICS

Credits:04

Total Teaching Hours: 60 hrs

I	HISTOLOGY	20 hrs
	Study of histological structure and functions of the following mammalian organs	
	a. Tongue	
	b. Stomach	
	c. Intestine	
	d. Testis	
	e. Ovary	
	f. Liver	
	g. Islets of Langerhans	
	h. Thyroid	
	i. Kidney	
	j. Adrenal	
II	EVOLUTION	18 hrs
	Origin of earth, origin of life, theories of organic evolution. Lamarckism, <i>Darwin Wallace</i> Theory of natural selection Evidences in favor of evolution.	
	Neo-Darwinism (synthetic theory of evolution, gene mutation, gene flow, genetic drift, <i>Hardy Weinberg</i> equilibrium) concept of species Speciation, allopatric and sympatric species	
III	PALEONTOLOGY	15 hrs
	Geological time scales, fossils and fossilization. Radiometric dating – detection of age of fossils. Indian fossil sites. Mesozoic reptiles. Connecting links, living fossils, origin and evolution of man. Evolution of horse.	
IV	BIOSTATISTICS	07 hrs
	Use of statistics in life sciences, data collection, observations and variables, sampling and sampling methods, representation, tabular and graphical representations; frequency tables, line graphs, bar graphs, histograms, frequency polygon and curve and pie charts; measure of central tendency; mean; median and mode. Measures of dispersion; range, standard deviation; Standard error	

PRACTICAL DSCZOO 3.1

Total Teaching Hours : 60 hrs

1. Observation of mammalian histology slides of the organs studied in the theory paper.
2. Preparation of permanent histology slides, three slides to be submitted at the time of practical examination.
3. Evolution of man and horse (charts or models)
4. Mesozoic reptiles (charts or models)
5. Connecting links/living fossils : *Neopilina*, *peripatus*, *limulus*, *latimuria*, *sphenodon*, *archaeopteryx* and *duck billed platypus*
6. Vestigial organs
7. Biostatistics practicals
 - a. Measures of central tendency i) Obtain the mean, medium and mode, ii) Form a frequency distribution table of the data and then compute mean, median and mode.
 - b. Prepare a frequency distribution table and draw a histogram, frequency polygon and frequency curve.

SCHEME OF PRACTICAL EXAMINATION

1. Preparation of permanent histology slide	08
2. Identifications	
a. Histology – Any 4	08
b. Evolution – Any 1	02
c. Connecting links/living fossils – Any 1	02
3. Histology slide submission – 3 slides	06
4. Biostatistics	05
5. Viva	04
6. Journal	05
Total	40

IV SEMESTER
PAPER DSCZOOT 4.1: BIOCHEMISTRY AND PHYSIOLOGY

Credits: 04

Total Teaching Hours: 60 hrs

I	CARBOHYDRATES, PROTEINS and LIPIDS	09 hrs
	Definition, classification and biological significance.	
II.	ENZYMES	06 hrs
	Classification of enzymes – IUB system, mechanism of enzyme action, enzyme substrate complex, specificity of enzymes, reversibility of enzyme action, enzyme inhibitors, a brief account of coenzymes, cofactors and ions, clinical importance of enzymes	
III.	NUCLEIC ACIDS	03hrs
	Nucleotides, nucleosides, nitrogen bases, structure of nucleic acid (DNA & t-RNA).	
IV.	VITAMINS	04hrs
	Fat soluble vitamins (A, D, E and K) water soluble vitamins (B-complex and C) functions and deficiency symptoms	
V	BIOENERGETICS	04 hrs
	Concept of bioenergetics, energy yielding pathways, glycolysis, bioenergetics of glycolysis, the Kreb's cycle, bioenergetics of Kreb's cycle, the electron transportsystem, phosphorylation	
VI.	DIGESTION	03 hrs
	Mechanical digestion, chemical digestion, assimilation and absorption of proteins, carbohydrates and lipids. Hormonal regulation of enzyme secretion	
VII.	RESPIRATION	03 hrs
	External and internal respiration. Respiratory pigments, hemoglobin, hemocyanin and hemerythrin. Physiology of respiration, exchange of gases, transport of oxygen, oxygen dissociation curves, Bohr Effect, transport of carbon dioxide, chloride shift, respiratory quotient	
VIII.	CIRCULATION	03 hrs
	Types of circulation, structure, functions and regulation of human heart, blood pressure, Composition of human blood, Neurogenic and myogenic hearts	
IX.	NITROGEN EXCRETION	04 hrs
	Nitrogen excretion in aquatic terrestrial and aerial animals; ammonotelism, ureotelism and uricotelism with examples; ornithine cycle, physiology of urine formation in man	
X.	MUSCLE CONTRACTION	05 hrs
	Principal types of muscles, ultra-structure of striated muscles, role of myosin, actin, tropomyosin, troponin and actinin; Mechanism of muscle contraction and relaxation, the sliding filament theory, Chemical changes during muscle contraction, Neuromuscular junction	

