

**GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2025-26**

**Courses(With Practical) of 4Credit
3C for Theory + 1C for Practical**

**Four Year Undergraduate Program
Semester VII & VIII
Session 2025-26**

**Discipline Specific Course (DSC), Discipline Specific Elective (DSE)
and
General Elective Course (GEC)**

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
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COURSE CODE: BZO701 (DSC-07) Biostatistics and Computer applications

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VII Session: 2025-2026
1	Course Code	BZO701	
2	Course Title	Biostatistics and Computer Applications	
3	Course Type	Discipline Specific Course (DSC07)	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Know about the importance and scope of biostatistics. • Gain knowledge about the Types and classification of primary and secondary Data. • Understand the Management of Data in Research Fields. • Get informed about the basics of Computer Applications. • Understand the representation of data.	
5	Credit Value	3C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40

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Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	Topics (COURSE CONTENTS)	No. of Periods
I	Data collection, presentation, and Measures of central tendency: Collection and classification of data. Presentation of data: by Tables - rules for making tables, use of tables, Types of tables, By Graphs: rules for making graph & it's uses, Pie chart, Bar diagram, Histogram, Frequency polygon, Cumulative frequency curve (Ogive and Polygon). Measures of central tendency: Arithmetic Mean, Median, Mode.	12
II	Dispersion Correlation and Regression: Measures of dispersion: Standard deviation and Standard error. Correlation: Types, significance and application of correlation, calculation of correlation in continuous data and ordinal data. Regression: Linear regression, regression coefficient.	12
III	Probability and Analysis of Significant Test: Probability: Normal, Binomial distribution and Poisson distributions. Hypothesis testing. Test of significance: Paired and unpaired t-test and Chi square test. Analysis of Variance (one & two way ANOVA).	12
IV	Computer structure and Applications: History of Computers, Structure of Computers, Classification of Computers, Introduction to digital computer- basic knowledge of hardware & software, CPU, Input and Output devices. Computer Codes: Decimal System, Binary number system, hexadecimal system, octal system, conversion of numbers. Introduction to MS Office- MS Word, MS Excel, MS Power point, Introduction of Internet, web-mail, various search engine, Plagiarism, Artificial Intelligence (AI).	12

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Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

Part C - Learning Resource
Text Books, Reference Books, Other Resources
TEXT BOOKS Recommended : 1. Daniel, W.W. (2012) Biostatistics: A Foundation for Analysis in Health Sciences (10th edition) John Wiley. 2. Milton, J.S. & Tsokos, J.O. (1992) Statistical Methods in the Biological and Health Sciences (2nd edition) McGraw Hill. 3. Zar, J.H. (2013) Biostatistical Analysis (5th edition) Pearson. 4. Barnes, M.R. and Gray, I.C. (2003) Bioinformatics for geneticists, Wiley. 5. Mount, D.W. (2006) Bioinformatics (2nd edition) CBS.

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Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		75 Marks
Continuous Comprehensive Evaluation (CCE):		15 Marks
Semester End Exam (SEE):		60 Marks
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 4unit = 16 Marks Section-C: Short answer type question 04 x 4 unit = 16 Marks Section-D: Long answer type question 07 x 4 unit = 28 Marks Total = 60 Marks	

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
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Lab Course: BZOL501 (DSC-05) Biochemistry and Histology

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VII Session: 2025-2026
1	Course Code	BZOL701	
2	Course Title	Biostatistics and Computer Applications	
3	Course Type	Discipline Specific Lab. Course	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Know about the importance and scope of biostatistics. • Gain knowledge about the Types and classification of primary and secondary Data. • Understand the Management of Data in Research Fields. • Get informed about the basics of Computer Applications. • Understand the representation of data.	
5	Credit Value	1C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :25	Minimum Passing Marks:10
S. No.	List of Experiments		
1.	Graphical representation of data.		
2.	Problems based on measures of central tendency.		
3.	Problems based on measures of dispersion.		
4.	Problems based on combined mean and variance and coefficient of variation.		
5.	Testing of significance and confidence intervals for single mean and difference of two means and paired tests.		
6.	Testing of goodness of fit.		

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

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Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: Maximum Marks: 25 Marks (Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

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Course Code: BZO702 (DSE07) Biosystematics and Taxonomy

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VII	Session:2025-2026
1	Course Code	BZO702		
2	Course Title	Biosystematics and Taxonomy		
3	Course Type	Discipline Specific Elective		
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Gain a basic grasp on the rules and philosophy of scientific nomenclature. • Develop the critical understanding to identify the animals up to species level with the help of taxonomic keys. • Learn the Newer trends in biosystematics and apply it in Research.		
5	Credit Value	3C	1 credit =15 Hours – Learning and Observation	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40
Part B: Content of the Course				
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)				
Unit	Topics (COURSE CONTENTS)			No. of Periods
I	• Introduction to systematic and classification: Definition & basic concepts of biosystematics and Taxonomy. Historical resume of systematic. • Taxonomic Hierarchy: Definition, Linnean hierarchy and categories. • Classification: Purpose, use and basis. Theories of classification: Biological, artificial and natural classification. • Levels of taxonomy: alpha, beta and gamma taxonomy. Micro and macro taxonomy. • Scope and applications of biosystematics in biology. The relevance of systematics in conservation programs.			12

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II	• Taxonomic Characters and Scientific Nomenclature: Different types of taxonomic characters (morphological, physiological, ecological, ethological and geographical characters). • Zoological nomenclature: binominal and trinomial system, Principles and rules of International Code of Nomenclature (ICN), type material, author citation, criteria for publication, types of names, principle of priority and its limitations.	12
III	• Taxonomic Keys, Taxonomic treatment and Phylogenetics: Types of taxonomic key their merits and demerits. • Type concept: Process of typification and different Zoological types and their applications. Taxonomic treatment of Allopatric variation, And homology • Speciation: Reproductive and geographical isolating mechanisms and their role in • speciation process. Mechanism of speciation in panmictic and apomictic species. Species • concept: different species concepts, Species category: sub-species and other infra • Species categories. • Evolutionary taxonomy: Cladistics. Constructing trees/dendrograms: Phenogram, phylogram and cladogram and turning them into classifications.	12
IV	• Taxonomic procedure: Taxonomic Collection, curation, preservation, identification and classification. • Newer trends in Biosystematics: Morphological, Embryological, Behavioral, Ecological, Cytological and Biochemical approach. Numerical taxonomy. Differential systematic. • Molecular taxonomy. DNA bar coding for identification of species.	12

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Part C - Learning Resource
Text Books, Reference Books, Other Resources
Text Books Recommended — 1. RC. Dalella & R.S. Sharma, (2017) Animal Taxonomy & Museology. Jai Prakashnath & Co., Meerut. 2. V.C. Kapoor (2019). Theory and practice of animal taxonomy and biodiversity, 8 Edn. Reference Books Recommended — 1. EE. Mayer, (1991). Principles of Systematic Zoology. 2. G.G. Simpson (2012). Principles of animal taxonomy. Scientific Publisher, India 3. E.O. Wilson, (1988). Biodiversity. John Wiley & Sons. 4. Futuyama, D. J. (1986). Evolution, Systematics and Animal Behaviour. Evolutionary Biology. Sinauer Associates Inc. 5. Mayr, E. & Ashlock, P. D. (1991) Principles of Systematic Zoology (2 edition) McGraw Hill Int. Online Resources— • http://ndLiitkgp.ac.in/he document/swayamprabha/swayam_prabha/qtrdnp2xfxe?e=O species%20concept • http://ndLiitkgp.ac.in/he document/swayam uge moocs/214 21777 self learning

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Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 75 Marks		
Continuous Comprehensive Evaluation (CCE): 15 Marks		
Semester End Exam (SEE): 60 Marks		
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 4unit = 16 Marks Section-C: Short answer type question 04 x 4 unit = 16 Marks Section-D: Long answer type question 07 x 4 unit = 28 Marks Total = 60 Marks	

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Course Code: BZOL702 (DSE07) Biosystematics and Taxonomy

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VII	Session:2025-2026
1	Course Code	BZOL702		
2	Course Title	Biosystematics and Taxonomy		
3	Course Type	Discipline Specific Elective Lab. Course		
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Comprehend the basic concepts of Biosystematics and Txonomy. • Understand and learn the Taxonomic Hierarchy in animal kingdom.		
5	Credit Value	1C	1 credit =15 Hours – Learning and Observation	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10
S. No.		List of Experiments		
1.		• Study and sketch of museum specimens of Invertebrates and Vertebrates on the basis of systematic and Taxonomic Hierarchy.		
2.		• Preparation of identification keys for select specimens of non chordate (e.g. insects) and chordates (e.g., birds).		
3.		• Make a record of biodiversity of college campus.		
4.		• Construction the dendrograms.		
5.		• Distance-based methods of phylogenetic reconstruction using manual methods.		
6.		• An “animal album or Practical Record” containing sketches, photographs, cut outs, with appropriate writes up about the above mentioned taxa.		

