

Karnatak University, Dharwad

Subject: Zoology

Semester	Type of Course	Course Code	Instruction hour / week (hrs)	Total hours of Syllabus / Semester	Duration of Exam (hrs)	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC-5: Molecular Biology, Bioinstrumentation and Techniques in Biology (Theory) - V	033ZOO011	04	56	02	40	60	100	04
	DSCC-6: Molecular Biology, Bioinstrumentation and Techniques in Biology (Practical) -VI	033ZOO012	04	52	03	25	25	50	02
	OEC- 3 Endocrinology	003ZOO051	03	42	02	40	60	100	03
IV	DSCC -7: Gene Technology, Immunology and Computational Biology (Theory) - VII	034ZOO011	04	56	02	40	60	100	04
	DSCC -8: Gene Technology, Immunology and Computational Biology (Practical) - VIII	034ZOO012	04	52	03	25	25	50	02
	OEC- 4: Animal Behaviour	004ZOO051	03	42	02	40	60	100	03
Details of the other semesters will be given later									

Programme Outcome (PO)

After the completion of 03/ 04 years Degree in Zoology, students will be able to:

PO 1: Students gain knowledge and skill in the fundamentals of animal sciences, understands the complex interactions among various living organisms

PO 2: Analyze complex interactions among the various animals of different phyla, their distribution and their relationship with the environment

PO 3: Apply the knowledge of internal structure of cell, its functions in control of various metabolic functions of organisms

PO 4: Understands the complex evolutionary processes and behaviour of animals

PO 5: Correlates the physiological processes of animals and relationship of organ systems

- PO 6:** Understanding of environmental conservation processes and its importance, pollution control and biodiversity and protection of endangered species
- PO 7:** Gain knowledge of agro based small scale industries like sericulture, fish farming, butterfly farming and vermicompost production
- PO 8:** Understands about various concepts of genetics and its importance in human health
- PO 9:** Apply the knowledge and understanding of Zoology to one's own life and work
- PO 10:** Develops empathy and love towards the animals
- PO 11:** Candidates find opportunities in government departments, environmental agencies, universities, colleges, biotechnological, pharmaceutical, environmental/ecological fields
- PO 12:** There are numerous career opportunities for candidates completing their B.Sc, M.Sc and Ph.D. in Zoology in public and private sectors

Programme Specific Outcomes (PSO)

PSO III:

- PSO 1:** Understanding of the processes of central dogma viz. transcription, translation etc. underlying survival and propagation of life at molecular level
- PSO 2:** Understanding how genes are ultimately expressed as proteins, which are responsible for the structure and function of all the organisms
- PSO 3:** Learn how four sequences (3 letter codons) generate the transcripts of life and determine the phenotypes of organisms
- PSO 4:** Understand the basics of various instruments like microscopes and bioinstruments used in biological studies and their applications
- PSO 5:** They are able to understand the use of biological instrumentation and proper laboratory techniques
- PSO 6:** The students will be acquiring basic experimental skills in various techniques in the fields of molecular biology
- PSO 7:** To learn various techniques used in biology like histochemistry and immunotechniques

PSO IV:

PSO 1: To understand the principles of genetic engineering and its applications

PSO 2: To understand the basics of immunology and various mechanisms involved in immunity and their response

PSO 3: Acquired skills in diagnostic testing, haematology, staining procedures used in clinical and research laboratories, will provide them opportunity to work in diagnostic or research laboratory.

PSO 4: Acquired practical skills in biostatistics, bioinformatics can be used to pursue career as a scientist in drug development industry in India or abroad.

PSO 5: To know various type of biostatistical and bioinformatics techniques

PSO 6: Students gain skills in basics of computers, operating systems, overview of programming languages, internet services, sequencing techniques

PSO 7: Attained knowledge of data collection, tabulation and presentation of data and measures of central tendency, probability and Chi-square test.

