RANI CHANNAMMA UNIVERSITY BELAGAVI

THE COURSE STRUCTURE & SYLLABUS OF UNDER GRADUATE

BACHELOR OF SCIENCE

ZOOLOGY

1ST TO 6TH Semesters

w.e.f.

Academic Year 2020-21 and Onwards
Under

CHOICE BASED CREDIT SYSTEM (CBCS)

CHOICE BASED CREDIT SYSTEM [CBCS]
B.Sc. Program with Optional Subject: ZOOLOGY

(With effect from the academic year 2020-21 onwards)								
Sem	**Part**	**Paper Code**	**Title of the Paper**	**Hours/ Week**	**Marks**			**Subject Credits**
					IA	**Exam**	**Total**	
I	**Part – 1 DSC**	ZOODSCT 1.1	Animal discovery	4	20	80	100	3
		ZOODSCP 1.1	Practicals-1	3	10	40	50	1
		Total: Hours / Credits		**7**			**150**	**4**
II	**Part – 1 DSC**	ZOODSCT 2.1	Comparative anatomy and development biology of vertebrates	4	20	80	100	3
		ZOODSCP 2.1	Practicals-2	3	10	40	50	1
		Total: Hours / Credits		**7**			**150**	**4**

(With effect from the academic year 2021-22 onwards)								
Sem	**Part**	**Paper Code**	**Title of the Paper**	**Hours/ Week**	**Marks**			**Subject Credits**
					IA	**Exam**	**Total**	
III	**Part – 1 DSC**	ZOODSCT3.1	Physiology, Biochemistry and history	4	20	80	100	3
		ZOODSCP3.1	Practicals-3	3	10	40	50	1
	Part – 2 SEC	ZOOSECT3.2	Medical diagnostics	2	10	40	50	2
		Total: Hours / Credits		**9**			**200**	**6**
IV	**Part – 1 DSC**	ZOODSCT4.1	Genetics and evolutionary biology	4	20	80	100	3
		ZOODSCP4.1	Practicals-4	3	10	40	50	1
	Part – 2 SEC	ZOOSECT4.2	Aquarium fish keeping	2	10	40	50	2
		Total: Hours / Credits		**9**			**200**	**6**

(With effect from the academic year 2022-23 onwards)								
Sem	**Part**	**Paper Code**	**Title of Paper**	**Hours/ Week**	**Marks**			**Subject Credits**
					IA	**Exam**	**Total**	
V	**Part – 1 DSE**	ZOODSET 5.1	Applied zoology and Ethology	4	20	80	100	3
		ZOODSEP 5.1	Practicals-5	3	10	40	50	1
		ZOODSET 5.2A (**Elective I)**	Cell biology, Biotechnology, Biostatics and research methodology	4	20	80	100	3
		ZOODSEP 5.2A **(Elective I)**	Practicals-5A	3	10	40	50	1
		ZOODSET 5.2B **(Elective II)**	Immunology	4	20	80	100	3
		ZOODSEP 5.2B **(Elective II)**	Practicals-5B	3	10	40	50	1
	Part – 2 SEC	ZOOSECT5.3	Apiculture	3	10	40	50	2
		Total: Hours / Credits		**17**			**350**	**10**
Note: Students have to choose either Elective-I or Elective-II								
VI	**Part – 1 DSE**	ZOODSET 6.1	Reproductive biology	4	20	80	100	3
		ZOODSEP 6.1	Practicals-6	3	10	40	50	1
		ZOODSET 6.2A **(Elective III)**	Ecology, Zoogeography and wildlife conservation**.**	4	20	80	100	3
		ZOODSEP 6.2A **(Elective III)**	Practicals-6A	3	10	40	50	1
		ZOODSET 6.2B (**Elective IV)**	Insects, Vectors and Diseases	4	20	80	100	3
		ZOODSEP 6.2B (**Elective IV)**	Practicals-6B	3	10	40	50	1
	Part – 2 SEC	ZOOSECT 6.3	Apiculture	3	10	40	50	2
		Total: Hours / Credits		**17**			**350**	**10**
Note: Students have to choose either Elective-III or Elective-IV								

T: Theory, P: Practical, CC/EA: Co-curricular/Extension Activities. AECC: Ability Enhancement Compulsory Course, DSC: Discipline Specific Course. DSE: Discipline Specific Elective, SEC: Skill Enhancement Course).

Note: Duration of examinations is 03 h for 80 Marks theory and 02 h for 40 marks theory. For practicals, duration of examination is 03 h.

Schema of Evaluation for Practical Examination

	Particulars	Marks Allotted
1	**Experimental preparation involving the following ***	**30**
2	**Journal (record) assessment**	**05**
3	**Oral performance (Viva-voce)**	**05**
	Total	**40**
*	Brief description & tabulation	04
	Diagrams	04
	Preparation of required solutions and Experimental set-up	04
	Record of observation and performance of experiment	10
	Calculation including drawing graph	06
	Accuracy of result with unit	02

Question Paper pattern

First Semester B.Sc. Degree Examination, December 2020

(CBCS Scheme-2020-21: Regular)

ZOOLOGY

ZOODSCT 1.1: Animal discovery

Time: 3 Hours | Max. Marks: 80

Q. No. I. Answer any TEN of the following | 2X10= 20 Marks

1)
2)
3)
4)
5)
6)
7)
8)
9)
10)
11)
12)

Q. NO. II. Answer the following questions | 5X3=15 Marks

a)
b)
c)
OR
d)

Q. No. III. Answer the following questions | 5x3= 15 Marks

a)
b)
c)
OR
d)