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Part C - Learning Resource	
Text Books, Reference Books, Other Resources	
Reference Books Recommended —	
1. EE. Mayer, (1991). Principles of Systematic Zoology. 2. G.G. Simpson (2012). Principles of animal taxonomy. Scientific Publisher, India 3. E.O. Wilson, (1988). Biodiversity. John Wiley & Sons. 4. Futuyama, D. J. (1986). Evolution, Systematics and Animal Behaviour. Evolutionary Biology. Sinauer Associates Inc. 5. Mayr, E. & Ashlock, P. D. (1991) Principles of Systematic Zoology (2 edition) McGraw Hill Int.	
Online Resources—	
• http://ndLiitkgp.ac.in/he document/swayamprabha/swayam_prabha/qtrdnp2xfxe?e=O species%20concept • > http://ndLiitkgp.ac.in/he document/swayam uge moocs/214 21777 self learning	
Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods:	
Maximum Marks: 25 Marks (Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

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Course Code: BZO703 (DSE08) Molecular Biology

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VII Session:2025-2026
1	Course Code	BZO703	
2	Course Title	Molecular Biology	
3	Course Type	Discipline Specific elective	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Develop an understanding of concepts, mechanisms and evolutionary significance and relevance of molecular biology in the current scenario. • Get well versed in recombinant DNA technology which holds application in biomedical & genomic science, agriculture, environment management, etc. Therefore, a fundamental understanding of Molecular Biology will help in career building in all these fields. • Apply their knowledge in problem solving and future course of their career development in higher education and research. • Get new avenues of joining research in related areas such as therapeutic strategies or related opportunities in industry.	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100 Minimum Passing Marks:40	
Part B: Content of the Course			
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)			
Unit	Topics (COURSE CONTENTS)		No. of Periods
I	Chromosomes and Nucleic Acids: • Chromosomes structure: Chromatin (Euchromatin and heterochromatin), Types of chromosomes. Histones, Histone-odifications.		15

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	• Structure of Nucleic acids: Structure and functions of DNA, DNA forms: Plasmid DNA, Genomic DNA and Repetitive DNA. DNA polymorphisms. DNA modifications. • Structure and Function of RNA: Ribosomal RNA (rRNA), Transfer RNA (tRNA), Messenger RNA (mRNA), Noncoding RNA. RNA Induced Silencing Complex and CRISPR Technology. • Mutation: Chromosomal and gene mutation.	
II	Central dogma and DNA replication: Central dogma of Molecular Biology. DNA methylation. DNA-Protein interaction. DNA Replication, plasmid DNA replication and genomic DNA replication, Centromeric and Telomeric DNA replication, DNA replication and cell cycle regulation. DNA polymerases. DNA-damaging agents. DNA repairing.	15
III	Transcription: Concept of Transcription, RNA polymerase I, II, III, transcription factors. RNA processing, splicing of hnRNA into mRNA, 5'-capping and 3'-polyadenylation of mRNA, rRNA and tRNA modifications and processing. RNA editing, alternative splicing, trans- splicing, miRNA, siRNA, piRNA, lncRNA, RNA-protein complex.	15
IV	Translation: Structure of Ribosomes, Genetic Code, triplet codons, Wobble base, synonymous codons, degeneracy of codon. Translation in prokaryotic and Eukaryotic cells (Aminoacylation of tRNA, initiation, elongation, peptide bond formation, translocation, termination, recycling of ribosome). Post-translational modifications and processing of proteins, large protein-protein complexes and protein trafficking Reregulation of protein synthesis in prokaryotic and eukaryotic cell.	15

Name & Signature of Members of Board of Studies

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Subject Expert	1. Dr. Divya K. Minj
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Industrial Representative	5. Dr. Alka Mishra
Student Nominee	6. Mr. Sudesh Sahu
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Part C - Learning Resource	
Text Books, Reference Books, Other Resources	
TEXT BOOKS Recommended : 1. Watson, J.D. et al. (2013) Molecular Biology of the Gene (7th edition) CSHL Press Pearson. 2. Green, M. R and Sambrook, J. (2012) Molecular Cloning: a Laboratory Protocol (4th edition) CSHL Press. 3. Walter, P. (2007) Molecular Biology of the Cell (5th edition) Garland Science.	
Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods:	
Maximum Marks:	100 Marks
Continuous Comprehensive Evaluation (CCE): 20 Marks	
Semester End Exam (SEE):	80 Marks

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 4 unit = 16 Marks Section-C: Short answer type question 06 x 4 unit = 24 Marks Section-D: Long answer type question 10 x 4 unit = 40 Marks Total = 80 Marks	

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COURSE CODE: DSE 704 (DSE-09) Instrumentation and Biotechniques

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VII Session: 2025-2026
1	Course Code	DSE 704	
2	Course Title	Instrumentation and Biotechniques	
3	Course Type	Discipline Elective Course	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Understand the purpose of the technique, its proper use and possible modifications/ improvement. • Learn the theoretical basis of technique, its principle of working and its correct application. • Learn the maintenance laboratory equipments/ tools, safety hazards and precautions. • Understand the technique of cell and tissue culture. Learn the preparation of solution of given percentage and molarity. • Understand the process of preparation of buffer. Learn the techniques of separation of amino acids, proteins and nucleic acids.	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40

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Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	Topics (COURSE CONTENTS)	No. of Periods
I	• Introduction to Microscopy: Resolving Power, Limit of Resolution and Magnification, Basic principles of Light • Types of Microscopes: Bright field, dark-field microscope, Compound Microscope, Phase Contrast, Electron Microscope, Fluorescence Microscope • Tracer Techniques: Principle and Applications, Unit of radioactivity, half-life and measurement of radioactivity. • Microtomy: Tissue fixation, block preparation, ribbon cutting and stretching, staining	15
II	• Sterilization techniques: physical, Chemical, and radiation techniques and their applications. • Preparation of saline and buffers • pH metry: Principle, construction and Application of pH meter. • Colorimetry and Spectrophotometry: Basic principle, construction and Applications of colorimeter and spectrophotometer.	15
III	• Centrifugation: Basic principle of centrifugation, Preparatory and analytical centrifugation techniques and its applications. • Chromatography: Basic principle of chromatography; Types of chromatography techniques and their applications. • Electrophoresis: Basic principle of electrophoresis and their applications.	15
IV	• Immuno-assay: Principle and applications of RIA • Principle and applications of ELISA • PCR Techniques: Principles and applications of PCR techniques, DNA extraction and isolation.	15

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Part C - Learning Resource
Text Books, Reference Books, Other Resources
TEXT BOOKS Recommended : - Nelson, D.L. & Cox, M.M. (2017) Lehninger Principles of Biochemistry (7th edition)Worth. - Conn, E.E.; Stumpf, P.K.; Bruening, G. and Doi, R.H. (2006) Principles of Biochemistry(5th edition) Wiley. - Sangeeta M., Varalakshmi K.L. and Jyothi N. Nayak (2023) Text Book of Histology for Undergraduate. (2nd Edition) Medone Media. Reference Books : - Berg, J.M.; Tymoczko, J.L. and Stryer, L. (2012) Biochemistry (7th edition) Freeman. - Zubay, G. (2017) Biochemistry (4th edition) McGraw-Hill. Online Resources: (e- Resources/ e- Books/ e- Learning Portals) https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/biochemistry https://www.kenhub.com/en/library/anatomy/introduction-to-histology

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Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks		100 Marks
Continuous Comprehensive Evaluation (CCE):		20 Marks
Semester End Exam (SEE):		80 Marks
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test – 02 of 10 Marks each + 01 Assignment/Seminar of 10 Marks	Best of test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern - FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5 unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	8. Dr. Divya K. Minj
Subject Expert	9. Dr. Neeru Agrawal
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha
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COURSE CODE: DSE 705 (DSE-10) Research Methodology

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VII Session: 2025-2026
1	Course Code	DSE 10	
2	Course Title	Research Methodology	
3	Course Type	Discipline Specific Course	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Understand the concept of research and different types of research in the context of biology • Have basic awareness of data analysis-and hypothesis testing procedures • Develop laboratory experiment related skills. • Have basic knowledge on qualitative research techniques • Develop competence on data collection and process of scientific documentation • Analyze the ethical aspects of research • Evaluate the different methods of scientific writing and reporting.	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40