PSO 8: Know the applications of internet and statistical bioinformatics in research

B.Sc. Semester – III

DSCC-5: Molecular Biology, Bioinstrumentation and Techniques in Biology (Theory) - V (Code: 033ZOO011)

Course Outcome (CO):

After completion of this course (Theory)-V, students will be able to:

CO1: Acquire better understanding and comprehensive knowledge regarding most of the essential aspects of molecular biology subject, which in turn will provide a fantastic opportunity to develop professional skill related to the field of molecular biology.

CO2: The course will mainly focus on the study of principal molecular events of cell incorporating DNA Replication, Transcription and Translation in prokaryotic as well as eukaryotic organisms.

CO3: Acquiring knowledge on instrumentation and techniques in biology.

Syllabus	
DSCC-5: Molecular Biology, Bioinstrumentation and Techniques in Biology (Theory)-V (Code: 033ZOO011)	Total Hrs: 56
Unit I:	14 hrs
Chapter 1: Process of Transcription <ul style="list-style-type: none">• Fine structure of gene (Cistron, Recon, Muton)• RNA polymerases - types and functions• Transcription in prokaryotes and eukaryotes Chapter 2: Process of Translation <ul style="list-style-type: none">• Genetic code and its salient features• Translation in prokaryotes and eukaryotes	08
	06
Unit-II :	14 hrs
Chapter 3: Regulation of gene expression-I <ul style="list-style-type: none">• Regulation of gene expression in prokaryotes- lac operon (inducible) and trp operon(repressible) in <i>E. coli</i>• Regulation of gene expression in eukaryotes - Role of chromatin (euchromatin and heterochromatin) in gene expression• Post-transcriptional modifications: capping, splicing, polyadenylation• Concept of RNA editing (mRNA), gene silencing, and, RNAi. Chapter 4: Regulation of gene expression-II <ul style="list-style-type: none">• Post-translational modifications: purpose, advantages, and significance; glycosylation, methylation, phosphorylation, and acetylation.• Intracellular protein degradation (lysosomal autophagy and ubiquitin proteasome pathway).	09
	05

Unit-III:	14 hrs
Chapter 5: Microscopy <ul style="list-style-type: none"> Principles and applications of Light microscopy, Dark field microscopy, Phase contrast microscopy, Fluorescence microscopy, Confocal microscopy and Electron microscopy (SEM and TEM). Micrometry: Principle and applications of micrometry 	09
Chapter 6: Centrifugation and Chromatography <ul style="list-style-type: none"> Centrifugation: Principles, types, and applications (High speed and Ultracentrifugation) Chromatography : Principle and applications of: TLC, HPLC and GC 	05
Unit IV:	14 hrs
Chapter 7: Biochemical Instrumentation <ul style="list-style-type: none"> Colorimetry and Spectrophotometry: Beer-Lambert's law, Absorption spectrum, UV-VIS spectrophotometer. pH meter, measurement of pH Principle, applications and safety measures of Radio-tracer techniques - Autoradiography. 	06
Chapter 8: Molecular Techniques <ul style="list-style-type: none"> Principle and applications of Agarose Gel- Electrophoresis, SDS-PAGE, DNA Sequencing (Sanger's Dideoxy method), PCR, DNA Fingerprinting, ELISA, Southern Blotting and Western Blotting. 	08

Recommended Books/References:

- Principles & Techniques of Biochemistry And Molecular Biology Keith Wilson and John Walker 7th Edition Cambridge University Press (2010)
- Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
- Alberts et al: Molecular Biology of the Cell: Garland (2002).
- Cooper: The Cell: A Molecular Approach: ASM Press (2000).
- Karp: Cell and Molecular Biology: Wiley (2002).
- Watson et al. Molecular Biology of the Gene. Pearson (2004).
- Lewin. Genes VIII. Pearson (2004).
- Pierce B. Genetics. Freeman (2004).
- Sambrook et al. Molecular Cloning Vols I, II, III. CSHL (2001).
- Primrose. Molecular Biotechnology. Panima (2001).
- Clark and Switzer. Experimental Biochemistry. Freeman (2000)
- Principles of Genetics Robert H. Tamarin WC B/McGraw-Hill (1999)
- Animal Microtechniques by Humason (1962)
- De- Robertis- Cell and Molecular Biology.
- Verma, P.S. and Agrawal, V.K. Molecular Biology
- Bioinstrumentation by L. Veerakumari