XI.	NERVOUS COORDINATION Structure and conduction of nerve impulse in medullated and non-medullated nerves, synaptic transmission.	04 hrs
XII.	ENDOCRINE SYSTEM Structure and function of endocrine glands. Hypothalamo-hypophyseal Portal system. Types of hormones and their mechanism.	06hrs
XIII.	IMMUNOLOGY Type of immunity: Innate and adaptive immunity, Cell mediated and humoral mediated immunity, Haematopoiesis, Activation of adaptive immunity, Generation of antibody diversity, Vaccines and its types. AIDS: causative factors, effects and preventive measures	06 hrs

(Unit I to IV: Biochemistry; Unit V to XIII: Physiology)

PRACTICAL DSCZOOOP 4.1

Total Teaching Hours: 60 hrs

1. Biochemical tests for proteins, carbohydrates and fats.
2. Normal and abnormal constituents of urine.
3. Action of salivary amylase.
4. Preparation of haematin crystals.
5. Estimation of hemoglobin.
6. Total count (TC) differential count (DC) or RBC and WBC.
7. Blood clotting time.
8. Demonstration of blood pressure.
9. Blood typing – A, B, AB, O and Rh factors in Human blood.

SCHEME OF PRACTICAL EXAMINATION

1. Qualitative test for proteins/carbohydrates/fats	10
2. Normal/abnormal constituents of urine	05
3. Preparation of hematin crystals/clotting time/ Action of salivary amylase	06
4. Hemoglobin estimation TC/DC	10
5. Viva	04
6. Journal	05
Total	40