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Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	Topics (COURSE CONTENTS)	No. of Periods
I	Basic Concepts of Research: Research-definition and types of research (Descriptive vs analytical, applied vs fundamental, quantitative vs qualitative, conceptual vs empirical). Research methods vs methodology. Literature review and its consolidation, Library research, field research and laboratory research.	15
II	Data Collection and Documentation of Observations: Maintaining laboratory records, Tabulation and generation of graphs. Imaging of tissue specimens and application of scale bars. The art of field photography.	15
III	Overview of Biological Problems: History; Key biology research areas, Model organisms in biology (A brief overview): Genetics, Physiology, Biochemistry, Molecular Biology, Cell Biology, Genomics, Proteomics-Transcriptional regulatory network.	15
IV	Ethics and Art of Scientific Writing: Authors, acknowledgements, reproducibility, plagiarism, Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Power-point presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.	15

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Part C - Learning Resource	
Text Books, Reference Books, Other Resources	
TEXT BOOKS Recommended : 1. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi. 2. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong. 3. Ruzin, S. E. (1999). Plant microtechnique and microscopy. Oxford University Press, New York, U.S.A.	
Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods:	
Maximum Marks	100 Marks
Continuous Comprehensive Evaluation (CCE):	20 Marks
Semester End Exam (SEE):	80 Marks

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test – 02 of 10 Marks each + 01 Assignment/Seminar of 10 Marks	Best of test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern - FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5 unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

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DEPARTMENT OF ZOOLOGY

COURSE CURRICULUM 2025-26

COURSE CODE: GE 706 (GE-07) Biodiversity Conservation and Sustainable development

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VII Session: 2025-2026
1	Course Code	BZO706	
2	Course Title	Biodiversity Conservation and Sustainable Development	
3	Course Type	General Elective (GE)	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Understand the importance of bio diversity and the consequences of bio diversity loss • Learn about the judicious utilisation of natural resources • Follow the concept of green technology and the eco-friendly practises and other prospects of environment protection • Understand and practice appropriate legal/regulatory and ethical issues in the context of the work environment. • Design research projects to collect information to assess the effectiveness of current practices, and interpret the results of a statistical analysis of data, and use this to make informed decisions.	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40
Part B: Content of the Course			
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)			
Unit	Topics (COURSE CONTENTS)		No. of Periods

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I	Anthropogenic impact on environment: Man as an animal species in the ecosystem. Population explosion. Carrying capacity, exploitation of resources due to urbanization, industrialization and agricultural practices. Generation of agricultural, municipal, industrial waste; Pollution of air, water, soil and noise; radioactive pollution. Eutrophication. Deforestation; Threats to biodiversity, Extinction of species.	15
II	Depletion and contamination of resources: Natural resources: Land resources. Air and water resources. Bioresources. Conventional Fuel, wood, fossil fuels. Non-conventional or alternate sources of energy: sun, wind, bio-energy, geothermal, ocean, nuclear etc. Green house effect and global warming; climate change; Shrinking of glaciers. Threats to sustainable development.	15
III	Biodiversity and Resource Conservation Programmes: Management of wastes and disposal. Concepts of three Rs: reduce, reuse and recycle. Methods of prevention and control of Eutrophication. Bioremediation. Biodiversity conservation– In-situ e.g., Sanctuaries, National Parks, Biosphere Reserves, World Heritage Sites; Ex-situ e.g., botanical gardens, gene banks, cryopreservation etc. Contour farming, reforestation; Rainwater harvesting, groundwater water recharge. Green technologies, Eco-cities, Social and Joint forestry.	15
IV	Sustainable development and green technology: Sustainable Development; Brundland Report. Biosafety of GMOs and LMOs. Environmental movements. Public awareness of Environment problems. Role of Government, NGO's, Ecological footprint, International treaties and conventions. organizations, International efforts (Vienna Convention, Montreal Protocol, UNFCCC, Kyoto Protocol, Copenhagen Summit, etc.; IPCC; Environmental laws and acts. National Environmental Policy. NBPGR, BSI, ZSI, WWF, IUCN, Convention on Biological diversity; Ramsar Convention, other conservation efforts.	15

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Part C - Learning Resource							
Text Books, Reference Books, Other Resources							
TEXT BOOKS Recommended : 1. Joseph, B. (2008) Environmental studies, Tata McGraw Hill. 2. Miller, G.T. (2002). Sustaining the earth, an integrated approach. (5th edition) Books/Cole, Thompson Learning, Inc. 3. Chapman, J.L. and Reiss, M.J. (1999). Ecology: Principles and applications (2nd edition) Cambridge University Press. 4. Ghosh, S.K. and Singh, R. (2003). Social forestry and Forest Management. Global Vision Pub. 5. Wilson, E.O. (1986) Biodiversity, Academic press Washington 6. Wagher, R.H. (1974) Environment and Man. (Second Edition), Norton, New York.							
Part D: Assessment and Evaluation							
Suggested Continuous Evaluation Methods: <table> <tr> <td>Maximum Marks:</td><td>100 Marks</td></tr> <tr> <td>Continuous Comprehensive Evaluation (CCE):</td><td>20 Marks</td></tr> <tr> <td>Semester End Exam (SEE):</td><td>80 Marks</td></tr> </table>		Maximum Marks:	100 Marks	Continuous Comprehensive Evaluation (CCE):	20 Marks	Semester End Exam (SEE):	80 Marks
Maximum Marks:	100 Marks						
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Semester End Exam (SEE):	80 Marks						

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test – 02 of 10 Marks each + 01 Assignment/Seminar of 10 Marks	Best of test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

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COURSE CODE: GE 707 (GE-08) Intellectual Property Rights

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VII Session: 2025-2026
1	Course Code	BZO707	
2	Course Title	Intellectual Property Rights	
3	Course Type	General Elective (GE)	
4	Course Learning Outcome (CLO)	This Course will enable the students to: 1. Understand the concept of IPR 2. Differentiate between various agreements of IPR 3. Compare between copyrights, patents and Geographical Indicators 4. Examine various legal issues related to IPR 5. Relate to various cyber issues concerning IPR	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40
Part B: Content of the Course			
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)			
Unit	Topics (COURSE CONTENTS)		No. of Periods
I	Introduction to Intellectual Property Right (IPR): Copyright Act and IPR and its importance. IPR in India and other countries of the world: Genesis and scope. IPR and WTO (TRIPS, WIPO). Objectives, Rights, Patent treaty, 1970 and its amendments.		15

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II	Patents, Copyrights and Trademarks: Protocol of obtaining patents, Industrial Application - Non-patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Licence; Infringement of patents, Patent office. Copyrights: type of work protected under copyright laws, Rights, Transfer of Copyright, Infringement and penalties. Trademarks: Objectives, Rights of holder, Assignment, Infringement, Remedies and Penalties.	15
III	Protection of Traditional Knowledge, Industrial Designs: Concept of Traditional Knowledge, Holders, Traditional knowledge on the International Arena, at WTO, at National level, International enforcement of intellectual property rights. Bioprospecting and Bio-piracy, Commercial piracy, Transnational lawsuits. Germplasm protection in India. National gene bank, Benefit sharing. Protection of Plant Varieties and Farmers' Rights Act, 2001.	15
IV	Other examples of IPR and ethical issues: Biotechnological Inventions: Objective, Applications, Concept of Novelty, Concept Originality or creativity requirements. Patenting with microorganisms. Ethical issues in Patenting Biotechnological inventions. Computer Software and Intellectual Property, Database and Data Protection, Protection of Semiconductor chips etc.	15

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Part C - Learning Resource	
Text Books, Reference Books, Other Resources	
TEXT BOOKS Recommended :	
1. Gopalakrishnan, N.S. and Agitha, T.G. (2009) Principles of Intellectual Property right. Eastern Book Company, Lucknow. 2. David Kitchin, Q.C.; Llewelyn, D.; Mellor, J.; Meade, R.; Moody-Stuart, T.; Keeling, D. and Jacob, R. (2005) Kerly's Law of Trade Marks and Trade Names (14th Edition) Thomson, Sweet & Maxweel. 3. Narayanan, P. (2010) Law of Copyright and Industrial Designs; Eastern law House, Delhi. 4. Parulekar, A. and D' Souza, S. (2006) Indian Patents Law – Legal & Business Implications; Macmillan India Ltd. 5. Wadehra, B. L. (2000) Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India.	
Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods:	
Maximum Marks:	100 Marks
Continuous Comprehensive Evaluation (CCE):	20 Marks
Semester End Exam (SEE):	80 Marks