Q. No. IV. Answer the following questions | 5x3=15 Marks

a)
b)
c)
OR
d)

Q. No. V. Answer the following questions | 5x3=15 Marks

a)
b)
c)
OR
d)

Question Paper pattern

First Semester B.Sc. Degree Examination, December 2020

(CBCS Scheme-2020-21: Regular)

ZOOLOGY

ZOOSECT 3.2: Title of the Paper

Time: 3 Hours Max. Marks: 40

Q. No. I. Answer any **FIVE** of the following 2X5= 20 Marks

1)

2)

3)

4)

5)

6)

Q. NO. II Answer the following questions 5X3=15 Marks

a)

b)

c)

OR

d)

Q. No. III. Answer the following questions 5x3= 15 Marks

a)

b)

c)

OR

d)

Instruction to set the DSC/DSE question paper.

- Question number 1 has 12 sub questions consisting of 3 questions from each unit. Each question carries two marks. Student has to answer any ten questions.
- Question number II are from unit I.
- Question number III are from unit II.
- Question number IV are from unit III
- Question number V are from unit IV.

Instruction to set the SEC question paper.

- Question number 1 has 6 sub questions consisting of 3 questions from each unit. Each question carries two marks. Student has to answer any five questions.
- Question number I is from unit I.
- Question number II is from unit II.

First Semester B.Sc. (Zoology)

Paper Code: ZOODSCT 1.1 **Paper Title:** Animal Diversity
Teaching Hours: 4 H / Week **Marks:** Th-80+IA-20
Total hours:60 **Credits :**3

UNIT – 1 **15 Hours**

Kingdom Protista: General characters and classification up to classes with one example for each class. locomotion in Protozoa

Phylum Porifera: General characters and classification up to classes with one example for each class. Canal System in *Sycon*

Phylum Cnidaria: General characters and classification up to classes with one example for each class. Polymorphism

Phylum Platyhelminthes: General characters and classification up to classes with one example for each class. Parasitic adaptations

Phylum Nemathelminthes: General characters and classification up to classes with one example for each class. Life history of *Ascaris.* Parasitic adaptations in roundworms

UNIT – 2 **15 Hours**

Phylum Annelida: General characters and classification up to classes with one example for each class. Metamerism in Annelida

Phylum Arthropoda: General characters and classification up to classes with one example for each class. Metamorphosis in Insects

Phylum Mollusca: General characters and classification up to classes with one example for each class. Torsion in gastropods

Phylum Echinodermata: General characters and classification up to classes with one example for each class. Water-vascular system in Asteroidea

UNIT – 3 **15 hours**

Phylyum Chordata: Characters of chordates. Differences between chordates and non-chordates. General features of Protochordata (Brief note on Hemichordata, Urochordata, Cephalochordata)

Agnatha and Gnathostomata: General features of Agnatha and Gnathostomata. Classification of cyclostomes up to classes

Pisces: General features and classification up to living orders. Scales in fihses Migration in Fishes

Amphibia: General features and classification up to living orders. Parental care in amphibians

Reptiles: General features and Classification up to living orders. Differences between poisonous and non-poisonous snakes. Snake bite and treatment

UNIT – 4 **15 Hours**

Aves: General features. Salient features of Passeriformes, Pisciformes, Columbiformes,

Mammals: General characters. Salient features of Monotremes, Marsupialia, Insectivora, Rodentia, Perissodactyla, Chirpotera, Edentata, Cetaceae and Primates with one example for each. Ear ossicles in mammals.

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
5. New Synthesis, III Edition, Blackwell Science
6. Barrington E. J. W. (1981): Invertebrate structure and Function. ELBS. Dhami P.S. and Dhami J. K.
7. (2000): Chordate Zoology. S. Chand & Co. Dhami P.S. and Dhami J. K. (2000): Invertebrate Zoology. S. Chand & Co.
8. Ekambaranatha Iyer M. and Anantakrishnan T. N. (1990): A manual of Zoology. Vol. I. Invertebrata (Part 1 &2). S. Vishwanathan Pvt. Ltd.
9. Ekambaranatha Iyer M. and Anantakrishnan T. N. (1990): A manual of Zoology. Vol. II. Chordata S. Vishwanathan Pvt. Ltd.
10. Jordan E. L. and Verma P.S. (1976): Chordate Zoology. S. Chand & Co. Jordan E. L. and Verma
11. P.S. (1976): Invertebrate Zoology. S. Chand & Co.
12. Kotpal R. L. (1993): Protozoa- Echinodermata (all volumes). Rastogi Publ. Pough H (2004): Vertebrate life, VIII Edition, Pearson International.
13. Ruppert and Barnes, R.D. (2006): Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.

First Semester B.Sc. (Zoology)

Paper Code: ZOODSCP 1.1 **Paper Title: Practicals-1**
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours: 45 **Credits :**1