PAPER DSEZOOT 5.1 A V SEMESTER

PAPER DSCZOOT 5.1A: MOLECULAR CELL BIOLOGY AND DEVELOPMENTAL BIOLOGY

Credit: 04

Total Teaching Hours: 60 hrs

I	MICROSCOPY	03 hrs
	Properties of Light. Light, fluorescence, electron and phase contrast microscopes.	
II	CELL AND ITS ORGANELLES	05 hrs
	Ultra-structure of prokaryotes and eukaryotes (animals cell) molecular structure and function of Plasma membrane, endoplasmic reticulum, Golgi complex, mitochondria, lysosomes, ribosomes, nucleus and nucleolus.	
III	CHROMOSOMES	<u>03 hrs</u>
	Types of Chromosomes, heterochromatin and euchromatin, polytene chromosomes.	
IV	FLOW OF GENETIC MATERIAL AND ITS MAINTAINENCE AND REGULATION:	05 hrs
	Griffith's transformation experiment, Avery–MacLeod–McCarty experiment. Hershey – Chase experiment, Double helical structure of DNA, Messilson and Sthal semi-conservative replication, Replication in prokaryotes and eukaryotes. DNA _Transcription, Translation in prokaryotes, RNA_ RNA as genetic material, types of RNA and structure of t-RNA. Genetic code and its properties.	
IV	MITOSIS AND CELL CYCLE	04 hrs
	Stages of Mitosis, Interphase, G ₁ S and G ₂ phases, molecular events at different stages of cell cycle.	
V	MEIOSIS	04 hrs
	Phases of meiotic cycle, first meiotic division - prophase-I, leptotene, zygotene, pachytene, synaptonemal complex and recombination and diplotene, diakinesis, Mechanism of crossing over, metaphase I, anaphase I and telophase I and cytokinesis, second meiotic division, Significance of meiosis	
VI	CANCER AND CARCINOGENIC AGENTS	03 hrs
	Types of cancer, proto-oncogenes, oncogenes, carcinogenic agents, physical, chemical and biological causes and suppressor genes (RB gene, p53 gene).	
VII	INTRODUCTION TO DEVELOPMENTAL BIOLOGY	02 hrs
	Scope and theories of development biology. Gametogenesis (in detail)	
VIII	FERTILIZATION	03 hrs
	Types and mechanism of fertilization, approximation of gametes, fertilizin and antifertilizin acrosome reaction, amphimixis, Monospermic and polyspermic fertilization. Significance of fertilization.	

IX	PARTHENOGENESIS	03 hrs
	Kinds of parthenogenesis. Natural arrhenotoky, thelytoky and cyclical. Artificial parthenogenesis, significance of parthenogenesis	
X	CLEAVAGE	04 hrs
	Types of cleavage, holoblastic, meroblastic, radial and spiral types with examples	
XI	EARLY DEVELOPMENT OF FROG	05 hrs
	Structure of frog's egg, cleavage, blastula, fate maps, gastrulation, morphogenesis, notogenesis, and neurulation.	
XII	ORGANIZER PHENOMENON	05 hrs
	Definition, potencies of the dorsal lip of the blastopore of amphibian gastrula, Brachet's experiment, experiment of Spemann and Mangold, induction, chemical nature of organizer, parts of organizer, theories of organizer phenomenon	
XIII	EXTRA-EMBRYONIC MEMBRANES AND EARLY DEVELOPMENT OF CHICK	08 hrs
	Development, structure and functions of yolk sac, amnion, chorion and allantois. Structure of hen's egg, cleavage, blastula, gastrulation, origin and structure of primitive streak, structure of 18, 24, 36 and 48 hrs chick embryos	
XIV	PLACENTA	03hrs
	Yolksac placenta, allantoic placenta, structure (morphological and histological) and functions of placenta, classification of placenta with examples	
	(Unit I to VII: Cell Molecular Biology; Unit VIII to XV: Developmental Biology)	

PRACTICAL DSE ZOOP 5.1A

Credit: 04

1. Study of fixatives and stains: Preparation of formaldehyde (4 to 10%), alcohol (70 to 100%) Boin's fluid, Carnoy's fluid, borax carmine (alcoholic), eosin (alcoholic) iron hematoxylin, acetocarmine, aceto-orcien, Schiff's reagent (Feulgen method) and Giemsa's stain.
2. Observation and study of permanent slides for mitosis, meiosis and salivary gland chromosomes
3. Squash preparation of onion root tip to study stages of mitosis
4. Squash preparation of grass hopper testis/flower bud to study stages of meiosis
5. Squash preparation of salivary gland chromosomes of Drosophila
6. Stages of development of frog : the study of cleavage stages, blastula, gastrula and neurula and various stages of tadpole
7. Observation of various stages of frog development in nature
8. Study of permanent slides of chick embryo: 18 hrs, 24 hrs, 36 hrs and 48 hrs whole mounts and T, S of 18 hrs and 24 hrs chick embryos
9. Mounting of chick embryo