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test – 02 of 10 Marks each + 01 Assignment/Seminar of 10 Marks	Best of test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern - FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

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COURSE CODE: GE 708 (GE-09) Biofertilizers

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VII Session: 2025-2026
1	Course Code	BZO708	
2	Course Title	Biofertilizers	
3	Course Type	General Elective (GE09)	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Develop their understanding on the concept of bio-fertilizer • Identify the different forms of biofertilizers and their uses • Compare between the Green manuring and organic fertilizers • Develop the integrated management for better crop production by using both nitrogenous and phosphate bio fertilizers and vesicular arbuscular mycorrhizal (VAM).	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40
Part B: Content of the Course			
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)			
Unit	Topics (COURSE CONTENTS)		No. of Periods
I	Microbes as fertilizers: General account about the microbes used as biofertilizer Rhizobium: isolation, identification, inoculum production and field application, legume/pulses plants. Carrier-based inoculants, Actinorrhizal symbiosis. Azospirillum: isolation and mass multiplication: carrier-based inoculant, associative effect of different microorganisms. Azotobacter: classification, characteristics: crop response to <i>Azotobacter</i> inoculum, maintenance and mass multiplication.		15

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II	Blue green algae, Phosphate solubilising microbes: Cyanobacteria (blue green algae): Azolla and Anabaena azollae association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation. Phosphate solubilizing microbes: Isolation, characterization, mass inoculum production, field application.	15
II	Mycorrhizal effect on plant growth: General account of Mycorrhizae; Types of mycorrhizae: ectomycorrhizae and endomycorrhizae; Types of associations, occurrence and distribution, Nutrition, growth and yield – colonization of vesicular-arbuscular mycorrhiza (VAM)– isolation and inoculums; production of VAM and its influence on growth and yield of crop plants.	15
IV	Microbial use in bioinsecticides and biocompost: Microbes used as bioinsecticides and their merits over synthetic pesticides. Bacillus thuringiensis: production and Field application. Viruses: cultivation and field applications. Organic farming – Green manuring and organic fertilizers, Recycling of bio-degradablewastes: municipal, agricultural and Industrial wastes. Methods of making biocompost: Procedure of vermicomposting and field application.	15

Name & Signature of Members of Board of Studies

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Part C - Learning Resource							
Text Books, Reference Books, Other Resources							
TEXT BOOKS Recommended: 1. Dubey, R.C. (2005). A Text book of Biotechnology S. Chand & Co, New Delhi. 2. John Jothi Prakash, E. (2004). Outlines of Plant Biotechnology. mKay Publication, New Delhi. 3. Kumaresan, V. (2005). Biotechnology, Saras Publications, New Delhi. 4. NIIR Board. (2012). The complete Technology Book on Biofertilizer and organic farming. 2nd Edition. NIIR Project Consultancy Services. 5. Sathe, T.V. (2004) Vermiculture and Organic Farming. Daya publishers. 6. Subba Rao, N.S. (2017). Biofertilizers in Agriculture and Forestry. Fourth Edition. Medtech. 7. Vayas, S.C.; Vayas, S. and Modi, H.A. (1998). Bio-fertilizers and organic Farming Akta Prakashan, Nadiad							
Part D: Assessment and Evaluation							
Suggested Continuous Evaluation Methods: <table> <tr> <td>Maximum Marks:</td><td>100 Marks</td></tr> <tr> <td>Continuous Comprehensive Evaluation (CCE):</td><td>20 Marks</td></tr> <tr> <td>Semester End Exam (SEE):</td><td>80 Marks</td></tr> </table>		Maximum Marks:	100 Marks	Continuous Comprehensive Evaluation (CCE):	20 Marks	Semester End Exam (SEE):	80 Marks
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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test – 02 of 10 Marks each + 01 Assignment/Seminar of 10 Marks	Best of test and Assignment shall be considered against 20 marks
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COURSE CURRICULUM 2025-26
COURSE CODE: GE 709 (GE-10) Aquatic Biology

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VII Session: 2025-2026
1	Course Code	GEC10	
2	Course Title	Aquatic Biology	
3	Course Type	General Elective (GE)	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Understand and apply relevant scientific principles in the area of aquatic biology • Appreciate the multidisciplinary nature of the study of aquatic biology and engage positively with people and ideas beyond their own discipline. • Explore some of the unique environmental problems dealing with aquatic environments. • Develop employable skills in freshwater biological water quality analysis.	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40
Part B: Content of the Course			
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)			
Unit	Topics (COURSE CONTENTS)		No. of Periods
I	Abiotic conditions of Freshwater ecosystems: Physical Properties of Water; chemical properties of water; Brief introduction of the aquatic ecosystems. Freshwater ecosystems (lakes, wetlands, streams and rivers). Physico-chemical Characteristics of fresh water bodies: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity: dissolved gases (Oxygen, Carbon dioxide). Origin and classification of lakes; Streams: Different stages of stream development.		15

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II	Aquatic organisms: Feeding in aquatic organisms; respiration in aquatic organisms; osmoregulation in freshwater and marine organisms; sensory world of aquatic organisms; Locomotion in water. Adaptation of hill-stream fishes. Adaptation of deep sea organisms.	15
III	Abiotic conditions of marine ecosystems: Classification of marine ecosystem: Estuaries, intertidal zones, Oceanic pelagic zone, marine benthic zone. Coral reefs. Physico-chemical environment, Salinity and density of sea water and Continental shelf; other factors viz., Light, Temperature, Thermal stratification, Dissolved Solids, Turbidity: dissolved gases (Oxygen, Carbon dioxide).	15
IV	Management of Aquatic Resources: Aquatic pollution - Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation. Water pollution acts of India. Sewage treatment and water quality assessment - BOD and COD.	15

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Part C - Learning Resource							
Text Books, Reference Books, Other Resources							
TEXT BOOKS Recommended : 1. Goldman, C. (1994) Limnology (2nd edition). 2. Ananthakrishnan, T.N. (1989) Bioresources Ecology (3rd edition). 3. Odum, E.P. and Barrett, G.W. (2004) Fundamentals of Ecology (5th edition). 4. Pawlowski, L. (1980) Physicochemical Methods for water and Wastewater Treatment. 5. Wetzel, R. (2001) Limnology (3rd edition) Elsevier. 6. Trivedy, R.K. and Goyal, P.K. (1986) Chemical and biological methods for water pollution studies. 7. Welch, P.S. (2014) Limnology Vol. I-II.							
Part D: Assessment and Evaluation							
Suggested Continuous Evaluation Methods: <table> <tr> <td>Maximum Marks:</td><td>100 Marks</td></tr> <tr> <td>Continuous Comprehensive Evaluation (CCE):</td><td>20 Marks</td></tr> <tr> <td>Semester End Exam (SEE):</td><td>80 Marks</td></tr> </table>		Maximum Marks:	100 Marks	Continuous Comprehensive Evaluation (CCE):	20 Marks	Semester End Exam (SEE):	80 Marks
Maximum Marks:	100 Marks						
Continuous Comprehensive Evaluation (CCE):	20 Marks						
Semester End Exam (SEE):	80 Marks						

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test – 02 of 10 Marks each + 01 Assignment/Seminar of 10 Marks	Best of test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	8. Dr. Divya K. Minj
Subject Expert	9. Dr. Neeru Agrawal
VC Nominee	10. Ms. Mausumi Dey
Member of other Department	11. Dr. Sanju Sinha
Industrial Representative	12. Dr. Alka Mishra
Student Nominee	13. Mr. Sudesh Sahu
	14. Mr. Anurag Mishra

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COURSE CURRICULUM 2025-26
COURSE CODE: BZO801 (DSC-08) Ichthyology

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VIII Session: 2025-2026
1	Course Code	BZO801	
2	Course Title	Ichthyology	
3	Course Type	Discipline Specific Course (DSC08)	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • To gain knowledge in the areas of distribution, characterization and classification of fresh water and marine fishes. • To understand the different techniques involved in fish farming • To know about the preparation and maintenance of fish farm • To develop the skill of proper fish marketing in the area.	
5	Credit Value	3C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40