B.Sc. Semester – III

DSCC-6: Molecular Biology, Bioinstrumentation and Techniques in Biology (Practical) - VI (Code: 033ZOO012)

Course Outcomes (CO):

After completion of this Course (Practical) - VI, students will be able to:

- CO 1:** To understand the principle of qualitative and quantitative analysis of nucleic acids (DNA and RNA)
- CO 2:** Understand the basic principles and applications of bioinstruments and biotechniques
- CO 3:** Understand the basic principles of microscopy, working of different types of microscopes
- CO 4:** Understand the principle of measuring the concentrations of macromolecules in solutions by colorimeter and spectrophotometer
- CO 5:** Learn about some of the commonly used separation techniques like centrifugation, chromatography
- CO 6:** To know about measurement of cells types through micrometry and also to get knowledge about virtual labs

Syllabus

DSCC-6: Molecular Biology, Bioinstrumentation and Techniques in Biology (Practical) - VI (Code: 033ZOO012)

List of the experiments for 52 hrs / Semester

1. To study the working principle of Simple, Compound, and Binocular microscopes
2. To study the working principle of various laboratory equipments: pH Meter, Electronic balance, Laminar air flow, Incubator, Centrifuge, Micropipettes, Chromatography apparatus, Colorimeter, Spectrophotometer, PCR, Electrophoresis.
3. To prepare fixatives, stains and buffers (Phosphate, Citrate, Tris-HCL buffer).
4. To learn the working of measurement of the absorbance of any sample by using Colorimeter and/ or Spectrophotometer
5. To study Blotting techniques (working principle, procedure and applications)
6. Estimation of RNA by Orcinol method.
7. Estimate of DNA by Diphenyl Amine (DPA) method
8. To identify different unknown amino acids using ascending paper chromatography.
9. Isolation of DNA extraction from blood or any tissue samples.
10. Micrometry study of different cell types
11. Demonstration of differential centrifugation to fractionate components in a given mixture.
12. To estimate amount of protein by Lowry's method
13. Visit to nearby University/Research Institutions for demonstration of molecular biology techniques, bioinstruments/ biotechniques for students (not mandatory)
14. Any other practical's related to this paper may be added based on the feasibility

Recommended Books/References:

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. Molecular Biology of the Cell, 4th edition. New York: Garland Science (2002).
2. Daniel L. Hartl and Maryellen Ruvolo. Genetics: Analysis of Genes and Genomes, 8th Edition. Burlington, Mass.: Jones & Bartlett Learning (2012).
3. Gerald Karp. Cell and Molecular Biology: Concepts and Experiments, 5th Edition. Wiley Publication (2008).
4. Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Freeman. Molecular Cell Biology, 5th edition. W. H. & Company (2003).
5. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick. Molecular Biology of the Gene, 5th edition. Cold Spring Harbor Laboratory Press (2003).
6. Stryer, Lubert. Biochemistry, 2nd Edition. W. H. Freeman and Company, New York (1981).

General instructions:

Perform all the experiments as per the instructions in each question.

Scheme of Practical Examination (distribution of marks): 25 marks for

Semester end Examination

1. Major Experiments	08 Marks
2. Minor Experiments	05 Marks
3. Identifications (A-D)	08 Marks
4. Viva	02 Marks
5. Journal	02 Marks

Total 25 Marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

B.Sc. Semester – III

OEC- 3: Endocrinology (Code: 003ZOO051)

Course Outcome (CO):

After completion of this course, Endocrinology, students will be able to:

CO 1: Differentiate among endocrine, paracrine and autocrine systems.