SCHEME OF PRACTICAL EXAMINATION

1. Composition and preparation	i. Fixative	02
	ii. Stain	02
2. Stages of mitosis/meiosis (two stages)		04
3. Squash preparation (mitosis/meiosis)		07
4. Mounting of chick embryo		08
5. Identifications, Developmental stages of frog (2) chick (2)		08
6. Viva		04
7. Journal		05
		<hr/>
	Total	40

OR
Credit: 04 **DSEZOOT: 5.1 B ETHOLOGY & APPLIED ZOOLOGY**

5.2.1: ETHOLOGY: (Unit I to VIII)

I	INTRODUCTION	04 hrs
	Definition, scope of ethology, contributions of Konrad Lorenz, Niko Tinbergen and Karl Von Frisch.	
II	TYPES OF ANIMAL BEHAVIOUR	06 hrs
	Innate behavior, taxes, reflexes, instincts and motivation, learned behavior, habituation, imprinting, conditioned reflexes and insight learning.	
III	SOCIAL ORGANIZATION IN ANIMALS	05 hrs
	Honey bees, termites and langur.s	
IV	COURTSHIP BEHAVIOUR	05 hrs
	General principles of courtship behavior with suitable examples Courtship behavior, Types of courtship behavior with suitable examples (Fiddler crab, Scorpion, Salamander, Bower bird).	
V	PARENTAL CARE	05 hrs
	Parental care in fishes, amphibians and birds with suitable examples.	
VI	NESTING BEHAVIOUR	05 hrs
	Types of Nests: Nests and nesting behavior in wasps and birds (with suitable examples).	
VII	COLORATION AND MIMICRY	05 hrs
	Definition, types of mimicry, Batesian Mullerian protective, aggressive and warning mimicry with suitable Indian examples.	

APPLIED ZOOLOGY (Unit IX to XIV)

VIII	AQUACULTURE	05 hrs
	Fresh water, brackish and marine water fish culture in India, prawn and pearl culture.	
IX	VERMICULTURE	05 hrs
	Introduction and importance of vermiculture. Different species of earthworm used in vermiculture, uses of earthworms for biodegradation of organic waste materials, earthworm as protein source, vermiculture technique.	

XII.	POULTRY SCIENCE	05 hrs
	Introduction, breeds of fowls, poultry keeping, nutritive value of egg and meat, poultry diseases.	
XIII.	DAIRY TECHNOLOGY	05 hrs
	Introduction, breeds of cattle, breeding and cattle improvement in India nutritive value of milk and milk byproducts.	
XIV	SERICULTURE	05 hrs
	Introduction, Life cycle of Bombyx mori, Rearing of silkworm (Early and Late age), Types Of montages, Harvesting of cocoons and Spinning. Diseases of silkworm and control . Measures.	

Credit : 02 PRACTICAL DSCZOOP 5.1B

1. Identification of castes in social insects.
2. Observation of courtship behavior in animals.
3. Observation of parental care in animals.
4. Observation of different types of nests and nest materials.
5. Coloration and mimicry.
6. Breeds of poultry.
7. Study of commercially important
 - a. Crustaceans
 - b. Molluscs
 - c. Fishes
8. Visit to nearby diary, poultry, bee keeping unit, vermiculture unit and termite mound for observation.

SCHEME OF PRACTICAL EXAMINATION

1.	<u>Identification</u>	20
	a. Types of Nest (any 1)	
	b. Castes in social insects (any 2)	
	c. Coloration and mimicry	
	d. Poultry breeds	
	e. Commercially important fishes, crustaceans, molluscans, freshwater fish and marine water fish (one from each)	
	f. Courtship behavior (any one)	
	g. Parental care (any one).	
2.	Project	10
3.	Viva	04
4.	Journal	05
		Total 40

