Semester: IV Semester, B. Sc., (Hons) Zoology

Course Title: **Core Course Content: Gene Technology Immunology and Computational Biology**	Course Code: **DSCC5ZOOT4**
Course Type: **Discipline Core Theory, L-T-P: 4-0-0**	Course Credits: **4**
Total Contact Hours: **56**	Duration of ESA: **3 Hrs.**
Formative Assessment Marks: **40**	Summative Assessment Marks:**60**

Course Outcomes (COs):

At the end of the course the student should be able to:

Acquaint knowledge on versatile tools and techniques employed in genetic engineering and recombinant DNA technology.
An understanding on application of genetic engineering techniques in basic and applied experimental biology.
To acquire a fundamental working knowledge of the basic principles of immunology.
To understand how these principles, apply to the process of immune function.
Use, and interpret results of, the principal methods of statistical inference and design; helps to communicate the results of statistical analyses accurately and effectively; helps in usage of appropriate tool of statistical software.

Course Content	Hrs.
Unit I	**14**
Chapter 1: Principles of Gene Manipulation • 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	07
Chapter 2: Applications of Genetic Engineering • 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**

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Chapter 3: Introduction to the Immune System • Defence against diseases: Introduction, First and second line of defence, Innate and acquired immunity; Antigen presenting cells (APC's), Role of B and T-lymphocytes (Humoral immunity and cell mediated immunity), primary and secondary immune response. • Types of Immunity • Functional aspects of organs of the Immune system - Thymus and bone marrow, spleen, Lymph Node, Small intestine and Liver (Peyer's patches and Von Kupffer cells).	07 07
Chapter 4: Antigens and Antibodies • Antigens and haptens: Properties (foreignness, molecular size, heterogeneity). • B and T cell epitopes. • Structure of IgG and functions of different classes of immunoglobulins. • Major histocompatibility complex - Structure of MHC I & II.	
Unit III	**14**
Chapter 5: Clinical Immunology • 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.	07
Chapter 6: Bioinformatics • 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**
Chapter 7: Biostatistics I • Measures of central tendency: Mean, Median, Mode. • Data summarizing: Frequency distribution, Graphical presentation - bar diagram, pie diagram, histogram. • Elementary idea of probability and its applications.	07
Chapter 8: Biostatistics II • Measures of dispersion: Range, Standard Deviation, Variance. • Correlation and Regression. • Tests of significance: F-test, ANOVA, t-test and Chi square test.	07

Topics Suggested for Assignment/ Formative Assessment:

1. Q/A, Short Question, Quiz, MCQ, Assignment etc.

Recommended Books:

1. Primrose &Twyman. Principles of Genome Analysis and Genomics. Blackwell (2003).
2. Hartl& Jones. Genetics: principles &Analsysis 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. Clark & Switzer. Experimental Biochemistry. Freeman (2000)
6. Sudbery. Human Molecular Genetics. Prentice-Hall (2002).

7. Wilson. Clinical Genetics-A Short Course, Wiley (2000).
8. Pasternak. An Introduction to Molecular Human Genetics. Fritzgerald (2000).
9. Biostatistical Analysis (Fourth Edition) by Jerrold H. Zarr, Pearson Education Inc., Delhi.
10. Statistical Methods (Eighth Edition) by G. W. Snecdecor and W. G. Cochran, Willey Blackwell
11. Biostatistics (Tenth Edition) by W.W. Daniel and C. L. Cross, Wiley
12. Introductory Biological Statistics (Fourth Edition) by John E. Havel, Raymond E. Hampton and Scott J. Meiners
13. Westhead et al Bioinformatics: Instant Notes. Viva Books (2003)
14. Genetic engineering: Sandhya Mitra BITS, Pilani
15. Principles of Biostatistics Khan and Khanam
16. Transgenic animals: Ranga

Web Sources:

Pedagogy: Lectures, Presentations, videos, Assignments and Weekly Formative Assessment Tests.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Assignment/ Field Report/ Project	15 Marks
Test	20 Marks
Participation in class	05 marks
Total	**40 Marks**

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Semester: IV

Course Lab Content

Course Title: **Gene Technology, Immunology and Computational Biology**	Course Credits: **02**
Course Type: **Minor Discipline Core Practical, L-T-P: 0-0-4**	Corse Code: DSCC5ZOOP4
Total Contact Hours: **56**	Duration of ESA: 3 **Hours**
Formative Assessment Marks: **25**	Summative Assessment Marks: **25**
Model Syllabus Authors:	

Course Outcomes (COs):

At the end of the course the student should be able to:

Accurately, safely and appropriately use all the equipment regularly used in Molecular Biology (DNA manipulation, including balances, pipettes, electrophoresis and centrifuges).
Prepare chemical solution and reagents to the precision appropriate to the task.
Demonstrate knowledge of the biochemical basis underpinning the molecular biology techniques.

Lab IV Course Content

List of labs to be conducted	Hours
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 Restriction enzyme digestion using teaching kits (Demonstration only). 5. To detect genetic mutations by Polymerase Chain Reaction (PCR) using teaching kits (Demonstration only). 6. Demonstration of agarose gel electrophoresis for detection of DNA. 7. Demonstration of Polyacrylamide Gel Electrophoresis (PAGE) for detection of proteins. 8. To calculate molecular weight of unknown DNA and protein fragments from gel pictures. (https://youtube/mCiCiO0cfbg) 9. To learn nucleotide sequence database. 10. To learn sequence alignment: Pairwise alignment (Protein/ DNA).	