ZOODSC P11-PRACTICAL-I

1. Study of the following specimens making use of permanent slides / specimens:

i. Study of unicellular and cellular grade organized animals: *Amoeba, Euglena, Paramecium and Sycon*
ii. Study of tissue grade organized animals: *Obelia, Physalia, Aurelia, Metridium,* Study of flat worms: *Planaria, Taenia solium*
iii. Study of round worms: Male and female *Ascaris lumbricoides*
iv. Study of segmented Animals: *Nereis, Pheretima, Hirudinaria,*
v. Study of animal forms with jointed appendages: *Palaemon, Cancer, Limulus, Apis,*
vi. Study of soft bodied animals: *Chiton, Dentalium, Pila, Unio, Loligo, Sepia,*
vii. Study of spiny skinned animals: *Pentaceros, Ophiura, Echinus, Cucumaria* and *Antedon*
viii. Study of Protochordates: *Balanoglossus, Herdmania, Branchiostoma*
ix. Study of Fishes: *Torpedo,Labeo, Exocoetus, Anguilla*
x. Study of Amphibians: *Ichthyophis, Salamandra, Bufo, Hyla*
xi. Study of Reptiles: *Chelone, Chamaeleon, Draco, Vipera, Naja*
xii. Study of Birds: *Duck, Cuccoo, Wood pecker, Kingfisher, Owl, Peacock*
xiii. Study of Mammals: *Duck billed platypus, Manis, Bat, Loris*

2. Mounting of setae, blood glands, nephridia in Earthworm
(Collect the dead worms from vermicompost pits of farmers and preserve)
3. Mounting of mouth parts of honeybee, cockroach, housefly,mosquitoes
4. Mounting of brain in fowl / rat (collect dead fowl / rat heads and preserve)
5. Study tour / field visit: Compulsory tour / visit to understand faunaldiversity

SUGGESTED READINGS

1. Ruppert and Barnes, R.D. (2006): Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002): *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science
3. Young, J. Z. (2004): *The Life of Vertebrates*. III Edition. Oxford university press.
4. Pough H (2006): *Vertebrate life*, VIII Edition, Pearson International.
5. Hall B.K. and Hallgrimsson B. (2008): Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
6. P. S. Dhami and J. K Dhami (2000): Practical Zoology S. Chand and Co, New Delhi

Second Semester B.Sc. (Zoology)

Paper Code: ZOODSCT 2.1 **Paper Title:** Anatomy and Developmental Biology of Vertebrates

Teaching Hours: 4 H / Week **Marks:** Th-80+IA-20

Total hours:60 **Credits :**3

UNIT – 1 15 Hours

Integument in different classes of chordates: (fishes, amphibian, reptilian, aves and Mammalia)

Skeletal System (Girdles): Pectoral girdle and pelvic girdle in Frog, Varanus, Fowl and Rabbit

Digestive System: Brief account of alimentary canal (digestive tract) of different vertebrates

UNIT - 2 15 Hours

Respiratory System: Brief account of gills, lungs, trachea and air sacs in vertebrates

Circulatory System: Comparative account of heart in different vertebrates

Nervous System: Comparative account of brain in different vertebrates

UNIT - 3 15 Hours

Early Embryonic Development: Gametogenesis (Spermatogenesis and oogenesis), Fertilization, Types of Eggs and Patterns of Cleavage, Types of Eggs and Patterns of Cleavage, Placenta types, functions and structure

UNIT - 4 15 Hours

Early Development: Frog development up to Gastrulation. Organizer phenomenon. Development of chick (Fertilization, structure of egg, cleavage, blastulation), 24 hours, 36 hours and 48 hours chick embryo. Human Development – up to implantation

Suggested Readings:

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

Second Semester B.Sc. (Zoology)

Paper Code: ZOODSCT 2.1 **Paper Title:** Practicals-2
Teaching Hours: 3H / Week **Marks:** Th-40+IA-10
Total hours: 45 **Credits :**1

1. Osteology: Disarticulated skeleton of frog and rabbit
2. Comparative study of girdles: Pectoral girdle and pelvic girdle in Frog, Varanus, Fowl and Rabbit
3. Comparative account of heart in different vertebrates
4. Comparative account of brain in different vertebrates
5. Embryology: Study of developmental stages – Whole mounts and sections through permanent slides, specimens: cleavage stages, blastula, gastrula
6. Chick embryo mounting (24-hour, 36-hour, 48hour)

SUGGESTED READINGS

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

Third Semester B.Sc. (Zoology)

Paper Code: ZOODSCT 3.1 **Paper Title:** Physiology, Biochemistry and Histology
Teaching Hours: 4 H / Week **Marks:** Th-80+IA-20
Total hours:60 **Credits :**3

UNIT – 1 15 Hours

Digestion: Physiology of digestion. Absorption of carbohydrates, proteins and lipids Concept of balanced diet

Respiration: Pulmonary ventilation, Transport of Oxygen and carbon dioxide in blood. Chloride shift, Respiratory pigments

Excretion: Structure of Nephron, Mechanism of Urine formation, Ornithine cycle, Counter-current Mechanism

UNIT - 2 15 Hours

Circulation Composition of blood, Hemostasis, Structure of Heart. Types of Hearts - Neurogenic and Myogenic heart., Origin and conduction of the cardiac impulse. Cardiac cycle. Blood pressure. Carbohydrate Metabolism: Glycolysis, Krebs Cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Electron transport chain

UNIT - 3 15 Hours

Lipid Metabolism: Biosynthesis and β oxidation of palmitic acid

Protein metabolism: Transamination and Deamination

Enzymes: Introduction, Mechanism of action, Enzyme inhibitors, specificity of Enzymes, reversibility of enzymes action and Enzyme inhibitors. Brief account of coenzymes and cofactors. Clinical importance of enzymes**.**

UNIT - 4 15 Hours

Nerve and muscle: Structure of a neuron, resting membrane potential, Origin of Action potential and its propagation in myelinated fibre, Ultra-structure of skeletal muscle, Sliding filament theory of muscle contraction, neuromuscular junction, neurotransmitters

Histology: Histological details of the organs - Salivary gland, pancreas, liver, kidney, adrenal, testis and ovary

Suggested readings:

