Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

Shivajinagar, Pune - 5

Third Year of B.Sc. Blended (Biosciences)

(2024Course under NEP 2020) Semester V

Course Code: 24ScBleU5101 **Course Name: Biochemistry**

Teaching Scheme: TH: 2 Hours/Week **Credit: 2C (2T)**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: Biology and chemistry

Course Objectives:

- Students will be given the basic information of bimolecular, metabolic pathways,

Course Outcomes:

On completion of the course, student will be able to–

- Study all basic fundamentals of chemistry and biomolecules.
- Understand structure and functions of biomolecules.

Course Contents

Semester V

Unit	Title	Lectures
Unit 1	**Basic bio molecules and their properties**	**5 Lectures**
	• Sugars, • Amino acids, • fatty acids and nucleic acids, • Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc)	
Unit 2	**Biological thermodynamics**	**5 Lectures**
	• Concept of free energy, • energy rich compounds, • Free energy and oxidation reduction reactions. • Energy cycle	
Unit 3	**Enzymes**	**5 Lectures**
	• Definition, classification, properties, • Lock and key hypothesis, • factors affecting activity of enzymes, Kinetics, • Coenzymes and role in biological systems. • Isoenzymes and their role. Ligand	

	Binding and Allostery	
Unit 4	**Metabolic pathways**	**10 Lectures**
	• Carbohydrate metabolism- Glycolysis, fates of pyruvate: cori cycle fermentation, ED pathway, TCA cycle, Anapleurotic reactions, gluconeogenesis, glycogen breakdown and glycogen synthesis, Glyoxylate pathway, pentose phosphate pathway. Regulation of pathways. • Lipid metabolism Action of lipases, Beta oxidation of Fatty acids (Even No.) ketone bodies, synthesis of fatty acids, overview of cholesterol synthesis. And phospholipid synthesis • protein metabolism Metabolic fates of amino acids, transamination, transfer of amino group by glutamate, urea cycle, Amino Acid Biosynthetic Families, Grouped by Metabolic Precursorj	
Unit 5	**Techniques to purify and characterize biomolecules**	**5 Lectures**

Suggested Reference books:

1. John Kuriyan, Boyana Konforti & David Wemmer; The Molecules of life: Physical and Chemical Principles, (2013), Garland Science

2. Lehninger Principles of Biochemistry David L. Nelson, Michael M. Cox. Publisher: W. H. Freeman, Fourth Edition

3. Jeremy M Berg; John Tymoczko; Lubert Stryer (2012), Biochemistry, $7^{th}/6^{th}$ edition (or older), Wiley.

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Third Year of B.Sc.Blended (Biosciences)

(2024 Course under NEP 2020) Semester V

Course Code: 24ScBleU5102 **Course Name: Molecular Biology**
Teaching Scheme: TH: 2Hours/Week **Credit: 2C (2T)**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: Biology, chemistry and biochemistry

Course Objectives:

- Students will be given the basic information of nucleic acids, basic processes like replication, transcription and translational.

Course Outcomes:

On completion of the course, student will be able to–

- Obtain the latest developments in the field of Molecular Biology

CO No	Course Outcomes (COs)	Blooms Cognitive Level
CO1	Finding relevant information about transcription,	1
CO2	Translation process from reference books	1
CO3	Understanding the molecular mechanisms in the cells	2
CO4	Compare transcription and translation processes in eukaryotic and prokaryotic organisms	3
CO5	Examine posttranscriptional modifications.	4
CO6	Correlating the molecular mechanisms to a cellular level	1
	Explain major contributions towards the development of branch of molecular biology	5

Course Contents :

Unit	Title	Lectures

Unit 1	**Central Dogma in Biology**	**2 Lectures**
	• **Central Dogma in Biology:** A historical perspective	
Unit 2	**Maintenance of the genome**	**3Lectures**
	• DNA, Chromosomes and Genome • Replication of DNA • The Mutability and Repair of DNA • Homologous Recombination at the Molecular Level	
Unit 3	**Gene expression**	**20 Lectures**
	• Transcription and Transcription regulation • Transcription machinery • Concept of operon • Gene regulation in prokaryotes and eukaryotes • RNA Editing • Translation • -Post translational modifications and protein folding	
Unit 4	**Techniques in Molecular Biology**	**5 Lectures**
	• Molecular Cloning methods • Molecular Tools for Studying Genes and Gene Activity	