Fifth Semester B.Sc. (Zoology) Skill Enhancement Course

Paper Code: SEC-1 ZOOT 5.2A
Teaching Hours: 2 H / Week
Total hours: 30

Paper Title: Immunology
Marks: Th-40+IA-10
Credits :2

Unit 1: Overview of the Immune System. Introduction to basic concepts in immunology, principles of innate and adaptive immune system	08 Hours
Unit 2: Cells and Organs of the Immune System: Haematopoiesis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system	06 Hours
Unit 3: Antigens: Basic properties of antigens, B and T cell, epitopes.	06 Hours
Unit 4: Antibodies: Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis.	06 Hours
Unit 5: Vaccines: General introduction to vaccines, Various types of vaccines; Attenuated viral and bacterial (Live) vaccines, Inactivated vaccines, Toxoid vaccines, Sub unit vaccines and Conjugate vaccines.	04 Hours

SUGGESTED READINGS

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Freeman and Company.
2. David, M., Jonathan, B., David, R. B. and Ivan R. (2006). *Immunology*, VII Edition,
3. Mosby, Elsevier Publication.
4. Abbas, K. Abul and Lechtman H. Andrew (2003.) *Cellular and Molecular Immunology*. V Edition. Saunders Publication.

Fifth Semester B.Sc. (Zoology) Skill Enhancement Course

Paper Code: SCE-2 ZOOT 5.2B

Teaching Hours: 2 H / Week

Total hours:30

Paper Title: APICULTURE

Marks: Th-40+IA-10

Credits :2

Unit 1: Biology of Bees

5hr

History, classification and biology of honey bees.

Social organization of bee colony, honey bee foraging plants.

Unit 2: Rearing of Bees

12hr

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth

Bee Pasturage

Selection of Bee species for Apiculture

Bee keeping equipment.

Methods of extraction of honey (Indigenous and Modern).

Unit 3: Diseases and Enemies

5hr

Bee diseases and enemies.

Control and preventive measures

Unit 4: Bee economy

4hr

Products of Apiculture industry and its uses (honey, bee wax, propolis),

pollen, etc.

Unit 5: Entrepreneurship in Apiculture

6hr

Bee keeping industry – recent efforts, modern methods in employing artificial

Bee hives for cross pollination in horticultural gardens.

SUGGESTED READINGS

1. Bisht D.S.-Apiculture, ICAR Publication.
2. Singh S., () Beekeeping in India, Indian council of Agricultural Research, New Delhi.
3. Prost. P.J. (1962) – Apiculture, Oxford and IBH, New Dhelli

VI SEMESTER

PAPER DSEZOOT:6.1A: GENETICS, BIOTECHNOLOGY AND NANO TECHNOLOGY Credits:04

Total Teaching Hours : 60 hrs

I	INTRODUCTION	04 hrs
	Heredity and environment, definition of genotype, phenotype, Mendel and his contributions, monohybrid and dihybrid cross.	
II	INTERACTION OF GENES	08 hrs
	Supplementary factors- 9:3:3:1 Dominant epistasis – 12:3:1 Recessive epistasis - 3:3:4 Complementary factors 9:7 Lethal gene	Example : comb pattern in fowls Example : plumage color in Leghorn and Wyandotte Example – coat color in mice Example – flower color in sweet peas Example- coat color in mice
III	MULTIPLE ALLELES	04 hrs
	Inheritance of coat color in rabbit, isoalleles – psuedoalleles and position effect, ABO blood groups in human, Rh factor	
IV	LINKING AND CROSSING OVER	04 hrs
	Linkage in Drosophila, theories of linkage, crossing over, cytological basis of crossing over, significance of crossing over, genetic map of chromosomes	
V	SEX DETERMINATION	04 hrs
	Chromosomal mechanism of sex determination, genic balance theory, gynandromorphs and intersexes. Environmental and hormonal effects on determination of sex, Amniocentesis.	
VI	SEX LINKED INHERITANCE	04 hrs
	Sex linked inheritance in Drosophila and man. Hemophilia and color blindness in man. Sex linkage in poultry. Y linked genes.	
VII	MUTATIONS	03 hrs
	Chromosomal aberrations, molecular basis of gene mutation and types.	
VIII	HUMAN GENETICS AND EUGENICS	09 hrs
	Karyotype analysis: normal male, normal female, Down's syndrome, cat cry syndrome, Turner syndrome, Klinefelter syndrome, and 21 trisomy; Common human genetic disorders, inborn errors of metabolism, albinism, phenylketonuria, alkaptonuria, sickle cell anemia, thalassemia, Huntington's chorea, Eugenics.	
IX	EXTRACHROMOSOMAL INHERITANCE	02 hrs
	Kappa particles in paramecium	