1. Essentials of Animal Physiology By Rastogi S C. New Age International Publishers, New Delhi
2. Animal Physiology By Nigam H C. Vishal Publishing Co. New Delhi
3. Animal Physiology By P S Verma, V K Agarwal and B S Tyagi. S Chand & Company Ltd, New Delhi
4. Lehninger Principles of Biochemistry By Nelson D L Publisher: W H Freeman & Co Biochemistry By Mathews Van Holde Publsiher. Ahren Pearson Education
5. Animal Physiology by Schmidt Nielson Cambridge University Publications Introduction to Histology By Gauba R K Tata Mc Graw Hill New Delhi
6. Cells and Tissues: Introduction to Histology By N D Cells and Rogers. A W Academic Press
7. Basic medical Histology: Biology of cells, tissues and organs By Kessel Richard G Oxford University Press
8. Text Book of Histology By Bloom and Fawcett. Saunders Publishers Philadelphia
9. Bailey's Text Book of Histology By W M Copenhaver, R P Bunge and Mary B Bunge. Willims and Wilkins Company, Baltimore

Third Semester B.Sc. (Zoology)

Paper Code: ZOODSCP 3.1 **Paper Title:** Practicals-3
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours: 45 **Credits :**1

ZOODSC P31: PRACTICAL-III **60 Hours**

1. Preparation of hemin crystals
2. Study of permanent histological sections of mammalian Salivary gland, pancreas, liver, kidney, adrenal gland, testis and ovary
3. Qualitative tests for carbohydrates in given solutions (Glucose, Sucrose and Starch)
4. Qualitative tests for proteins and lipids in given solutions
5. Study of activity of salivary amylase under optimum conditions
6. Preparation of permanent histological slides

SUGGESTED READINGS

1. Tortora, G.J. and Derrickson, B.H. (2009). *Principles of Anatomy and Physiology*, XII Edition, John Wiley & Sons, Inc.
2. Widmaier, E.P., Raff, H. and Strang, K.T. (2008) *Vander's Human Physiology*, XI Edition., McGrawHill
3. Guyton, A.C. and Hall, J.E. (2011). T*extbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
4. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). *Biochemistry*. VI Edition. W.H Freeman and Co.
5. Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). *Principles of Biochemistry*.
6. IV Edition. W.H. Freeman and Co.
7. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). *Harper's Illustrated Biochemistry*. XXVIII Edition. Lange Medical Books/McGraw3Hill.

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

Paper Code: ZOOSEC 3.2 **Paper Title:** Medical Diagnostics
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours: 30 **Credits :**2

UNIT – 1

Introduction to Medical Diagnostics and its Importance **Diagnostic methods used for analysis of blood:** Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R)
Diagnostic Methods Used for Urine Analysis: Urine Analysis: Physical characteristics; Normal and abnormal constituents

UNIT – 2
Non-infectious Diseases: Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit
Infectious Diseases: Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis
Tumours: Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone, fracture, PET, MRI and CT Scan (using photographs).
Syndrome: AIDS – causes, symptoms, prevention

SUGGESTED READINGS

1. Park, K. (2007), *Preventive and Social Medicine*, B.B. Publishers
2. Godkar P.B. and Godkar D.P. *Textbook of Medical Laboratory Technology*, II. Edition, Bhalani Publishing House
3. Cheesbrough M., *A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses*
4. Guyton A.C. and Hall J.E. T*extbook of Medical Physiology*, Saunders
5. Robbins and Cortan, *Pathologic Basis of Disease*, VIIIEdition, Saunders
6. Prakash, G. (2012), *Lab Manual on Blood Analysis and Medical Diagnostics*, S. Chand and Co. Ltd.

Fourth Semester B.Sc. (Zoology)

Paper Code: ZOODSCT 4.1 **Paper Title:** Genetics and Evolutionary Biology
Teaching Hours: 4 H / Week **Marks:** Th-80+IA-20
Total hours: 60 **Credits :**3

UNIT – 1 15 **Hours**

Introduction to Genetics: Mendel and his contribution. Monohybrid, Dihybrid cross (Laws). Definition of genetics terminologies. Genetic Variation, Molecular basis of Genetic Information

Mendelian Genetics: Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, sex linked inheritance

Chromosomes: Normal and giant chromosomes (salivary gland & lampbrush)

Linkage, Crossing Over and Chromosomal Mapping: Linkage and crossing over, Recombination frequency as a measure of linkage intensity. Somatic cell genetics – an alternative approach to gene mapping

UNIT – 2 15 Hours

Mutations: Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations

Sex Determination: Chromosomal mechanisms, dosage compensation

Introduction to Evolutionary Theories: Lamarckism, Darwinism, Neo-Darwinism

UNIT – 3 15 Hours

Origin of Life: origin of life and its theories

Evidences in favor of organic evolution: Fossilization, Types of fossils. Dating of fossils. Evolution of man. Morphological and paleontological evidences in favour of evolution

Processes of Evolutionary Change: Organic variations, Isolating Mechanisms; Natural selection (Example: Industrial melanism). Artificial selection

UNIT – 4 15 Hours

Species Concept: Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric and Sympatric)

Macro-evolution: Macro-evolutionary Principles (example: Darwin's Finches)

Direct Evidences of Evolution: Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse