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Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 48 Periods (48 Hours)		
Unit	Topics (COURSE CONTENTS)	No. of Periods
I	Taxonomy and Systematic • General characters and classification of fishes up to the level of order. • Principles of fish taxonomy and systematics. • Identification techniques: morphometric and meristic characters. • Use of keys in identification of fishes. • Importance of fishes	12
II	Freshwater Fisheries: Riverine Fisheries: Ganga, Brahmaputra and Kaveri riverine system and their fish fauna Reservoir Fisheries: Management and use of Reservoirs with special reference to Dams and their effect on fish migration. Cold water fisheries: General characteristics of cold water, cold water fisheries and their importance. Fish Farming: Composite Fish Culture and Integrated fish farming	12
III	Fish Breeding and Spawning: Natural Breeding: Bundh breeding, Hapa breeding Hatchery management Induced breeding: Hypophysation, Use of different synthetic and natural hormones, their formulation and Mechanism of action, , Production of monosex population, Hybridization, Cryo-preservation of gametes and embryo, Transgenic fish. Fish Harvesting: Fish Gear, Fish Net, Fish craft	12
IV	Fish Preservation and storage, marketing and by products Methods of fish preservation and storage, marketing channels and strategies, Fish by-products: Fish leather, Fish oil, fish glue, FPH, Fish icing glass, pearl essence, fish fertilizer.	12

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Name & Signature of Members of Board of Studies

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Subject Expert	1. Dr. Divya K. Minj
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Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

Part C - Learning Resource
Text Books, Reference Books, Other Resources
TEXT BOOKS Recommended : 1. An Introduction to Fishes: S.S. Khanna, Central Book Depot, Allahabad. 2. An Intriduction to study of fishes: Albert G.L. Gunther, Atlantic Publishers & distri. 3. The Physiology of Fishes: I Margaret Brown, Acadmic Press inc. publishers, Newyork. 4. Ichthyology: Karl F. Lagler & Robert Miller, John Willey & Sons Inc. Newyork. 5. Classification of Fishes (both recent & fossil): Leo Berg, A.J. Reprints agency, New Delhi. 6. History of Fishes: H. Greenwood, Earnst bean limited, London. 7. Fishes of U.P. and Bihar: Gopal ji Srivastava, Vishvavidhyalaya Prakashn Chouk Varanasi. 8. Fish and Fisheries of India: V.G. Jhingran. Hindustan Publcation Coporation (India), Delhi.

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Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		75 Marks
Continuous Comprehensive Evaluation (CCE):		15 Marks
Semester End Exam (SEE):		60 Marks
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 4unit = 16 Marks Section-C: Short answer type question 04 x 4 unit = 16 Marks Section-D: Long answer type question 07 x 4 unit = 28 Marks Total = 60 Marks	

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2025-26
Lab Course: BZOL801 (DSC-08) Ichthyology

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VIII Session: 2025-2026
1	Course Code	BZOL801	
2	Course Title	Ichthyology	
3	Course Type	Discipline Specific Lab. Course	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • To gain knowledge in the areas of distribution, characterization and classification of ostracoderms, chondrichthys, Teleost and holocephali • To explain the integumentary system, locomotion, skeletal and digestive system • To understand the respiratory, blood vascular and excretory system • To understand the nervous system and sense organs and reproductive system.	
5	Credit Value	1C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :25	Minimum Passing Marks:10
S. No.	List of Experiments		
1.	Morphometry and identification of Fishes		
2.	Study of fishes through museum specimens		
3.	Field work		

Name & Signature of Members of Board of Studies

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COURSE CURRICULUM 2025-26

Part C - Learning Resource
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Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: Maximum Marks: 25 Marks (Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2025-26
COURSE CODE: BZO802 (DSC-11) Wildlife Conservation and Management

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VIII Session: 2025-2026
1	Course Code	BZO802	
2	Course Title	Wildlife Conservation and Management	
3	Course Type	Discipline Specific Elective (DSE11)	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Develop an understanding of how animals interact with each other and their natural environment • Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues • Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management • Develop an ability to analyze, present and interpret wildlife conservation management information.	
5	Credit Value	3C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40

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COURSE CURRICULUM 2025-26

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 48 Periods (48 Hours)		
Unit	Topics (COURSE CONTENTS)	No. of Periods
I	Introduction To Wild Life • Definition of Wildlife, Historical background of wildlife • Values of wild life - positive and negative, Valuable products of forest and wildlife • Importance of wild animals in India and World • Major threats to wildlife and Human-wildlife conflict • Concept of threatened species- rare, endangered, threatened and endemic species of fishes, amphibians, reptiles, birds and mammals in India • Cause of extinction of forests and wildlife	12
II	Strategies of Wildlife Conservation • Definition of wildlife conservation • International and National Organizations for wildlife conservation - IUCN, WWF, Wildlife Conservation Society (WCS), Convention on Biological Diversity (CBD), Agenda 21 of United Nations, Govt. and Non. Govt. organizations • Wild life Legislation • Protected areas- <i>in-situ</i> and <i>ex-situ</i> conservation: Wildlife Sanctuaries, National Parks, Biosphere reserves, Safaris, Zoos and Zoological Parks • Wildlife Conservation Projects: Tiger, Elephant, Lion	12
III	Ecology And Population Estimation Population density, Natalty, Birth rate, Mortality, fertility schedules and sex ratio Population estimation- Direct count- Vehicle transect methods, visual encounter survey, waterhole survey & Indirect count- Call count, track and signs, pellet count, pugmark, camera trap, capture-recapture technique	12

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IV	Concepts Of Wildlife Management- • Management of Habitat -Topography, Geology, Soil and water parameters • Population monitoring- Bio-telemetry (Radio, GPS, Satellite, Acoustic & Physiological) • Management of Wildlife Health- Care of injured and diseased animals, translocation, Quarantine and quarantine acts • Zoonotic diseases and management: Ebola, Salmonellosis, Rabies, Foot and Mouth Disease, Monkeypox, SARS, Bovine and Avian Flu • Role of traditional and tribal knowledge in management of forest and wildlife.	12
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Name & Signature of Members of Board of Studies

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Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
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DEPARTMENT OF ZOOLOGY
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Part C - Learning Resource
Text Books, Reference Books, Other Resources
TEXT BOOKS Recommended : 1. Caughley, G., and Sinclair, A.R.E. (1994) Wildlife Ecology and Management. Blackwell Science. 2. Woodroffe, R., Thirgood, S. and Rabinowitz, A. (2005) People and Wildlife, Conflict or Co-existence? Cambridge University. 3. Bookhout, T.A. (1996) Research and Management Techniques for Wildlife and Habitats (5th edition) The Wildlife Society, Allen Press. 4. Sutherland, W.J. (2000) The Conservation Handbook: Research, Management and Policy. Blackwell Sciences 94 5. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008) Problem solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2025-26

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		75 Marks
Continuous Comprehensive Evaluation (CCE):		15 Marks
Semester End Exam (SEE):		60 Marks
Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 4unit = 16 Marks Section-C: Short answer type question 04 x 4 unit = 16 Marks Section-D: Long answer type question 07 x 4 unit = 28 Marks Total = 60 Marks	

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2025-26
Lab Course: BZOL802 (DSC-11) Wildlife Conservation and Management

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.		Semester - VIII Session:2025-2026
1	Course Code	BZOL802		
2	Course Title	Wildlife Conservation and Management		
3	Course Type	Discipline Specific Elective Lab. Course		
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Develop an understanding of how animals interact with each other and their natural environment • Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues • Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management • Develop an ability to analyze, present and interpret wildlife conservation management information.		
5	Credit Value	1C	1 credit =15 Hours – Learning and Observation	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10
S. No.		List of Experiments		
1.		Biodiversity assessment of local area		
2.		Field visit to study protected area management		
3.		Habitat use and home range study		
4.		Estimation of avian diversity and nesting- by Bird Watching		
5.		Identification of animals by Pug marks		
6.		Study of animal behavior- in natural habitat vs. in captivity		
7.		Invasive species impact assessment		
8.		Wildlife rescue and rehabilitation practices		
9.		Isolation and identification of parasites from Animals		

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2025-26

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
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Part C - Learning Resource

Text Books, Reference Books, Other Resources

TEXT BOOKS Recommended :

1. Caughley, G., and Sinclair, A.R.E. (1994) Wildlife Ecology and Management. Blackwell Science.
2. Woodroffe, R., Thirgood, S. and Rabinowitz, A. (2005) People and Wildlife, Conflict or Co-existence? Cambridge University.
3. Bookhout, T.A. (1996) Research and Management Techniques for Wildlife and Habitats (5th edition) The Wildlife Society, Allen Press.
4. Sutherland, W.J. (2000) The Conservation Handbook: Research, Management and Policy. Blackwell Sciences 94
5. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008) Problem solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