Suggested Reference books:

1. Molecular Biology of the Gene by Watson, Baker, Levine, Losick et al. [2007] 6 Ed. Benjamin Cummings

2. Principles of Gene Manipulation by Primrose, Twyman, Old [2002] 6 Ed. Wiley-Blackwell

3. Molecular Biology by Weaver [2011] 5 Ed. McGraw- Hill Science.

4. Molecular Biology and Genomics by Mulhardt [2006] 1 Ed. Elsevier.

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Third Year of B.Sc. Blended (Bioscience) Semester V
(2024 Course under NEP 2020 pattern)

Course Code:24ScBleU5103 **Course Name: Genetic Engineering**

Teaching Scheme: TH: 2Hours/Week **Credit: 2 C (2T)**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Basics of Molecular Biology

Course Objectives:

- To learn the basic concept of genetic modifications to obtain the desired product.
- To study different techniques used in Genetic engineering.
- To learn the progress in the field of Recombinant DNA technology.

Course Outcomes:

On completion of the course, student will be able to–

CO No.	Course Outcomes (COs)	Bloom's cognitive taxonomy level
CO 1	Define the historical perspective of rDNA technology and its relation to Molecular Biology	1
CO 2	Outline the basic concept of rDNA technology tools and techniques.	2
CO 3	Identify the various transformation and transformant selection techniques.	3
CO 4	List of various vectors used in gene cloning.	4
CO 5	Understand the importance of PCR and gene sequencing techniques.	5
CO 6	Design and application of gene cloning and DNA analysis.	6

Course Contents

Unit	Title	30 Lectures
Unit 1	**Introduction to Genetic Engineering**	**2 Lectures**
	• Historical perspective • Overview of Recombinant DNA Technology	
Unit 2	**Molecular tools used in Genetic Engineering**	**3 Lectures**
	• Different enzymes – Restriction enzymes, Ligases, Polymerases, Alkaline Phosphatases, Nucleases, Transferases • Introduction to PCR technology: Steps in PCR, Factors affecting PCR, Applications of PCR	
Unit 3	**Vectors used in Genetic Engineering**	**4 Lectures**
	• Plasmids • Bacteriophages: lambda and M13 • Expression vectors: pET Vector • Agrobacterial Vectors – pTi plasmid • YAC, BAC • Chimeric Vectors - • Cosmids: Single Cos cosmids and Dual cos cosmids • Phasmids: lambda ZAP series • Phagemids: pGEMZf series, pEMBL8 • Fosmids: pFOS1	
Unit 4	**Transformation: Techniques of introduction of DNA into the host cell**	**6 Lectures**
	• Methods of introduction of DNA into: Bacterial cell, Animal cell and Plant cell. • Selection and Characterization of transformants	
Unit 5	**Purification of DNA from living cells and yield analysis**	**4 Lectures**
	1. Purification of Total cellular / chromosomal DNA and its characterization 2. Purification of Plasmid DNA – Plasmid Characterization **3.** Purification of Bacteriophage DNA and its characterization	
Unit 6	**Sequencing of Genes and Genomes**	**2 Lectures**
	• Maxam Gilbert's method • Sanger's Manual method • Automated DNA sequencing	
Unit 7	**Genome Mapping**	**2 Lectures**
	• Techniques of Genome mapping: Physical and Genetic	

	• DNA Fingerprinting	
Unit 8	**Construction of Genomic and cDNA Library**	**2 Lectures**
	• Process of library construction • Comparison between Genomic and cDNA library	
Unit 9	**Applications of Recombinant DNA Technology and Guidelines to create genetically modified organisms**	**5 Lectures**
	• Application in Agriculture • Application in Food Industry • Application in healthcare and Pharmaceutical industry	

References:

- Gene Cloning and DNA Analysis –An Introduction. T.A. Brown. Eighth Edition (2020). Wiley Blackwell.
- Genetic Engineering. By Smita Rastogi and Neelam Pathak. Oxford University Press (2009).
- Principles of Gene Manipulation & Genomics, 7th Edition (2006), Primrose and Twyman, Blackwell Publishing, USA.
- Molecular Biology of the Gene, 7th Edition (2013), James D. Watson, Tania Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Lodwick, Pearson Education, Inc.