Suggested readings

1. Principles of Genetics By Gardner Eldon John, Michael J Simmons and Peter Snustad John Wiley & Sons, Inc. NewYork
2. Genetics By Kavita B Ahluwalia. Wiley Eastern Ltd, New Age International Ltd, NewDelhi
3. A text book of Genetics By H S Bhamrah and C M Chaturvedi. Anmol Publications Pvt. Ltd. NewDelhi
4. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology By Dr P S Verma and Dr V K Agarwal. S Chand & Company Pvt. Ltd. NewDelhi
5. Genetics: A survey of the principles of Heredity By A M Winchester Oxford and IBH
6. Principles of Molecular Genetics By S Sundara Rajan. Anmol Publications Pvt. Ltd
7. Genetics By P S Verma and V K Agarwal. S Chand & Company Pvt. Ltd. New Delhi
8. Principles of Genetics By Edmund W Sinnott, L C Dunn and T Dobzhanksy. Tata McGraw Hill Publishing Company, NewDelhi
9. Genetics By Monroe W Strickberger. Prentice Hall of India Pvt. Ltd, New Delhi

Fourth Semester B.Sc. (Zoology)

Paper Code: ZOODSCP 4.1 **Paper Title:** Practicals-4
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours:45 **Credits :**1

Genetics and Evolutionary Biology

1. Study of Mendelian Inheritance and gene interactions (Non-Mendelian Inheritance) using suitable examples.
2. Study of Linkage, recombination
3. Study of Human Karyotypes (normal and abnormal)
4. Study of fossil (Use models and pictures)
5. Study of homology and analogy from suitable specimens /pictures
6. a) Evolution of horse with diagrams and b) Darwin's Finches with diagrams / cut outs of beaks of different species
7. Preparation of salivary gland chromosomes
8. Compulsory visit and submission of report

SUGGESTED READINGS

1. Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons
2. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings.
3. Russell, P. J. (2009). *Genetics- A Molecular Approach.* III Edition. Benjamin Cummings.
4. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
5. Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
6. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H.(2007)
7. *Evolution*. Cold Spring, Harbour Laboratory Press.
8. Hall, B. K. and Hallgrimsson, B. *Evolution*. IV Edition. Jones and Bartlett Publishers
9. Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.

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

Paper Code: ZOOSEC 4.2 **Paper Title**: Aquarium fish keeping
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours:30 **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

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

Fifth Semester B.Sc. (Zoology)

Paper Code: ZOODSET 5.1 **Paper Title:** Applied Zoology & Ethology
Teaching Hours: 4 H / Week **Marks:** Th-80+IA-20
Total hours:60 **Credits :**3

UNIT – 1 **15 Hours**

Vermitechnology: Species of Earthworms used in vermitechnology, Vermiculture technique and importance of vermiculture Brief account of Vermicompost, vermiwash and vermicast
Aquaculture: *Prawn fisheries*: Species of prawns, culture of freshwater and marine prawns, preservation and processing of prawns
***Pearl culture*:** Pearl producing molluscans, pearl formation, pearl producing sites in India. Quality and composition of pearl industry: Artificial insertion of nucleus
***Pisciculture*:** Brief technique of fish culture, Composite fish culture, Preservation of fishes and their by-products

UNIT - 2 **15 Hours**

Animal husbandry: *Poultry*: Breeds of fowl, diseases of poultry, maintenance of poultry farm, Backyard and Cage system of rearing Composition of egg and nutritive value of egg
***Dairy technology*:** Cattle and Buffalo breeds (both exotic and indigenous), Diseases of cattle and buffaloes. Products and byproducts. Composition of milk and nutritive value of cow milk
Parasites: Life history of Entamoeba, Plasmodium, Trypanosoma, Ascaris, Wuchereria
Insects of economic importance: Economic importance of Honey bees & silkworms

UNIT – 3 **15 Hours**

Introduction to Host-parasite Relationship: Host, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism
Epidemiology of Diseases: Transmission, Prevention and control of diseases: Tuberculosis, typhoid
Lac culture: Classification and life history of Lac insect (Techardia lacca). Host plants, cultivation of Lac, composition, properties and economic importance

UNIT – 4 **15 Hours**

Ethology: Introduction, scope, contributions of Lorenz, Tinbergen and Karl Von Frisch
Types of animal behaviour: (1) Innate Behaviour: Taxes, Reflexes, Instincts and Motivation. (2) Learned Behaviour: Habituation, Imprinting, Conditioned, Reflexes and Insight learning (3) Social behaviour: Types of animal society and colony in Honey Bees and Monkey troops (4) Territoriality & Courtship Behaviour in Scorpion, Stickle Back Fish and Peacock (5) Study of nesting behavior and mimicry in animal (6) Biological clock, Circadian rhythm and Chronobiology
***Animal communication*:** Chemical, Visual and Audio. Functions of Signals odors, sounds and light
Parental care: Concepts, Parental care in Fishes, Amphibians and Birds

Fifth Semester B.Sc. (Zoology)

Paper Code: ZOODSEP 5.1 **Paper Title:** Practicals-5
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours:45 **Credits :**1

1. Study of Plasmodium, Entamoeba, Trypanosoma, Ancylostoma and Wuchereria and their life stages through permanent slides / photomicrographs or specimens
2. Study of arthropod vectors associated with human diseases: Culex, Anopheles, Aedes
3. Study of poultry breeds
4. Study of different species of earthworms, prawns, pearls, fishes
5. Study of Cattle and buffalo breeds
6. Visit to poultry farm or animal breeding center. Submission of visit report

SUGGESTED READINGS

1. Park, K. (2007). Preventive and Social Medicine. XVI Edition. B.B Publishers
2. Arora, D. R and Arora, B. (2001). Medical Parasitology. II Edition. CBS Publications and Distributors
3. Kumar and Corton. Pathological Basis of Diseases
4. Atwal, A.S. (1986). Agricultural Pests of India and South East Asia, Kalyani Publishers
5. Dennis, H. (2009). Agricultural Entomology. Timber Press
6. Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher
7. Dunham R.A. (2004). Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K
8. Pedigo, L.P. (2002). Entomology and Pest Management, Prentice Hall.