X	CONCEPT AND SCOPE OF BIOTECHNOLOGY	04 hrs
XI	Isolation of DNA, molecular cloning, gene cloning, gene library, diagnosis of hereditary diseases, DNA finger printing, PCR technique, application of biotechnology, animal cloning, transgenic animals/proteomics, genomics, human genome project.	08 hrs
XII	Introduction to nano science and nanotechnology, Types of nano-materials, nanobiotechnology in healthcare, environmental nanotechnology	06 hrs

(Unit I to X: Genetics; Unit XI: Biotechnology; Unit XII : Nanotechnology)

PRACTICAL: DSCZOOP :6.1A

Credits: 02

1. Karyotype analysis; normal male, normal female, Down's syndrome, Catcry syndrome, Tuner's syndrome, Klinefelter's syndrome, and 21 trisomy
2. Mutant forms of Drosophila
3. Genetic problems; monohybrid inheritance (3), dihybrid inheritance (3)
4. Genetic problems: multiple alleles- ABO blood groups in humans (3)
5. Genetic problems: sex linked inheritance in Drosophila (2) and man (2)
6. Calculation of allele frequency – PTC (Phenyl thio Carbamide) tongue rolling, attached earlobes

SCHEME OF PRACTICAL EXAMINATION

1. Karyotype analysis	10
2. Mutant forms of drosophila (any 2)	06
3. Genetic problem (5) Monohybrid, dihybrid, multiple alleles and sex-linked inheritance in drosophila and man	15
4. Viva	04
5. Journal	05
Total	40

OR
PAPER DSEZOOT 6.1B: ENVIRONMENTAL BIOLOGY & ZOOGEOGRAPHY AND WILDLIFE
BIOLOGY

Credit: 04

Total Teaching Hours: 60 hrs

I	INTRODUCTION	03 hrs
	Ecological spectrum, subdivisions of ecology, scope of ecology	
II	BIOGEOCHEMICAL CYCLES	06 hrs
	Principles and concepts to biogeochemical cycles. Hydrological, Carbon, Nitrogen, Oxygen, Sulphur and Phosphorus cycles	
III	ABIOTIC AND BIOTIC FACTORS	08 hrs
	Biotic factors, light, effect of light on plants and animals. Temperature; thermal stratification, cyclomorphosis. Adaptations to extreme temperatures; soil; soil organisms; water; oxygen; carbon dioxide; fire and wind	
	Biotic factors, animal relationships, mutualism, commensalism, parasitism, amensalism, predation and competition with relevant examples	
IV	HABITATS	06 hrs
	Marine habitat, zonation of the sea and ecological classification of marine biota, coastal ecology, estuarine ecology and mangroves.	
	Freshwater habitat, lentic and lotic systems. Ecological classification of fresh water animals'	
	Terrestrial habitat; a brief account of biomes	
	Ecological adaptations to marine, freshwater and terrestrial habitats	
V	POPULATION ECOLOGY	04 hrs
	Population density, natality and mortality, age distribution, population growth rate, population growth curves, biotic potential, Allee's principle and Gause's Principle	
VI	COMMUNITY ECOLOGY	06 hrs
	Community structure, ecological determinants, ecological stratification, ecotone and edge effect, ecological niches, ecological succession, climax community, alpha, beta, gamma diversity, Shanon index. Liebig's and Shelford's laws and combined concept of limiting factors	
VII	POLLUTION	06 hrs
	Air, Water, Soil Pollution, noise, visual and agricultural pollution, e-waste, solid and hazardous waste management with example. Toxicants – natural and synthetic toxicants and toxicity measurements. Global warming, acid rain, bio-accumulation, bio - magnification, eutrophication- types and its impact.	