CO 2: Describe the different classes and chemical structures of hormones.

CO 3: Identify the glands, organs, tissues and cells that synthesize and secrete hormones, hormone precursors and associated compounds.

CO 4: Identify and discuss the integration of the endocrine system in general with focus on specific interactions.

CO 5: Explain the consequences of under- and overproduction of hormones.

Syllabus OEC-3: Title- Endocrinology (Code: 003ZOO051)	Total Hrs: 42
Unit-I:	14 hrs
Chapter 1: About Endocrine glands <ul style="list-style-type: none">• Endocrine glands and classifications of hormones.• Characteristics and Transport of Hormones. Chapter 2: Hypothalamus-Hypophysis <ul style="list-style-type: none">• Hypothalamus as a neuroendocrine organ• Pituitary – Structure and functions• Chemical nature, mode of action, and functions.• Pituitary disorders Chapter 3: Pineal gland <ul style="list-style-type: none">• Structure and functions of Pineal gland.• Hypo- and hyperactive states of the gland.	
Unit-II:	14 hrs
Chapter 4: Thyroid and parathyroid <ul style="list-style-type: none">• Histological structure of the glands.• Chemical nature, mode of action, and functions of the hormones.• Hypo- and hyperactive states of the glands. Chapter 5: Adrenal cortex and medulla <ul style="list-style-type: none">• Histological structure of the gland. Chemical nature, and functions• Hypo- and hyperactive states of the gland. Chapter 6. Prostaglandins	

Unit-III:	14 hrs
<p>Chapter 7: Pancreas</p> <ul style="list-style-type: none"> • Pancreatic islets - histological structure. Chemical nature, and function. Hormonal control of blood sugar. • Hyperinsulinism and diabetes mellitus. <p>Chapter 8: Gastro-intestinal hormones</p> <ul style="list-style-type: none"> • Functions and regulation of secretion of the hormones. <p>Chapter 9: Different types of Rhythms</p> <ul style="list-style-type: none"> • Ultradian, circadian, infradian. Different zeitgebers and their relation with circadian clock • Neural basis of biological clock and role of suprachiasmatic nuclei. Sleep-wakefulness cycle. Time keeping genes. Jet-lag and shift work. 	

Recommended Books/References:

1. William's Text Book of Endocrinology Larsen et al.: An Imprint of Elsevier.
2. Endocrinology, Mac E. Hadley, Pearson Education.
3. The Kidney-An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
4. Vander's Human Physiology, E.P. Widmaier et al., McGraw-Hill, Higher Education.
5. Concise Medical Physiology by S.K. Chaudhuri, New Central Book Agency.
6. Endocrinology. Vols.I, II and III by L.O. DeGroot. W.B. Saunders Co.
7. The Physiology of Reproduction, Vols.I & II, by E. Knobil and J.D. Neil. Raven Press.
8. Guyton and Hall. Textbook of Medical Physiology. 13th Edition.
9. Histology: A Text and Atlas. Sixth Edition. Ross & Pawlina. Lippincott Williams & Wilkins.
10. Vertebrate Endocrinology by David O. Norris.

Details of Formative Assessment (IA) for DSCC/OEC (Theory):40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8 th Week
Written test-2	10%	1 hr	12 th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	-----	--
Total	40% of the maximum marks allotted for the paper		

**GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for Semester end Examination with 2 Hrs duration)**

Part-A

1. Question number 1-06 carries 2 Marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

B.Sc. Semester – IV

DSCC- 7: Gene Technology, Immunology and Computational Biology (Theory) - VII (Code: 034ZOO011)

Course Outcome (CO):

After completion of this course (Theory)-VII, students will be able to:

CO1: Acquaint knowledge on versatile tools and techniques employed in genetic engineering and recombinant DNA technology.

CO2: An understanding on application of genetic engineering techniques in basic and applied experimental biology.

CO3: To acquire a fundamental working knowledge of the basic principles of immunology.