Fifth Semester B.Sc. (Zoology)

Paper Code: ZOODSET 5.2A **Paper Title:** Cell Biology, Biotechnology, Biostatistics & Research Methodology

Teaching Hours: 4 H / Week **Marks:** Th-80+IA-20

Total hours:60 **Credits :**3

UNIT – 1 **5 Hours**

Cell Biology: Ultra structure of animal cell, Cell theory & cell cycle

Ultra-Structure & function of cell organelles: Plasma membrane, Endoplasmic reticulum, Ribosome's, Golgi-complex, Lysosomes, Mitochondria and Nucleus

Chromosomes: Structure and types of chromosomes. Ultra-structure of chromosome

Cell division: Types and significance: mitosis and meiosis

UNIT – 2 **15 Hours**

Cell Biology (continued)Cellular aging and cell death: Concept of aging theories, effect of aging on cell organelles. Apoptosis, Necrosis : Definition and significance

Cancer Biology: Introduction, Characteristics of cancer cells. Carcinogens, cause & Prevention.

Biotechnology: Introduction: Sub-fields of biotechnology history of Biotechnology Scenario in India

Types of Biotechnology: Animal Biotechnology. Plant Biotechnology Microbial Biotechnology. Environmental Biotechnology Medical Biotechnology

Molecular biotechnology Genetic engineering, isolation of DNA, Gene cloning Vectors, Restriction enzymes - Polymerase Chain Reaction (PCR) DNA finger printing

UNIT – 3 **15 Hours**

Applications of Biotechnology: *Agricultural application:* Improvements in crop yield. *Industrial application:* Ethanol production, Food processing, Food fermentors and Industrial enzymes. *Environmental Applications:* Cleaning up of environmental pollutants, Bioremediation. *Medical Applications:* Gene testing, Gene therapy, Drug discovery Diagnosis of inherited disorders, personal identification.

Biostatistics: Fundamentals of Biostatistics, Preliminary Concepts. Frequency distribution. Graphical presentation of Data. Measures of Central Tendency- Mean, Median and Mode. Measures of variation. Probability. Chi-Square Test

UNIT – 4 **15 Hours**

Research Methodology

Foundations of Research: Meaning, Objectives, Motivation: Research Methods *vs* Methodology, Types of Research: Analytical *vs* Descriptive, Quantitative *vs* Qualitative, Basic *vs* Applied

Research design: Need for research design: Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation. Developing a research plan: Problem identification, Experimentation, Determining experimental designs

Data collection, analysis and report writing: Observation and Collection of Data, Methods of data collection. Sampling Methods, Data Processing. A brief idea of report writing. Data Presentation using digital technology

SUGGESTED READINGS

1. Julio Celis Nigel Carter Kai Simons J. Small Tony Hunter David Shotton, Cell Biology (3rd edition). Academic Press
2. Verma P.S. (Author), Agarwal (2004): Cell Biology, Genetics, Molecular Biology, Evolution & Ecology. S Chand publisher
3. N Arumugam (2014): Cell Biology & Molecular Biology. Saras publications
4. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.
5. Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA.
6. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.
7. Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.
8. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA Genes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y., USA.
9. B K Mahajan: Methods in Biostatistics for Research Workers
10. K Visweswara Rao: Biostatistics a Manual of Statistical Methods for Use in Health Nutrition and Anthropology
11. Anthony, M, Graziano, A.M. and Raulin, M.L. 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
12. Walliman, N. 2011. Research Methods- The Basics. Taylor and Francis, London, New York.
13. Wadhera, B.L.: Law Relating to Patents, Trade Marks, Copyright Designs and Geographical Indications, 2002, Universal Law publishing.
14. C.R. Kothari: Research Methodology, New Age International, 2009.
15. Coley, S.M. and Scheinberg, C.A. 1990, “Proposal writing”. Stage Publications.

Fifth Semester B.Sc. (Zoology)

Paper Code: ZOODSEP 5.2A **Paper Title:** Practicals-5A
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours:45 **Credits :**1

1) Study of permanent cytology slides of Mitosis & Meiosis
2) Study of temporary preparation of Mitotic stages from onion root tip cells
3) Study of temporary preparation of Meiotic stages from onion flower bud / Grass hopper testis.
4) Study of Paper Chromatography
5) To form frequency distribution table & draw histogram, frequency polygon & frequency curve
6) Measurement of central tendency (range, mean, mode and median)
7) Isolation of DNA / RNA
8) Make a data collection of any fauna found nearby the campus, prepare a mini-dissertation report

Fifth Semester B.Sc. (Zoology)

Paper Code: ZOOSEC 5.2B **Paper Title:** Immunology
Teaching Hours: 4 H / Week **Marks:** Th-80+IA-20
Total hours: 60 **Credits :**3

Unit 1: 15 Hours

Overview of the Immune System: Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system

Cells and Organs of the Immune System: Haematopoeisis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system

Unit 2: **15 Hours**

Antigens: Basic properties of antigens, B and T cell epitopes, haptens and adjuvants

Antibodies: Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis

Unit 3: **15 Hours**

Working of the immune system: Structure and functions of MHC, exogenous and endogenous pathways of antigen presentation and processing, Basic properties and functions of cytokines, Complement system: Components and pathways.