ZOOGEOGRAPHY AND WILDLIFE BIOLOGY (Unit – VIII to XII)		
VIII	GEOGRAPHIC DISTRIBUTION OF ANIMALS	03 hrs
	Continuous and discontinuous distributions with examples, barriers of dispersal, topographic and vegetation barriers, large bodies of water as barriers, climatic barriers	
IX	ZOOGEOGRAPHY	06 hrs
	Zoogeographical realms (with subdivisions) of world, with climatic conditions and examples of characteristic fauna, a brief account of Wallace's line	
X	DISTRIBUTION OF WILD LIFE IN INDIA	04 hrs
	The Himalayan ranges, the peninsular India subregion, deccan plateau, western ghats, eastern hill chain, Aravali ranges, Indian desert, tropical rain forests, wildlife in Andaman and Nicobar Islands	
XI	WILD LIFE PROBLEMS	02 hrs
	Hunting, overharvesting, habitat destruction degradation, due to over population, and possibilities of climatic changes	
XII	WILD LIFE CONSERVATION	06 hrs
	Need for wild life conservation agencies engaged in wild life conservation. Government organization and nongovernment organizations. Wild Life Protection Act 1972, CITES: Convention on International Trade in Endangered Species of wild life flora and fauna; endangered fauna and flora of India. Red data book. Ramsar convention. CBD: convention of Biological Diversity, Project Tiger	

PRACTICAL DSCZOOP 6.1B

1. Estimation of dissolved oxygen, carbon dioxide, hardness, chloride, alkalinity and pH of waters. **Credit: 02**
2. Study of tropical pond as an ecosystem, study of fauna and flora and interaction between the various constituents using Charts
3. Study of community by quadrat method to determine frequency, density and abundance of different species present in the community, alpha diversity
4. Location of species of zoological interest on the Indian map and world map, flightless birds, Tiger, Lion, Gorilla, Hippopotamus, Rhinoceros, Dipnoi and Peripatus.
5. Location of tiger reserves, national parks, biosphere reserves, wild life sanctuaries of India on map
6. Study of threatened animals of India (by models/pictures/charts) Tiger, Lion, One horned Rhinoceros, Gaur, Golden Langur, Lion tailed monkey, Musk deer, Mouse deer, Kashmir stag, Great Indian Hornbill and Indian rock python
7. Study of biomass of consumers of a particular area by quadrat method- by determining the dry weight of living organisms – both animals and plants per unit area.
8. Study of ecological adaptations and morphological peculiarities- Hermit crab, Stick insect, Glow worm, Stinkbug, Pufferfish, Anglerfish, Exocoetes, Phrynosoma, Draco, Chameleon, and Bat

SCHEME OF PRACTICAL EXAMINATION

1. Estimation	10
2. Identification-5	10
3. Project works report on ecology/wildlife biology	10
4. Viva connected with field work report	05
5. Journal	05
Total	40

Sixth Semester B.Sc. (Zoology) Skill Enhancement Course

Paper Code: SEC-1 ZOOT 6.2 A

Paper Title: INSECT, VECTOR AND DISEASES

Teaching Hours: 2 H / Week

Marks: Th-40+IA-10

Total hours: 30

Credits : 2

Unit I: Introduction to Insects: General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts and feeding habits.	05 Hours
Unit II: Concept of Vectors: Brief introduction of Carrier and Vectors (mechanical and biological vector).	04 Hours
Unit III: Dipteran as Disease Vectors : Dipterans as important insect vectors – Mosquitoes, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Filariasis; Causes, symptoms Control of mosquitoes and Control of house fly.	10 Hours
Unit IV: Siphonaptera as Disease Vectors: Fleas as important insect vectors; Study of Flea-borne diseases – Plague, Control of fleas.	04 Hours
Unit VI: Siphunculata as Disease Vectors: Human louse (Head, Body) as important insect vectors; Study of louse-borne diseases –Typhus fever and Control of human louse.	04 Hours
Unit VII: Hemiptera as Disease Vectors Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Control and prevention measures.	03 Hours