CO4: To understand how these principles, apply to the process of immune function.

CO5: Use, and interpret results of, the principal methods of statistical inference and design; helpsto communicate the results of statistical analyses accurately and effectively; helps in usage of appropriate tool of statistical software.

Syllabus DSCC- 7: Gene Technology, Immunology and Computational Biology (Theory) - VII (Code: 034ZOO011)	Total Hrs: 56
Unit-I:	14 hrs
Chapter 1: Principles of Gene Manipulation <ul style="list-style-type: none">● Recombinant DNA Technology: Introduction, steps involved.● Restriction enzymes and Ligases and Nucleic acid modifying enzyme.● Gene cloning vector: Concept of Plasmids-pBR322, Lamda phage vectors, Cosmids● Gene transfer techniques (Direct and indirect).● Screening and selection of recombinant colonies/cells	07
Chapter 2: Applications of Genetic Engineering <ul style="list-style-type: none">● Transgenic animals (Transgenic Cow, Transgenic Fish); Transgenic plants (cry protein); Gene silencing (Knock out and Knock in mouse).● Production of Human Recombinant insulin and● Hybridoma technology: Synthesis and applications of Monoclonal antibodies● Gene Therapy (SCID)● Biosensors and its applications	07
Unit-II:	14 hrs
Chapter 3: Introduction to the Immune System <ul style="list-style-type: none">● Defence against diseases: Introduction, First and second line of defence, Types of immunity: Innate and acquired immunity; Antigen presenting cells (APC's), Role of Band T-lymphocytes (Humoral immunity and Cell mediated immunity), primary and secondary immune response.● Functional aspects of organs of the Immune system - Thymus and bone marrow spleen, Lymph Node, Small intestine and Liver (Peyer's patchesand Von Kupffer cells).	07

Chapter 4: Antigens and Antibodies <ul style="list-style-type: none"> • Antigens and haptens: Properties (foreignness, molecular size, heterogeneity). Recommended Books/References: • B and T cell epitopes. • Structure of IgG and functions of different classes of immunoglobulins. • Major histocompatibility complex - Structure of MHC I & II. 	07
Unit-III:	14 hrs
Chapter 5: Clinical Immunology <ul style="list-style-type: none"> • Immunity against diseases of viral, bacterial and protozoan infections. • Vaccines: Types and Uses - Immunization schedule for children. • Transplantation immunology: Transplantation of organ- Types, graft rejection and Immuno-suppressors. Chapter 6: Bioinformatics <ul style="list-style-type: none"> • Databases: Sequence and structural • Sequence analysis (Homology): Pairwise and Multiple Sequence alignment- BLAST, CLUSTALW, Sequence alignment- FASTA. • Scope and applications of Bioinformatics. 	07
Unit-IV:	14 hrs
Chapter 7: Biostatistics I <ul style="list-style-type: none"> • Measures of central tendency: Mean, Median, Mode. • Data summarizing: Frequency distribution, Graphical presentation - Bar diagram, Pie diagram, Histogram. Chapter 8: Biostatistics II <ul style="list-style-type: none"> • Measures of dispersion: Range, Standard Deviation, Variance. • Correlation and Regression. • Tests of significance: F-test, ANOVA, t-test and Chi square test. 	07

1. Les of Genome Analysis and Genomics. Blackwell (2003).
2. Hartl & Jones. Genetics: Principles & Analysis of Genes & Genomes. Jones & Bartlett (1998).
3. Sambrook *et al*. Molecular Cloning Vols I, II, III. CSHL (2001).
4. Primrose. Molecular Biotechnology. Panima (2001).
5. An Introduction to Genetic Engineering by Desmond S. T. Nicholl
6. Principles of Genetics by D. Peter Snustad and Michael J. Simmons
7. Fundamental Immunology by William E. Paul
8. A Textbook of Immunology by Dr. P Madhavee Latha
9. Basic Bioinformatics by S. Ignacimuthu
10. Kuby Immunology by Punt, W. H. Freeman
11. Introduction to Bioinformatics (2003) by T.K. Attwood & D.J. Parry
12. Statistical Methods by G. W. Snecdeor and W. G. Cochran, Willey Blackwell.
13. Introductory Biological Statistics by John E. Havel, Raymond E. Hampton and Scott J. Meiners.
14. Sambrook *et al*. Molecular Cloning Vols I, II, III. CSHL (2001).
15. Clark and Switzer. Experimental Biochemistry. Freeman (2000)
16. Animal Microtechniques by Humason (1962)
17. De- Robertis- Cell and Molecular Biology.
18. Verma, P.S. and Agrawal, V.K. Molecular Biology
19. Bioinstrumentation by L. Veerakumari