Unit 4: **15 Hours**

Immune system in health and disease: Gell and Coombs' classification and brief description of various types of hypersensitivities, Introduction to concepts of autoimmunity and immunodeficiency.

Vaccines: General introduction to vaccines, Various types of vaccines 015

Fifth Semester B.Sc. (Zoology)

Paper Code: ZOODSEP 5.2B **Paper Title:** Practicals-5B
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours:45 **Credits :**1

ZOODSE P52B: PRACTICAL **60 Hours**

1. Demonstration of lymphoid organs

2. Histological study of spleen, thymus and lymph nodes through slides/ photographs

3. Preparation of stained blood film to study various types of blood cells.

4. Ouchterlony's double immuno-diffusion method.

5. ABO blood group determination.

6. Cell counting and viability test from splenocytes of farm bred animals/cell lines.

7. Demonstration of a) ELISA b) Immunoelectrophoresis

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.

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

Paper Code: ZOOSEC 5.3 **Paper Title:** Immunology
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours:30 **Credits :**2

UNIT – 1

Biology of Bees: Classification and Biology of Honey Bees, Social Organization of Bee Colony

Rearing of Bees: Artificial Bee rearing, Beehives, Selection of Bee Species for Apiculture, Bee Keeping Equipment, Methods of Extraction of Honey (Indigenous and Modern)

Significance of apiculture

UNIT – 2

Diseases and Enemies: Bee Diseases and Enemies, Control and Preventive measures

Bee Economy: Byproducts of Apiculture (Honey and Bees Wax), Apiculture industry and its Uses

Entrepreneurship in Apiculture: Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial, Beehives for cross pollination in horticultural gardens

SUGGESTED READINGS

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

Sixth Semester B.Sc. (Zoology)

Paper Code: ZOODSET 6.1 **Paper Title:** Reproductive Biology
Teaching Hours: 4 H / Week **Marks:** Th-80+IA-20
Total hours:60 **Credits :**3

Unit 1: **15 Hours**

Reproductive Endocrinology: Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophins, secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia

Unit 2: **15 Hours**

Functional anatomy of male reproduction: Outline and histological of male reproductive system in rat and human; Testis: Cellular functions, germ cell, system cell renewal; Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract

Unit 3: **15 Hours**

Functional anatomy of female reproduction: Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation

Unit 4: **15 Hours**

Reproductive Health: Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning

Sixth Semester B.Sc. (Zoology)

Paper Code: ZOODSEP 6.1 **Paper Title:** Practicals-6
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours: 45 **Credits :**1

1. Study of animal house: set up and maintenance of animal house, breeding techniques, care of normal and experimental animals.
2. Examination of vaginal smear rats from live animals.
3. Surgical techniques: principles of surgery in endocrinology. Ovarectomy, hysterectorny, castration and vasectomy in rats.
4. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
5. Sperm count and sperm motility in rat
6. Study of modern contraceptive devices
7. Visit to animal house to study breeding techniques

SUGGESTED READINGS

1. Austin, C.R. and Short, R.V. reproduction in Mammals. Cambridge University Press.
2. Degroot, L.J. and Jameson, J.L. (eds). Endocrinology. W.B. Saunders and Company.
3. Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd.
4. Hatcher, R.A. et al. The Essentials of Contraceptive Technology. Population Information Programme.

Sixth Semester B.Sc. (Zoology)

Paper Code: ZOODSET 6.2A **Paper Title:** Ecology, Zoogeography and Wildlife Conservation

Teaching Hours: 4 H / Week **Marks:** Th-80+IA-20

Total hours:60 **Credits :**3

UNIT-I **15Hours**

Ecology: (Part – A)

Earth as living planet, sub divisions of ecology, scope of ecology, biosphere

Abiotic factors: Lightand Temperature (effect on animals and plants)

Biotic Factor: Mutualism, commensalism, amensialism, parasitism, predation, competition and parasitism

Biogeochemical cycles: Principles and concepts of water, nitrogen, carbon, oxygen cycles

Community ecology: Community structure, ecological niches, edge effect, stratification, ecotone

UNIT-II **15 Hours**

Ecology: (Part – B)

Habitats: *Freshwater* habitat Lotic and Lentic systems. *Zonation of Sea*, Marine Biota, *Esturine* ecology, *Mangrooves*. *Terrestrial* habitat: A brief account of Biomes. Ecological Adaptations of Freshwater, Marine and Terrestrial fauna. Ecological Adaptations of Freshwater, Marine and Terrestrial animals

Population ecology: Density, natality, mortality, age distribution, population growth, types and curves

UNIT-III **15 hours**

Zoogeography: Zoogeographical realms of world, a brief account of Wallace's line, means of dispersal, factors affecting the dispersal of animals, continental drift theory, types of distribution of animals, island life, insular fauna, new world marsupials

UNIT-IV **15 hours**

Wildlife and its Conservation: Wildlife conservation methods, Wildlife in India, Causes for the depletion of wildlife, Wildlife conservation techniques, methods and measures. Brief account of: IUCN, WWF, Bombay Natural History Society, Indian Board for Wild Life, Red Data Book. Wild Life Act 1972 and its amendments in India, CITES. Project Tiger and Biosphere Reserve. Management of protect areas, Conservation of wetlands, Wildlife ecotourism