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COURSE CURRICULUM 2025-26

Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: Maximum Marks: 25 Marks (Will include Internal assessment, Lab records and End Semester Viva/Voce and performance)	
Semester End Exam (SEE)	Laboratory performance: As per Dept. (LOCF)

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
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FOUR YEAR UNDERGRADUATE PROGRAM
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COURSE CURRICULUM 2025-26
Course Code: BZO803 (DSE112) Genetic Engineering and Biotechnology

Part A: Introduction				
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VIII	Session:2025-2026
1	Course Code	BZO803		
2	Course Title	Genetic Engineering and Biotechnology		
3	Course Type	Discipline Specific elective (DSE)		
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Learn Develop an understanding of the fundamental molecular tools and their applications of DNA modification and cloning. • Develop future course of their career development in higher education and research with a sound base. • Apply their knowledge with problem solving approach to recommend strategies of genetic engineering for possible applications in Biotechnology and allied industry.		
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40
Part B: Content of the Course				
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)				
Unit	Topics (COURSE CONTENTS)			No. of Periods
I	Introduction to Biotechnology: • An overview of Biotechnology: History, Definition, scope, applications and ethical issues in biotechnology. • Recombinant DNA, Restriction Enzymes, Application of different enzymes in Recombinant DNA technology, Restriction and modification system, Linkers & Adaptors, Restriction mapping. Vectors (Cloning and Expression Vectors).			15

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	• Gene Recombination and Gene transfer: Transfection, Transduction, Microinjection, Electroporation and Ultrasonication. Antibiotic Resistant Gene and their mode of action. • Polymerase chain reaction (PCR): Principle and applications of different types of PCR. DNA and RNA Purification	
II	Elementary Genetic Engineering: • Preparation and comparison of Genomic and cDNA library, screening of recombinants, Genome: organization, coding and non-coding sequences & genome mapping, Comparative genome hybridization. Whole genome shotgun sequencing, Chromosome Banding. Gene tagging, DNA Cloning, DNA Sequencing methods, DNA profiling. • Genetic Markers, Molecular markers: Types & Features. Stem Cells: Embryonic Stem Cells, Adult Stem Cells and Induced Pluripotent Stem Cells, Formation and selection of recombinant ES cells, Role of ES cells in gene targeting in mice, Gene Probe, Colony Hybridization, Blotting Techniques (Southern, Northern, Western and Eastern Blotting), Animal Cell Culture (Primary Cultures, Cell line, Transformation characteristics, Culture Media & Growth Cycle).	15
III	Advancements in Genetic Engineering: Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis. Gene Editing, Gene shuffling, Genetic Manipulation of Animal Cells (Transgenesis and transgenic animals), Gene Knockout, Nuclear Transfer Technology and Animal Cloning, Gene Therapy, Gene Delivery System (Virus mediated transduction & non-viral transduction methods). Molecular Farming (Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines), Microarrays and next generation sequencing technologies.	15
IV	Applications of Genetic Engineering & Bioinformatics: Cord blood banking, Genetically Modified Organism (GMO), Animals as bioreactors: Genetically engineered animals for research. RISPR-Cas9 and its applications in treating genetic disorders, Genetic modification of livestock for improved productivity and disease resistance. Ethical, Legal, and Social Implications (ELSI) of genetic engineering.	15

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2025-26

Name & Signature of Members of Board of Studies

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Part C - Learning Resource
Text Books, Reference Books, Other Resources
TEXT BOOKS Recommended : 1. Lehninger — Principles of Biochemistry, WH Freeman. Satyanarayan U - Biotechnology, Saras Publication 2. Gupta P.K. — Elements of Biotechnology, Rastogi Publications. 3. Gupta P.K. —Biotechnology and Genomics, Rastogi Publications. 4. Kumar Pranav, Verma Praveen, Meena Usha — Biotechnology: A problem approach- Pathfinder Publications. 5. Rastogi S.C., Rastogi P., MendirattaN :Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery, PHI Learning. 6. Bosu Orpita, Thukral S.K.- Bioinformatics: Experiments, Tools, Databases, and Algorithms — Oxford University Press Reference Books : 1. Watson JD et al.-Macmillan - Recombinant DNA: Genes and Genomes, A Short Course. 2. Alberts B et al., Molecular Biology of the Cell, - Garland .Brown TA — Genomes, Garland Online Resources: (e- Resources/ e- Books/ e- Learning Portals) https://epgp.inflibnet.ac.in/Home/ViewSubject2catid=31BI+Y/JyOotvtlwaZoi+e—= http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/ksrdg67pyn8?e=1 bioinformatics http://ndl.iitkgp.ac.in/he_document/nptel/nptel/courses/102/106/102106065/video/lec66?e=3 bioinformatics http://ndl.iitkgp.ac.in/he_document/cee/cec/OF_oDrArwTUPLNspmbLKJ8K5HAWWhRVvEHrBSI1XVO-oF?e=0 biotechnology%20:%20WUgenome%20editing%20tools%20-%203%20(crispr/cas9) VVVVVVVVVvWVWW https://vlab.amrita.edu/?sub=3&brch=274&sim=1428&cnt=1 > http://ndl.iitkgp.ac.in/he_document/cec/PRwJGpZUSYMPLNspmbLKJ8K5HAWWhRVvE,HrBSI1XVO-oE

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Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		100 Marks
Continuous Comprehensive Evaluation (CCE):		20 Marks
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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 4 unit = 16 Marks Section-C: Short answer type question 06 x 4 unit = 24 Marks Section-D: Long answer type question 10 x 4 unit = 40 Marks Total = 80 Marks	

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2025-26
Course Code: BZO804 (DSE13) Toxicology

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VIII Session: 2025-2026
1	Course Code	BZO804	
2	Course Title	Toxicology	
3	Course Type	Discipline Specific elective (DSE)	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • understand gene-environment interactions • examine the application how xenobiotics disrupt normal cellular processes of genomics, proteomics, and metabolomics data • understand mechanisms of systemic and organ toxicity induced by xenobiotics; and • learn how to analyze and interpret complex data sets in toxicological research and deliver a scientific presentation. • use clinical and laboratory findings in the treatment of acute toxic exposures	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks:100	Minimum Passing Marks:40
Part B: Content of the Course			
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)			
Unit	Topics (COURSE CONTENTS)		No. of Periods
I	Basic Concept of Toxicology Introduction of toxicology, history of toxicology, definition of toxicology, definition of poison, definition of toxicity and classification of toxicants. Mode of action of toxic agents.		15

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II	Xenobiotics Introduction, Important of xenobiotics concerned to Human health, absorption of xenobiotics, distribution of xenobiotics, accumulation of xenobiotics, elimination, biotransformation and excretion. Adverse effects of xenobiotics through Biological Magnification and Biotransformation, mechanism of Xenobiotic Translocation, Membrane permeability and mechanism of chemical transfer	15
III	Pesticides and Heavy Metal Toxicity: Pesticides and their toxicological effects. Classification of Pesticides, Insecticides, Mode of action of Insecticide. Heavy Metal Toxicity: Introduction, dispersion, general principal of metal toxicity, sources, toxic metals and their toxicity. Arsenic, Alumunium, Cadmium (Itai- Itai disaster), Chromium Lead, Mercury, Manganese, Zinc and Nickel.	15
IV	Evaluation of toxicity: Acute subAcute and chronic assays LD50, LC50, NOEL. Maintenance and general handling of animals for toxicological laboratory. Ecotoxicology, clinical toxicology, occupational and nanotoxicology.	15

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

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Part C - Learning Resource	
Text Books, Reference Books, Other Resources	
TEXT BOOKS Recommended : 1. Williams, P.L.; James, R. C. Roberts, S.M. (2003) Principles of Toxicology:Environmental and Industrial Applications, John Wiley & Sons, Inc. 2. Klaassen, C. (2007) Casarett and Doull's Toxicology The basic science of poisons –McGraw-Hill. 3. Duffs, J. and Worth, H. (2006) Fundamental Toxicology, RSC Publ	
Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods:	
Maximum Marks:	100 Marks
Continuous Comprehensive Evaluation (CCE): 20 Marks	
Semester End Exam (SEE):	80 Marks

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 4 unit = 16 Marks Section-C: Short answer type question 06 x 4 unit = 24 Marks Section-D: Long answer type question 10 x 4 unit = 40 Marks Total = 80 Marks	

Name & Signature of Members of Board of Studies

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COURSE CURRICULUM 2025-26
Course Code: BZO805(DSE14) Population Genetics