- Genomes 3. T.A. Brown. Third Edition (2008). Garland Science Taylor and Francis Group, New York and London.

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Third Year of B.Sc.Blended (Biosciences)

(2024 Course under NEP 2020) Semester V

Course Code: 24ScBleU5104 **Course Name: Animal Sciences (T)**
Teaching Scheme: TH: 2 Hours/Week **Credit: 2C(2T)**
PR: 2 Hours/Week
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: Zoology and Biology.

Course Objectives:

- Students will be given the basic and advance information of animal sciences

Course Outcomes:

On completion of the course, student will be able to–

- Apply the basic knowledge of animal sciences in the field of biology

Course Contents

Unit	Title	Lectures
Unit 1	**Animal development**	**15 L**
	• Gametogenesis: oogenesis and spermatogenesis Fertilization • Types and patterns of cleavage, blastulation • Gastrulation in amphioxus, frog and chick up to formation of three germinal layers • Overview of organogenesis in frog, chick • Concept of stem cells, Progenitor cells, cell lineages, determination, commitment and differentiation • Concept of dedifferentiation, redifferentiation, transdifferentiation • Role of gene/s in patterning and development of *Drosophila*.	
Unit 2	**Cell signaling and signal transduction**	**8 L**
	• Communication between cells,n signaling molecules, major signaling pathways –	

	• G protein coupled receptors, Ras map pathway. • Role of secondary messengers in cell signaling	
Unit 3	**Techniques in animal sciences**	**7 L**

Suggested Reference books:

1. Development Biology, 9th edition, (2010), Gilbert S.F.(Sinauer Associates, USA)

2. Principles of Development, 4th edition (2010), Wolpert L and Tickle C, Publisher: Oxford University Press, USA.

3. Cell Biology, 6th edition, (2010) Gerald Karp. John Wiley & Sons., USA

4. The Cell: A Molecular Approach, 6th edition (2013), Geoffrey M. Cooper, Robert E. Hausman, Sinauer Associates, Inc. USA

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Third Year of B.Sc.Blended (Biosciences)

(2024 Course under NEP 2020) Semester V

Course Code: 24ScBleU5105 **Course Name: Lab course on 24ScBleU5101 & 24ScBleU5104**

Teaching Scheme: TH: 4Hours/Week **Credit: 2P**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: Biology and chemistry

Course Objectives:

- Students will be given the basic information of bimolecular, metabolic pathways,

Course Outcomes:

On completion of the course, student will be able to–

- Apply the basic knowledge of biochemistry in the field of biology

Course Contents

Practical	**Biochemistry**	**15 practicals**
Practical 1	**Qualitative analysis of Sugar:**	**1**
	• To perform qualitative analysis of given sugar sample	
Practical 2	**Quantitative analysis of Sugar:** To perform quantitative analysis of reducing sugars from given solution by DNSA method	**1**
Practical 3	**Biuret method:** To quantitatively estimate proteins by Biuret method	**1**
Practical 4	**Lowry's method:** To estimate the amount of proteins by Lowry's method	**1**
Practical 5	**Paper chromatography:** To separate free amino acids by paper chromatography	**1**
Practical 6	**Enzyme assay:** To carry out enzyme assay of amylase using DNSA method	**1**
Practical 7	**Titration curve:** To study the titration curve of Glycine	**1**

	Animal Sciences	
Practical 1	**Study of eggs: To study different types of eggs**	**1**
Practical 2	**Study of frog development:** To study early developmental stageslife cycle of frog embryo (*Rana tigrina*)	**1**
Practical 3	**Study of chick embryo development:** To study whole mount of **c**hick embryo and study staging and staining	**1**
Practical 4	**Study of amphioxus development:**To study amphioxus development, observe its embryo and different developmental stages.	**1**
Practical 5	**Study of external characteristics of *Drosophila melanogaster*:** To study the external characteristics of Drosophila melanogaster with reference to external characters	**1**
Practical 6	**Regeneration in Hydra:** To demonstrate regeneration in Hydra	**2**
Practical 7	**Primary cell culture from chick embryo:** To initiate primary cell culture from chick embryo	**1**

