

Programme/Class: Diploma	Year: Second	Semester: Fourth
Subject: ZOOLOGY		
Course Code: B050401T	Course Title: Gene Technology, Immunology and Computational Biology	
Course outcomes: The student at the completion of the course will be able to: <ul style="list-style-type: none"> • Understand the principles of genetic engineering, how genes can be cloned in bacteria and the various technologies involved in it. • Know the applications of biotechnology in various fields like agriculture, industry and human health. • To have an in depth understanding about Immune System & its mechanisms. • Get introduced to DNA testing and utility of genetic engineering in forensic sciences. • Get introduced to computers and use of bioinformatics tools. • Enable students to get employment in pathology/Hospital. • Take up research in biological sciences. 		
Credits: 4		Core: Compulsory
Max. Marks: 25+75		Min. Passing Marks: as per rules
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 4-0-0		
Unit	Topic	Total No. of Lectures (60)
I	Principles of Gene Manipulation <ul style="list-style-type: none"> • Recombinant DNA Technology • Selection and identification of recombinant cells • Restriction Enzymes, DNA modifying enzymes, Cloning Vectors, Ligation • Gene transfer techniques, Gene therapy 	10
II	Applications of Genetic Engineering <ul style="list-style-type: none"> • Single cell proteins • Biosensors, Biochips • Crop and live stock improvement, development of transgenics • Development of DNA drugs and vaccines 	8
III	DNA Diagnostics <ul style="list-style-type: none"> • Genetic analysis of human diseases, detection of known and unknown mutations • Concept of pharmacogenomics and pharmacogenetics 	4
IV	Immune System and its Components <ul style="list-style-type: none"> • Historical perspective of Immunology, Innate and Adaptive Immunity, clonal selection, complement system • Structure and functions of different classes of immunoglobulins, Hypersensitivity • Humoral immunity and cell mediated immunity • HLA complex: organization, class I and II HLA molecules 	10
V	Biostatistics I <ul style="list-style-type: none"> • Calculations of mean, median, mode, variance, standard deviation • Concepts of coefficient of variation, Skewness, Kurtosis • Elementary idea of probability and application 	7

VI	Biostatistics II <ul style="list-style-type: none"> • Data summarizing: frequency distribution, graphical presentation- pie diagram, histogram • Tests of significance: one and two sample tests, t-test and Chi-square test 	7
VII	Basics of Computers <ul style="list-style-type: none"> • Basics (CPU, I/O units) and operating systems • Concept of homepages and websites, World Wide Web, URLs, using search engines 	6
VIII	Bioinformatics <ul style="list-style-type: none"> • Databases: nucleic acids, genomes, protein sequences and structures, Bibliography • Sequence analysis (homology): pairwise and multiple sequence alignments-BLAST, CLUSTALW • Phylogenetic analysis 	8
<p>Suggested Readings:</p> <ol style="list-style-type: none"> 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 <i>et al</i>. 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. Fitzgerald (2000). 9. Biostatistical Analysis (Fourth Edition) by Jerrold H. Zarr, Pearson Education Inc., Delhi. 10. Statistical Methods (Eighth Edition) by G. W. Snedecor and W. G. Cochran, Wiley 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 <i>et al</i> Bioinformatics: Instant Notes. Viva Books (2003). <p style="text-align: center;">Course Books published in Hindi may be prescribed by the Universities and Colleges</p>		
<p>This course can be opted as an elective by the students of following subjects:</p> <p>The eligibility for this paper is 10+2 with Biology as one of the subject</p>		
<p>Suggested Continuous Evaluation Methods:</p> <p>House Examination/Test: 10 Marks</p> <p>Written Assignment/Presentation/Project / Term Papers/Seminar: 10 Marks</p> <p>Class performance/Participation: 5 Marks</p>		
Further Suggestions: None		

At the End of the whole syllabus any remarks/ suggestions:

Programme/Class: Degree	Year: Second	Semester: Fourth
Subject: ZOOLOGY		
Course Code: B050402P/R	Course Title: Genetic Engineering and Counselling Lab	
Course outcomes: The student at the completion of the course will be able to: <ul style="list-style-type: none"> • Understand the principles of genetic engineering with hands-on experiments in mutation detection, testing of infectious diseases like Covid 19. • Get introduced to DNA testing and utility of genetic engineering in forensic sciences. • Apply knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics existing software effectively to extract information from large databases and to use this information in computer modeling. • Use bioinformatics tools to find out evolutionary/phylogenetic relationship of organisms using gene sequences. • Get employment in Hospitals/Diagnostic and forensic labs/Counsel families with genetic disorders. • Enable students to take up research in biological sciences. 		
Credits: 2	Core: Compulsory	
Max. Marks: 25+75	Min. Passing Marks: as per rules	
Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P:0-0-4		
Unit	Topic	Total No. of Lectures (60)
I	1. Measure the pre and post clitellar lengths of earthworms and calculate mean, median, mode, standard deviation etc. 2. Measure the height and weight of all students in the class and apply statistical measures.	10
II	1. Determination of ABO Blood group 2. To perform bacterial culture and calculate generation time of bacteria. 3. To study Restriction enzyme digestion using teaching kits. 4. To detect genetic mutations by Polymerase Chain Reaction (PCR) using teaching kits. 5. Demonstration of agarose gel electrophoresis for detection of DNA. 6. Demonstration of Polyacrylamide Gel Electrophoresis (PAGE) for detection of proteins. 7. To calculate molecular weight of unknown DNA and protein fragments from gel pictures.	20
III	1. To learn the basics of computer applications 2. To learn sequence analysis using BLAST 3. To learn Multiple sequence alignment using CLUSTALW 4. To learn about Phylogenetic analysis using the programme PHYLIP. 5. To learn how to perform Primer designing for PCR	15

	using available softwares etc.	
IV	Virtual Labs (Suggestive sites) <ol style="list-style-type: none"> 1. Gel Documentation System- https://youtu.be/WPpt3-FanNE 2. Colorimeter- https://youtu.be/v4aK6G0bGuU 3. PCR Part 1- https://youtu.be/CpGX1UFSI4A 4. PCR Part 2- https://youtu.be/6lcHAYPTAEw 5. DNA isolation Part 1- https://youtu.be/QE7UI0JnY9A 6. DNA isolation part 2- https://youtu.be/-efr_HFeHxM 7. DNA curve- https://youtu.be/ubL8QxTeuG4 8. Spectrophotometer- https://youtu.be/ubL8QxTeuG4 9. Agarose Part 1- https://youtu.be/7gvHPFww--g 10. Agarose part 2- https://youtu.be/j_bOZCHNsSg 11. Use softwares like Primer3, NEB cutter 12. NCBI, BLAST, CLUSTAL W, PHYLIP 	15
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This course can be opted as an elective by the students of following subjects: <p style="text-align: center;">The eligibility for this paper is 10+2 from Arts/Commerce/Science</p>		
Suggested Continuous Evaluation Methods: House Examination/Test: 10 Marks Written Assignment/Presentation/Project / Term Papers/Seminar: 10 Marks Class performance/Participation: 5 Marks		
Further Suggestions: None		

At the End of the whole syllabus any remarks/ suggestions: University must ensure incorporation of all 04 units including virtual labs in practical evaluation.