Suggested readings

	Title of the Book	Author (s)	Publisher(s)
1	Ecology	Mohan P Arora	Himalaya Publishing House, Mumbai
2	Ecology	Eugene P Odum	Oxford and IBH Publishing Co. New Delhi
3	Concepts of Ecology	R L Kotpal and N P Bali	Vishal Publishing Co. Jalandhar City
4	Concepts of Ecology	N Arumugam	Saras Publications, Nagercoil, Tamilnadu
5	Ecology and environment	P D Sharma	Rastogi publications, Meerut
6	Fundamentals of Environmental Biology	S Arora	Kalyani Publishers, New Delhi
7	Essentials of Ecology and Environmental Science	S V S Rana	PHI Learning Private Ltd. Delhi
8	Elements of Animal Ecology and Zoogeography	R Nagabhushanam	Emkay Publications, Delhi
9	Basics of Ecology	Nirmal Chandra Pradhan	Anmol Publications Pvt. Ltd, New Delhi
10	Fundamentals of Ecology	M C Dash	Tata Mc Graw Hill New Delhi
11	Concepts of Ecology	Edward J Kormonty	Pearson - Prentice Hall - Dorling, Kindorsley (India) Pvt. Ltd,Licencees in South Asia
12	Evolution: Process and Product	Edwrad O Dodson	Reiuhold Publishing Corporation, New York
13	Evolution	Ruth Moore	Time Incorported, New York
14	The origin of species by means of natural selection	Charles Darwin	Surjeet Publications, Delhi
15	Principles of organic evolution	T S Gopalkrishnari, Itta Sambasivaiah and A P Kamalakar Rao	Himalaya Publishing House, Mumbai
16	Introduction to Evolution	Paul Amos Moody	Kalyani Publishers, New Delhi
17	Environmental Economics: A text book	M Karpagam	Sterling Publishers Pvt. Ltd, New Delhi
18	A text book of Environmental Chemistry	A K de	Wiley Eastern Limited New Delhi
19	Wildlife wealth in India (Resources and Management)	Majupuria Trilok Chandra	Teepress Service, L.P Bangkok, Thailand

Fifth Semester B.Sc. (Zoology)

Paper Code: ZOODSEP 6.2A **Paper Title:** Practicals-6A
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours:45 **Credits :**1

1. Study of threatened animals of India (Tiger, Lion, Single horned Rhinoceros, Musk deer, Gaur, Golden Langur, Lion tailed monkey)
2. Estimation of CO_2 from different water samples
3. Estimation of dissolved oxygen from different water samples
4. Estimation of total hardness
5. Study of Ecological Adaptations and Morphological peculiarities: Examples" Hermit crab, Draco, Stick insect, Puffer fish, Exocetus, Phrynosoma, Chameleon and Bat.
6. Marking of existing Project tiger areas and Biosphere reserves in Indian map
7. Spotting of the endangered animals conserved in protected areas of Karnataka state (using Karnataka map)
8. Marking of National parks in Karnataka map
9. Marking of Wildlife sanctuaries in Karnataka map
10. Visit to nearby locality or forest to study the ecosystem

Sixth Semester B.Sc. (Zoology)

Paper Code: ZOODSET 6.2B **Paper Title:** Insect, Vectors and Diseases
Teaching Hours: 4 H / Week **Marks:** Th-80+IA-20
Total hours:60 **Credits :**3

Unit I: **Hours 15**

Introduction to Insects: General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits

Concept of Vectors: Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

Unit II: **Hours 15**

Insects as Vectors: Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Dipteran as Disease Vectors : Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly Study of house fly as important mechanical vector, Myiasis, Control of house fly

Unit III: **Hours 15**

Siphonaptera as Disease Vectors: Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas

Siphunculata as Disease Vectors: Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

Unit VI: **Hours 15**

Hempitera as Disease Vectors

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as

mechanical vectors, Control and prevention measures

Sixth Semester B.Sc. (Zoology)

Paper Code: ZOODSEP 6.2B **Paper Title:** Practicals-6B
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours: 45 **Credits:** 1

1. Study of different kinds of mouth parts of insects

2. Study of following insect vectors through permanent slides/ photographs: *Aedes, Culex, Anopheles, Pediculus humanus capitis, Pediculus humanus corporis, Phithirus pubis, Xenopsylla cheopis, Cimex lectularius, Phlebotomus argentipes, Musca domestica,* through permanent slides/ Photographs
3. Study of different diseases transmitted by above insect vectors

Submission of a project report on any one of the insect vectors and disease transmitted

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: ZOOSEC 6.3 **Paper Title:** SERICULTURE
Teaching Hours: 3 H / Week **Marks:** Th-40+IA-10
Total hours: 30 **Credits :**2

UNIT – 1 **Hours 15**

Introduction: Sericulture: Introduction and present status, Types of silkworms, Distribution and Races, Mulberry and non-mulberry Sericulture

Biology of Silkworm: Life cycle of *Bombyx mori,* Structure of silk gland and secretion of silk

Rearing of Silkworms and reeling of silk: *PART A*: Selection of mulberry variety and establishment of mulberry garden, Rearing house and rearing appliances. Disinfectants: Formalin, bleaching powder

UNIT – 2

Rearing of Silkworms and reeling of silk: *PART B*: Silkworm rearing technology: Early age and Late age rearing Types of mountages, Spinning, harvesting and storage of cocoons. Silkworm reeling techniques

Pests and Diseases: Pests of silkworm: Uzi fly and dermestid beetles, Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial, Control and prevention of pests and diseases

Entrepreneurship in Sericulture: Prospectus of Sericulture in India: Sericulture industry in different states, employment opportunities. Visit to various sericulture centres.

SUGGESTED READINGS

1. Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
2. Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
3. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan
4. Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore
5. Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome
6. A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore
7. Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore

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