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(2024 Course under NEP 2020) Semester V

Course Code: 24ScBleU5106 **Course Name: Lab course on 24ScBleU5102 & 24ScBleU5103**

Teaching Scheme: TH: 4Hours/Week **Credit: 2P**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: Biology and chemistry

Course Objectives:

- Students will be given the basic information of bimolecular, metabolic pathways,

Course Outcomes:

On completion of the course, student will be able to–

- Apply the basic knowledge of biochemistry in the field of biology

Course Contents

Practical	**Molecular Biology**	**15 practicals**
Practical 1	**Isolation of plant DNA:** To isolate total DNA form given plant tissue (Cauliflower inflorescence)	**1**
Practical 2	**Isolation of bacterial DNA:** To isolate chromosomal DNA from small scale *E. coli* culture	**1**
Practical 3	**Plasmid isolation:** To isolate plasmid DNA from *E. coli* by alkaline lysis method	**1**
Practical 4	**Transformation of *E. coli*:** To study the transformation experiment by preparing competent cells and learning the concept of alpha complementation	**2**
Practical 5	Restriction enzyme digestion and ligation of plasmid	**1**
Practical 6	Polymerase chain reaction	**1**
	Genetic Engineering	
Practical 1	**Genomic DNA Isolation and its characterization**	**3**

	(Qualitative / Quantitative)	
	• Isolation of Bacterial Chromosomal DNA • Isolation of Plant DNA • Isolation of Animal DNA	
Practical 2	**Plasmid DNA Isolation and Gel Electrophoresis**	**1**
Practical 3	**DNA Ligation and Gel electrophoresis**	**1**
Practical 4	**Restriction Mapping of the DNA sample and Gel electrophoresis**	**1**
Practical 5	**Transformation of *E. coli* Cells:**	**1**
	• Preparation of Competent Cells • Transformation technique • Selection of Recombinants	
Practical 6	**PCR Reaction and Gel Electrophoresis**	**1**

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Third Year of B.Sc.Blended (Biosciences)

(2024 pattern under NEP2020)

Course Code: 24ScBLEU5201 **Course Name: Plant Sciences**

Teaching Scheme: TH: 2 Hours/Week Credit: 2(30L)

Examination Scheme: CIA: 20 Marks End-Sem: 40 Marks

Prerequisite Courses: Botany and Biology.

CO no.	Course Outcomes	Bloom's cognitive Taxonomy level
CO 1	Recall the basic knowledge of plant sciences in the field of biology and taxonomy	**1**
CO 2	Explain necessary and important techniques like plant tissue culture related to plant science.	**2**
CO 3	Identify plants, understand classification and use of plants.	**3**
CO 4	Discover plant metabolism and biochemistry.	**4**
CO 5	Explain plant development including embryology, gametogenesis etc.	**5**
CO 6	Discuss various plant families and learn in detail about them	**6**

Course Objectives:

Course Contents

Semester I

Chapter	Title	Lectures
Chapter-1	**Plant Taxonomy and morphology**	**10 Lectures+ 3 Tutorials**
	• **Introduction to Plant Taxonomy** • Definition, scope, objectives and importance • Identification, classification, nomenclature - Concept of Systematics • Study of Plant Families Study of following families with reference to systematic position, salient features, floral formula, floral diagram, and any	

	five examples with their economic importance – Malvaeceae, Meliaceae, Rubiaceae,Solanaceae, Asclepiadaceae, Euphorbiaceae and Liliaceae • Morphology-Phylotaxy, Inflorescence and fruit types.	
Chapter-2	**Plant metabolism and Biochemistry**	**6 Lectures+ 3Tutorials**
	• Nitrogen Metabolism: Biological nitrogen fixation and nitrogen cycle, ammonia assimilation, • Secondary Metabolites and their roles: Introduction to alkaloids, phenolics, plant terpenes, phytoalexins, sesquiterpenes and sterols • Cell signaling in plants.	
Chapter-3	**Plant development**	**10 Lectures+ 3 Tutorials**
	• Plant Embryology- Introduction, Definition and scope of plant embryology. • Microsporangium and male gametophyte -: Male gametophyte: structure and development of male gametophyte. • Megasporangium and female gametophyte-. a. Megasporangium: structure, types of ovules b. Megasporogenesis: structure and development of female gametophyte. • Fertilization: double fertilization (syngamy and triple fusion) and its significance. • Major phases of plant development - Vegetative development, Pattern formation in plants- vegetative Reproductive development: Shift from vegetative to reproductive phase, Pattern formation in plants- flowering	