Pedagogy: Lectures, Presentations, videos, Labs, Assignments, Tests, Individual or group Field oriented Project Report.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Assignment/Monograph	10
Test	10
Participation in class	05
Total	**25**

Course Content

Content	42Hrs
Unit – 1	
Chapter 1.: Introduction to Animal Behaviour • Brief contributions of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen. • Proximate and ultimate causes of behaviour. **Chapter 2. Patterns of Behaviour** • Stereotyped Behaviors - Orientation and Reflex. • Individual Behavioural patterns: Instinct and Learned Behaviour • Associative learning, classical and operant conditioning, Habituation, Imprinting.	14
Unit – 2	14
Chapter 3. Social Behaviour: • Social organization in termites and honey bees. • Social behaviour: Altruism. • Conflict behaviour. **Chapter 4. Sexual Behaviour** • 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 – 3	14
Chapter 5. Chronobiology • Brief historical developments in chronobiology. • Adaptive significance of biological clocks. • Biological Rhythms **Chapter 6: Communications in animals** • Bioluminescence in deep sea fishes and insects • Territoriality in Monkeys and Dogs • Role of pheromones in animal communication- Insects and Vertebrates, • Communication in Honey bees (Waggle Dance)	

Suggested Readings:

1. Animal Behaviour by Drickamar.
2. John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
3. Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
4. Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
5. Insect Clocks D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.) R.D. Lewis. (3rdEd) 2002 Barens and Noble Inc. New York, USA
6. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

Pedagogy: Chalk and Talk, PPT, Group discussion, Seminar, Interaction, virtual lab, Lab visit

Formative Assessment	
Assessment Occasion	**Weightage in**
House Examination/Test	15
Written Assignment / Case Presentation / Project / Seminar	20

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Class performance/Participation	05
Total	**40**

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Course pattern and scheme of examination for B.Sc./ B.Sc. (Hons.) as per NEP (2021-22 onwards)

Subject: ZOOLOGY

SL No.	Semester	Title of the paper	Teaching hours	Hours / week		Examination Pattern Max. & Min. Marks /Paper						Duration of Exam (hours)		Total Marks / paper	Credits	
						Theory			Practical							
				Theory	Practical	Max.	MIN.	IA	Max.	MIN.	IA	Theory	Practical		Theory	Practical
1	I	CORE subject	56	4	4	60	21	40	25	9	25	3	3	150	4	2
		Open elective	42	3	-	60	21	40	-	-	-	2.5	-	100	3	-
		Skill Enhancement Course	56	-	4	-	-	-	25	9	25	3	3	50	-	2
2	II	CORE subject	56	4	4	60	21	40	25	9	25	3	3	150	4	2
		Open elective	42	3	-	60	21	40	-	-	-	2.5	-	100	3	-
		Skill Enhancement Course	56	-	4	-	-	-	25	9	25	3	3	50	-	2

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Scheme of Internal Assessment Marks: Theory

Sl. No.	Particulars	IA Marks
1	Attendance	05
2	Internal Tests (Minimum of Two)	10 +10
3	Assignments /Seminar / Case Study / Project work / Reports on - Field visits made for observation and collection of data etc.,	15
	TOTAL Theory IA Marks	**40**

Scheme Internal Assessment Marks for Practicals:

Sl. No.	Particulars	IA Marks
1	Practical Test	15
2	Report / Seminar on practical experiments, etc.	05
3	Active participation in practical classes (Attendance)	05
	TOTAL Theory IA Marks	**25**

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Model Question Paper
BSC IV Semester Zoology Open Elective (OE)
GENE TECHNOLOGY IMMUBOLOGY
AND COMPUTATIONAL BIOLOGY

Time: 2.5 hrs **Max.Marks:60**

Instructions to Candidates:

1. All Sections/parts are compulsory.
2. Draw neat labelled diagrams wherever necessary.

PART A

I. Answer any five of the following **(5X2=10)**

1.
2.
3.
4.
5.
6.
7.

PART- B

II. Answer any five of the following **(5X4=20)**

1.
2.
3.
4.
5.
6.
7.

PART- C

III. Answer any three of the following **(3X10=30)**

1.
2.
3.
4.

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

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Model Question Paper
BSC IV Semester Zoology Open Elective
(OE)ANIMAL BEHAVIOUR

Time: 2.5 hrs **Max.Marks:60**

Instructions to Candidates:

1. All Sections/parts are compulsory.
2. Draw neat labelled diagrams wherever necessary.

PART A

I. Answer any five of the following **(5X2=10)**

1. Define habituation with example.
2. Mention the two dances of honey bees.
3. What is bioluminescent organism? Give example
4. Mention the four types of altruism.
5. List any two difference between classical & Operant conditioning.
6. List any four contribution of Ivan Pavlov.
7. What is meant by stereotyped behavior? Name any two types.

PART-B

II. Answer any five of the following **(5X4=20)**

1. " Termites are social insects". Justify.
2. Explain imprinting with an example of geese.
3. Write a note on mate choice in Peacock.
4. Explain kinship theory with reference inclusive fitness.
5. Explain territoriality in monkeys.
6. Write a note on parental offspring conflict.
7. Explain role of communication in Honey bees.

PART- C

III. Answer any three of the following **(3X10=30)**

1. What are Pheromones? Explain its role in animal communication example.
2. Explain Social organization in termites.
3. Explain parental care in fishes.
4. Briefly explain the historical development in Chronobiology.

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