SUGGESTED READINGS

1. Imms, A.D. (1977). *A General Text Book of Entomology*. Chapman & Hall, UK
2. Chapman, R.F. (1998). *The Insects: Structure and Function*. IV Edition, Cambridge University Press, UK
3. Pedigo L.P. (2002). *Entomology and Pest Management*. Prentice Hall Publication
4. Mathews, G. (2011). *Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases*. Wiley-Blackwell

Sixth Semester B.Sc. (Zoology) Skill Enhancement Course

Paper Code: SEC-2 ZOOT 6.2 B

Teaching Hours: 2 H / Week

Total hours:30

Paper Title: Aquarium fish keeping

Marks: Th-40+IA-10

Credits: 2

UNIT – 1

15 Hours

Introduction to Aquarium Fish Keeping: The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes.

Biology of Aquarium Fishes: Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish.

Food and feeding of Aquarium fishes: Use of live fish feed organisms. Preparation and composition of formulated fish feeds.

UNIT – 2

15 Hours

Fish Transportation: Live fish transport - Fish handling, packing and forwarding techniques.

Maintenance of Aquarium: General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a, Cottage Industry.

Aquarium design, Construction and preparation: size, shape, substrate, ornamental aquatic plants. Construction and functions of Bio-filters; aerators – accessories for fish tanks and maintenance of water quality: controlling ammonia build up, Ph.

SUGGESTED READINGS

1. Baradach, JE, JH Ryther and WO Mc Larney (1972). Aquaculture. The Farming and Husbandry of Freshwater and Marine Organisms. Wiley Interscience, New York.
2. Jameson, J.D. and R. Santhanam (1996). Manual of ornamental fisheries and farming technology. Fisheries College and Research Institute, Thoothukudi.
3. Mitchell Beazley, 1998. The complete guide to tropical aquarium fish care. Read and Consumes Book Ltd., London.
4. Jameson, J.D. Alangara Meen Valarpu (in Tamil). National Book House, New Delhi. 5. Mill Dick, 1993: Aquarium fish, DK Publ. Co, Inc. New York –USA

SCHEME OF THEORY EXAMINATION QUESTION PAPER
B.Sc Degree examination Month/Year
Semester
Zoology (CBCS System)
PAPER; DSC-ZT (code) Name of the paper

Time: Three Hours

Maximum marks; 80

Instruction to Candidates

- a) Answer all the questions
 - b) Draw a neat labeled diagram wherever necessary
-

I. Answer any TEN of the following in 3-4 sentences each 10 x2 =20
Q. 1- 12

II. Answer any SIX of the following in 10 - 15 sentences each 5 x6 =30
Q. 13- 20

III. Answer any of the following 3 x10 =30
Q. 21. a OR b.
22. a OR b
23. a OR b

The question paper should be prepared from all the units with equal weight age.

SCHEME OF THEORY EXAMINATION QUESTION PAPER

B.Sc Degree examination Month/Year

Semester

Zoology (CBCS System)

PAPER; SEC-ZT (code) Name of the paper

Time: Two Hours

Maximum marks; 40

Instruction to Candidates

a) Answer all the questions

b) Draw a neat labeled diagram wherever necessary

I. Answer any FOUR of the following in 3-4 sentences each

4 x2 = 8

Q. 1- 6

II. Answer any THREE of the following in 10 - 15 sentences each

3 x4 =12

Q. 7- 12

III. Answer any of the following

2 x10 =20

Q. 13. a OR b.

14. a OR b

The question paper should be prepared from all the units with equal weight age.