**DSCC-8: Gene Technology, Immunology and Computational Biology
(Practical) – VIII (Code: 034ZOO012)**

Course Outcomes (CO)

After completion of this course (Practical)-VIII, students will be able to:

- CO 1:** Understand the principles of genetic engineering with hands on experiments in detection of diseases
- CO 2:** Get introduced to DNA testing and utility of genetic engineering in forensic sciences.
- CO 3:** Understand the basics of immunology and its applications in clinical research.
- CO 4:** Study on immune system and its components
- CO 5:** Apply knowledge and awareness of the basic principles and concepts of biology, computers science and mathematics existing software's effectively to extract information from large data bases to use this in computer modeling
- CO 6:** Use bioinformatics tools to find out evolutionary/ phylogenetic relationship of organisms using gene /protein sequences
- CO 7:** Understand and can apply biostatistics and bioinformatics tools in research.

Syllabus

**DSCC-8: Gene Technology, Immunology and Computational
Biology (Practical) - VIII (Code: 034ZOO012)**

List of the Experiments for 52 hrs / Semesters

1. Calculate the mean, median, mode and standard deviation (Measurement of pre and post clitellar lengths (with suitable examples).
2. Measure the height and weight of all students in the class and apply statistical measures.
3. Determination of ABO Blood group and Rh factor.
4. To study of lymphoid organs: Thymus, Bone marrow, Spleen, Tonsil, Lymph node (Slides /Charts/ Video)
5. Preparation of blood smears to study various blood cells like RBC, WBC, Platelets, Lymphocytes & Monocytes
6. Separation of different blood cells like RBC, WBC, Platelets, Lymphocytes & Monocytes
7. To study Restriction enzyme digestion using teaching kits (Demonstration only).
8. To detect genetic mutations by Polymerase Chain Reaction (PCR) using teaching kits (Demonstration only).
9. Demonstration of agarose gel electrophoresis for detection of DNA.
10. Demonstration of Polyacrylamide Gel Electrophoresis (PAGE) for detection of proteins.
11. To calculate molecular weight of unknown DNA and protein fragments from gel pictures. (<https://youtube/mCiCiO0cfbg>)
12. To learn nucleotide sequence database.
13. To learn sequence alignment: Pairwise alignment (Protein/ DNA).
14. To learn about basics of computer applications in biology
15. Visit to nearby University/Research Institutions for demonstration of genetic engineering / Immunology/Bioinformatic techniques for students
16. Any other practical's related to this paper may be added based on the feasibility

Recommended Books/References:

1. Primrose & Twyman. Principles of Genome Analysis and Genomics. Blackwell (2003).
2. Hartl & Jones. Genetics: Principles & Analysis of Genes & Genomes. Jones & Bartlett (1998).
3. Sambrook *et al*. Molecular Cloning Vols I, II, III. CSHL (2001).
4. Primrose. Molecular Biotechnology. Panima (2001).
5. An Introduction to Genetic Engineering by Desmond S. T. Nicholl
6. Principles of Genetics by D. Peter Snustad and Michael J. Simmons
7. Fundamental Immunology by William E. Paul
8. A Textbook of Immunology by Dr. P Madhavee Latha
9. Basic Bioinformatics by S. Ignacimuthu
10. Kuby Immunology by Punt, W. H. Freeman
11. Introduction to Bioinformatics (2003) by T.K. Attwood & D.J. Parry
12. Statistical Methods by G. W. Snecdeor and W. G. Cochran, Willey Blackwell.
13. Introductory Biological Statistics by John E. Havel, Raymond E. Hampton and Scott J. Meiners.