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VIII Session: 2025-2026
1	Course Code	BZO805	
2	Course Title	Population Genetics	
3	Course Type	Discipline Specific elective (DSE)	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Compute allele frequencies and predict Hardy-Weinberg equilibrium. • Assess the effects of mutation, selection, and drift on genetic variation. • Interpret gene flow and inbreeding coefficients from population data. • Demonstrate competence in using population genetics software. • Report and analyse findings from practical experiments and simulations.	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40
Part B: Content of the Course			
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)			
Unit	Topics (COURSE CONTENTS)		No. of Periods
I	Introduction to Population Genetics • Scope and importance of population genetics • Genetic variation: types and sources • Allele and genotype frequencies • Hardy-Weinberg Principle: Assumptions, calculations, and implications • Departures from Hardy-Weinberg equilibrium		15

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II	Forces of Evolution I – Mutation and Selection • Mutation: types, rates, and effects on genetic variation • Natural selection: fitness, types of selection (directional, stabilizing, disruptive) • Selection coefficients and allele frequency changes • Balanced polymorphism and heterozygote advantage	15
III	Forces of Evolution II – Genetic Drift and Migration • Genetic drift: bottlenecks, founder effect, effective population size • Inbreeding and inbreeding depression • Gene flow and migration models (island model, stepping stone model) • Wahlund effect	15
IV	Quantitative Traits and Molecular Population Genetics • Quantitative trait loci (QTL) • Heritability: broad and narrow sense • Linkage disequilibrium • Molecular markers and neutral theory • Applications in conservation genetics, human evolution, and medical genetics	15

Name & Signature of Members of Board of Studies

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Part C - Learning Resource	
Text Books, Reference Books, Other Resources	
TEXT BOOKS Recommended : 1. Hartl, D.L. & Clark, A.G. – Principles of Population Genetics 2. Hedrick, P.W. – Genetics of Populations 3. Gillespie, J.H. – Population Genetics: A Concise Guide 4. Templeton, A.R. – Population Genetics and Microevolutionary Theory 5. Genetics – P. K. Gupta 6. A Textbook of Genetics – S. C. Rastogi	
Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods:	
Maximum Marks:	100 Marks
Continuous Comprehensive Evaluation (CCE): 20 Marks	
Semester End Exam (SEE):	80 Marks

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test - One of 15 Marks + Assignment/Seminar- One of 15 Marks	Best of test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 4 unit = 16 Marks Section-C: Short answer type question 06 x 4 unit = 24 Marks Section-D: Long answer type question 10 x 4 unit = 40 Marks Total = 80 Marks	

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COURSE CODE: GE 806 (GE-11) Parasitology

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VIII Session: 2025-2026
1	Course Code	BZO806	
2	Course Title	Parasitology	
3	Course Type	General Elective (GE)	
4	Course Learning Outcome (CLO)	This Course will enable the students to: - To understand about the mode of transmission of parasites and their interrelationship with host - To know about the viral diseases and their treatments - To understand the medical and veterinary important insect vectors and their control - To gain knowledge about diseases caused by protozoans and helminthes	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40
Part B: Content of the Course			
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)			
Unit	Topics (COURSE CONTENTS)		No. of Periods
I	Types of parasites, types of hosts, inter relationship between host and parasite, Responses of hosts to parasitic infection, mode of transmission of parasite, host specificity and parasitic adaptation, Concept of zoonotic diseases.		15
II	Viral diseases: Life cycle, mode of transmission, infection and treatment of Dengue, Influenza, H1N1 viruses, AIDS and Rabies Bacterial Diseases: Life cycle, mode of transmission, infection and treatment of Vibrio cholera, <i>Streptococcus pneumoniae</i> , <i>Salmonella typhi</i> , <i>Mycobacterium tuberculosis</i> .		15

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III	Fungal Diseases: Life cycle, mode of transmission, infection and treatment of Ringworm infection, aspergillus, candida. Protozoan Diseases: Life cycle, mode of transmission, infection and treatment of Entamoeba histolytica, Plasmodium, Trypanosoma, and Giardia Nematode Diseases: Life cycle, mode of transmission, infection and treatment of Wuchereria, Ancylostoma, Taenia solium and fasciola hepatica	15
IV	Vectors: definition and types of vector, Arthropod vector of medical and veterinary importance, sandflies, mosquitoes, horse flies and Rat flea, ticks, mites and vector control.	15

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Part C - Learning Resource	
Text Books, Reference Books, Other Resources	
TEXT BOOKS Recommended : 1. Ramnik Sood, 1993. Parasitology, C.B.S. Publisher, New Delhi. 2. K.D. Chaterjee, 1987. Parasitology, Medical Publisher Calcutta. 3. Hobler, E.R., and Noble, G.A., 1982. Parasitology 2nd Edition, Lea & Febieger U.S.A 4. Smit. D.G., 1997. Introduction Animal Parasitology 2nd Edition, Johns Willey SonsNew York. 5. Soulsby, E.J.L., 1969. Helminths, Arthropods & Protozoa of Domesticated Animals,ELBS Publication London Ed.	
Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods:	
Maximum Marks:	100 Marks
Continuous Comprehensive Evaluation (CCE):	20 Marks
Semester End Exam (SEE):	80 Marks

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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test – 02 of 10 Marks each + 01 Assignment/Seminar of 10 Marks	Best of test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern - FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

Name & Signature of Members of Board of Studies

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Course Code: GEC807 Evolution

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - V Session: 2025-2026
1	Course Code	GEC807	
2	Course Title	Evolution	
3	Course Type	General Elective Course	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • Acquire an in-depth knowledge on the diversity and relationships in animal world. • Develop a holistic appreciation on the phylogeny and adaptations in animals. • Enable the students to understand the evolution of universe and life. • Understanding on the process and theories in evolutionary biology. • Develop an interest in the debates and discussion taking place in the field of evolutionary biology.	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40

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Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	Topics (COURSE CONTENTS)	No. of Periods
I	Life's Beginnings: Big-bang, Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes; Historical review of evolutionary concept: Lamarckism, Darwinism, Neo-Darwinism. Evidences of Evolution: Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse, Molecular (universality of genetic code and protein synthesising machinery, three domains of life, neutral theory of molecular evolution, molecular clock, example of globin gene family, rRNA/cyt c; Sources of variations: Heritable variations and their role in evolution.	15
II	Hardy-Weinberg Law, Evolutionary forces upsetting H-W equilibrium: Natural selection Genetic Drift, Role of Migration and Mutation in changing allele frequencies.	15
III	Micro evolutionary changes (inter-population variations, clines, races, Species concept, Isolating mechanisms, modes of speciation—allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches; Extinctions, Back ground and mass extinctions (causes and effects), detailed example of K-T extinction	15
IV	Phylogenetic tree: Introduction, Types of phylogenetic tree, Methods and Steps (Character based method and distance based method) of Phylogenetic tree construction and interpretation of trees. Significance and limitations of phylogenetic tree.	15

Name & Signature of Members of Board of Studies

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Part C - Learning Resource							
Text Books, Reference Books, Other Resources							
TEXT BOOKS Recommended : 1. Ridley, M (2004) Evolution (3rd edition) Blackwell publishing 2. Hall, B.K. and Hallgrimson, B (2008) Evolution (4th edition) Jones and Barlett Publishers 3. Campbell, N.A. and Reece J.B (2011) Biology (9th edition) Pearson, Benjamin, Cummings 4. Douglas, J.F. (1997) Evolutionary Biology. Sinauer Associates. 5. Pevsner, J. (2009) Bioinformatics and Functional Genomics (2nd edition) Wiley- Blackwell. Reference Books : 1. Douglas, J.F. (1997) Evolutionary Biology. Sinauer Associates. 2. Pevsner, J. (2009) Bioinformatics and Functional Genomics (2nd edition) Wiley- Blackwell. Online Resources: (e- Resources/ e- Books/ e- Learning Portals) https://evolution.berkeley.edu/evolution-101/mechanisms-the-processes-of-evolution/ https://www.ncbi.nlm.nih.gov/books/NBK230201/ https://byjus.com/biology/evolution-brief-account/							
Part D: Assessment and Evaluation							
Suggested Continuous Evaluation Methods: <table> <tr> <td>Maximum Marks:</td><td>100 Marks</td></tr> <tr> <td>Continuous Comprehensive Evaluation (CCE):</td><td>20 Marks</td></tr> <tr> <td>Semester End Exam (SEE):</td><td>80 Marks</td></tr> </table>		Maximum Marks:	100 Marks	Continuous Comprehensive Evaluation (CCE):	20 Marks	Semester End Exam (SEE):	80 Marks
Maximum Marks:	100 Marks						
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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2025-26

Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test – 02 of 10 Marks each + 01 Assignment/Seminar of 10 Marks	Best of test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

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DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2025-26
Course Code: GEC808 Ecotourism

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VIII Session: 2025-2026
1	Course Code	GEC808	
2	Course Title	Ecotourism	
3	Course Type	General Elective Course	
4	Course Learning Outcome (CLO)	This Course will enable the students to: • identify and manage for ecological impacts to soil, water, vegetation, and wildlife resulting from recreation and tourism development; • understand ecological impacts and ecotourism management approaches in a variety of ecosystems under diverse landowners; • ability to analyze the environmental and social consequences of ecotourism management strategies and decisions; • understand management tools to reduce visitor related impacts that occur in ecotourism areas.	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40

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Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	Topics (COURSE CONTENTS)	No. of Periods
I	Baseline information about Ecotourism: History of ecotourism and its definitions. Types of Tourism: Extreme tourism Mass tourism. Why is mass tourism NOT eco-friendly? Evolution and characteristics of ecotourism, relevance of responsible tourism. World Ecotourism Summit- policies and formulations Howan ecotourism development can benefit future generations. Ecotourism as a tool of capacity building and conservation.	15
II	Ecotourism as an industry: Ecotourism as a growth sector within the tourism industry. Tourist resorts. Environmental, socio-cultural and economic impacts of ecotourism. Viewpoints on tourism industry and major constituents, Tourism organizations – international, national, state level and private sector, Importance of tourism statistics. Tourism industry in India, Ecotourism in Kerala- possibilities and problems.	15
III	Management functions and practices in tourism: Tourism policies and planning, Involvement of local bodies and officials in tourism, Coordination between tourists and hosts, Tourism products and operation, Tourist sites and attractions. Managing personnel in tourism, Managerial practices in tourism, Tourism services and management, Seasonality and destination in tourism, Preparation of maps and charts.	15
IV	Marketing ecotourism: Tourism marketing- definition, concepts and features Advertising and publicity in tourism Role of media in tourism, Tourism writing. Communication skills and tourism Ecotourism and competing resource users. International and domestic tourism markets, Marketing research and analysis, Tourism forecasting and use of technology in tourism marketing, Airlines, Travel Agency, hotel accommodation, tour packages marketing etc.	15

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Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
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Part C - Learning Resource							
Text Books, Reference Books, Other Resources							
TEXT BOOKS Recommended : 1. Mowforth, M., & Munt, I. (2009). Tourism and sustainability (3rd Edition). London,UK: Routledge. 2. Newsome, D., Moore, S.A., & Dowling, R.K (2002). Natural area tourism. Bristol,UK: Channel View. (Publications. 3. Weaver, D. (2008). Ecotourism (2nd Edition). Hoboken, NJ: JS Wiley. Staff : DrJulian Clifton.							
Part D: Assessment and Evaluation							
Suggested Continuous Evaluation Methods: <table> <tr> <td>Maximum Marks:</td><td>100 Marks</td></tr> <tr> <td>Continuous Comprehensive Evaluation (CCE):</td><td>20 Marks</td></tr> <tr> <td>Semester End Exam (SEE):</td><td>80 Marks</td></tr> </table>		Maximum Marks:	100 Marks	Continuous Comprehensive Evaluation (CCE):	20 Marks	Semester End Exam (SEE):	80 Marks
Maximum Marks:	100 Marks						
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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test – 02 of 10 Marks each + 01 Assignment/Seminar of 10 Marks	Best of test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

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FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM 2025-26
Course Code: GEC809 Food Nutrition and Health

Part A: Introduction			
Program: Bachelor in Science (Bio Group) Certificate/diploma/degree/honors		Class: B. Sc.	Semester - VIII Session: 2025-2026
1	Course Code	GEC809	
2	Course Title	Food Nutrition and Health	
3	Course Type	General Elective Course (GEC)	
4	Course Learning Outcome (CLO)	This Course will enable the students to: - Understand the role of food and nutrients in health and disease. - Provide culturally competent nutrition services for diverse individuals. - Implement strategies for food access, procurement, preparation, and safety that are relevant for the culture, age, literacy level, and socio-economic status of clients and groups. - Perform food system management and leadership functions that consider sustainability in business, healthcare, community, and institutional arenas. - Understand the principles and practices of food safety to prevent foodborne illnesses.	
5	Credit Value	4C	1 credit =15 Hours – Learning and Observation
6	Total Marks	Maximum Marks :100	Minimum Passing Marks:40
Part B: Content of the Course			
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)			
Unit	Topics (COURSE CONTENTS)		No. of Periods
I	Basic concept of Food: Components and nutrients. Concept of balanced diet, nutrient requirements and dietary pattern for different groups viz., adults, pregnant and nursing, mothers, infants, school children, adolescents and elderly people.		15

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II	Nutritional Biochemistry: Macronutrients. Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role. Micronutrients. Vitamins- Water-soluble and Fat-soluble vitamins- their sources and importance. Important minerals viz., Iron, Calcium, Phosphorus, Iodine, Selenium and Zinc: their biological functions.	15
III	Definition and concept of health: Common nutritional deficiency diseases- Protein malnutrition (e.g., Kwashiorkor and Marasmus), Vitamin A deficiency, Iron deficiency and Iodine deficiency disorders- their symptoms, treatment, prevention and government initiatives, if any.	15
IV	Life style dependent diseases- hypertension, diabetes mellitus, and obesity- their causes and prevention. Social health problems- smoking, alcoholism, narcotics. Acquired Immuno Deficiency Syndrome (AIDS): causes, treatment and prevention. Other ailments viz., cold, cough, and fever, their causes and treatment.	15

Name & Signature of Members of Board of Studies

Chair person/HOD: Dr. Usha Sahu	Departmental Members
Subject Expert	1. Dr. Divya K. Minj
Subject Expert	2. Dr. Neeru Agrawal
VC Nominee	3. Ms. Mausumi Dey
Member of other Department	4. Dr. Sanju Sinha
Industrial Representative	5. Dr. Alka Mishra
Student Nominee	6. Mr. Sudesh Sahu
	7. Mr. Anurag Mishra

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Part C - Learning Resource							
Text Books, Reference Books, Other Resources							
TEXT BOOKS Recommended : 1. Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed;; New Age International Publishers 2. Srilakshmi, B. (2007). Food Science; Fourth Ed; New Age International (P) Ltd. 3. Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO. 4. Bamji, M.S.; Rao, N.P. and Reddy, V. (2009). Text Book of Human Nutrition; Oxford & IBH Publishing Co. Pvt Ltd. 5. Gibney, M.J. et al. (2004). Public Health Nutrition; Blackwell Publishing. Reference Books : 1. Srilakshmi, B. (2002). Nutrition Science; New Age International (P) Ltd. 2. Wardlaw, G.M. and Hampl, J.S. (2007). Perspectives in Nutrition; Seventh Ed; McGraw Hill. 3. Lakra, P. and Singh M.D. (2008). Textbook of Nutrition and Health; First Ed; Academic Excellence. 4. Manay, M.S. and Shadaksharaswamy, M. (1998). Food-Facts and Principles; New Age International (P) Ltd. Online Resources: (e- Resources/ e- Books/ e- Learning Portals) https://www.who.int/news-room/fact-sheets/detail/healthy-diet https://www.nhsinform.scot/healthy-living/food-and-nutrition/eating-well/health-benefits-of-eating-well/ https://www.health.harvard.edu/topics/nutrition							
Part D: Assessment and Evaluation							
Suggested Continuous Evaluation Methods: <table> <tr> <td>Maximum Marks:</td><td>100 Marks</td></tr> <tr> <td>Continuous Comprehensive Evaluation (CCE):</td><td>20 Marks</td></tr> <tr> <td>Semester End Exam (SEE):</td><td>80 Marks</td></tr> </table>		Maximum Marks:	100 Marks	Continuous Comprehensive Evaluation (CCE):	20 Marks	Semester End Exam (SEE):	80 Marks
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Internal Assessment: Continuous Comprehensive Evaluation(CCE)	Internal Test – 02 of 10 Marks each + 01 Assignment/Seminar of 10 Marks	Best of test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern - FOUR Section A, B, C, D Each section will consist of questions from all 5 Units, Section C and D will have internal choices. Section-A & B: Very short answer type question- 02x02 = 04 x 5unit = 20 Marks Section-C: Short answer type question 05 x 5 unit = 25 Marks Section-D: Long answer type question 07 x 5 unit = 35 Marks Total = 80 Marks	

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