General instructions:

Perform all the experiments as per the instructions in each question.

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end Examination

1. Major Experiments	08 Marks
2. Minor Experiments	05 Marks
3. Identifications (A-D)	08 Marks
4. Viva	02 Marks
5. Journal	02 Marks

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

B.Sc. Semester – IV

OEC – 4: Animal Behaviour (004ZOO051)

Course Outcomes (CO)

After completion of this course, Animal Behaviour students will be able to:

CO 1: Understand types of animal behaviour and their importance to the organisms

CO 2: Explain about behaviour, migration and communication in animals

CO 3: Understand about ecological aspects of behaviour and social behaviour

CO 4: Understand animal behaviour and response of animals to different instincts

CO 5: Understand the proximate controls of behavior including the role of pheromones

CO 6: Learn about reproductive behaviour and parental care in animals

Syllabus OEC-4: Animal Behaviour (Code: 004ZOO051)	Total Hrs: 42
Unit-I:	14 hrs
Chapter 1: Introduction to Animal Behaviour <ul style="list-style-type: none">Brief contributions of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen.Proximate and ultimate causes of behaviour. Chapter 2: Patterns of Behaviour <ul style="list-style-type: none">Stereotyped Behaviors - Orientation and Reflex.Individual Behavioural patterns: Instinct and Learned BehaviourAssociative learning, classical and operant conditioning, Habituation, Imprinting.	
Unit-II:	14 hrs
Chapter 3: Social Behaviour: <ul style="list-style-type: none">Social organization in termites and honey bees.Social behaviour: Altruism.Conflict behaviour. Chapter 4: Sexual Behaviour <ul style="list-style-type: none">Sexual dimorphism, Mate choice in peacock.Intra-sexual selection (male rivalry in red deer).Kinship theory: Relatedness & inclusive fitness.Parental care in fishes (Nest Building & cost benefit)	
Unit-III:	14 hrs
Chapter 5: Chronobiology <ul style="list-style-type: none">Brief historical developments in chronobiology.Adaptive significance of biological clocks.Biological Rhythms Chapter 6: Communications in animals <ul style="list-style-type: none">Bioluminescence in deep sea fishes and insectsTerritoriality in Monkeys and DogsRole of pheromones in animal communication- Insects and Vertebrates,Communication in Honey bees (Waggle Dance)	

Recommended Books/References:

1. Drickameré Vessey: Animal Behaviour, Concepts, Processes and Methods (Wadsworth)
2. Grier: Biology of Animal Behaviour (Mosby College)
3. Immelmann: Introduction to Ethology (Plenum Press)
4. Lorenz: The Foundation of Ethology (Springer-Verlag)
5. Manning: An Introduction to Animal Behaviour (Addison - Wesley)
6. McFarland: Animal Behaviour, Psychology, Ethology and Evolution (Pitman)
7. Price & Stoker: Animal behaviour in laboratory and field (Freeman)
8. Wood-Gush: Elements of Ethology (Chapman and Hall)
9. Animal Behaviour by Alock (2013)
11. Introduction to Animal Behaviour by Manning A. & M.S.Dawkins (2012)
12. Ecology by Charles J. Krebs (2009)
13. Elements of Ecology by Clarke (2015).

Details of Formative Assessment (IA) for DSCC /OEC (Theory):40% weightage for total marks

Type of Assessment	Weightage	Duration	Commencement
Written test-1	10%	1 hr	8 th Week
Written test-2	10%	1 hr	12 th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	-----	--
Total	40% of the maximum marks allotted for the paper		

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC (60 marks for Semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 Marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.