Chapter-4	Techniques in plant sciences	4 Lectures
	Microscopy Plant tissue culture	

Suggested Reference books:

1. Taiz L, Zeiger E (2010) – Plant physiology (Sinauer Associates, USA).
2. Sharma HP (2009) – Plant embryology: Classical and experimental (alpha sci)
3. Steeves TA & Sussex IM (2004) – Patterns in plant development. (Cambridge Univ Press, Cambridge, New York)

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Third Year of B.Sc.Blended (Biosciences)

(2024 pattern under NEP2020)

Course Code: 24ScBLEU5202 **Course Name: Lab course on Plant Sciences**

Teaching Scheme: TH: 4 Hours/Week Credit: 2

Examination Scheme: CIA: 20 Marks End-Sem: 30 Marks

Prerequisite Courses: Basic Botany and Biology.

Sr.no.	Content of practical	Number of practicals(15)
1.	Plant Taxonomy and morphology	**1**
2.	Preparation of artificial key	1
3.	Preparation of herbarium file	**1**
4.	Study of family-Malvaceae	1
5.	Study of family-Maliaceae	**1**
6.	Study of family-Rubiaceae	1
7.	Study of family-Solanaceae	**1**
8.	Study of family-Apocynaceae	1
9.	Study of family-liliaceae	1
10.	PTC-laboratory organization and facility	1
11.	Aseptic manipulations	1
12.	Preparation and storage of Stock solutions of PTC growth medium	1
13.	Callus culture	1
14.	Anther culture	1
15.	Axillary bud culture	1

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Third Year of B.Sc.Blended (Biosciences) Semester V

(2024 Course under NEP 2020)

Course Code: 24ScBleU5202 **Course Name: Lab course on 24ScBleU5201**

Teaching Scheme: TH: 24Hours/Week **Credit: 2P**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: Basic knowledge of biology, chemistry, physics.

Course Objectives:

- Students will be given the basic information of techniques used in biology

Course Outcomes:

On completion of the course, student will be able to–

- Apply the basic knowledge of techniques and methods in the field of biology

Course Contents

Practical	**Plant Sciences**	**15 practicals**
Practical 1	Preparation of artificial key: To prepare a dichotomous key for given set of species	**1**
Practical 2	Herbarium File: To prepare plant specimen for scientific study	**1**
Practical 3	Study of families: To study Malvaceae, Rubiaceae family	**2**
Practical 4	To study Solanaceae, Asclepiadaceae family	**2**
Practical 5	To study Euphorbiaceae, Liliaceae, Meliaceae family	**1**
Practical 6	Placentation types: To observe and study different placentation types	**1**
Practical 7	Germination of Pollen grains: To study germination of pollen grains of different flowers	**1**
Practical 8	Aseptic techniques in plant tissue culture: To study aseptic techniques in plant tissue culture practices	**1**

Practical 9	Stock solution and Media preparation: To prepare MS basal medium and special media (with growth hormones) for micro propagation	**1**
Practical 10	Callus culture: To initiate callus culture of Datura	**2**
Practical 11	Anther culture: To initiate the anther culture of Datura	**2**

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Third Year of B.Sc.Blended (Biosciences)

(2024 Course Under NEP 2020)

Course Code: 24ScBleU5501 **Course Name: Analysis of Biological Data**

Teaching Scheme: TH: 4 Hours/Week **Credit: 2C (2P)**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: Mathematics, Statistics and Biology.

Course Objectives:

- Students will be given the basic and advance information of statistics and analysis of data

Course Outcomes:

On completion of the course, student will be able to–

- Apply the basic knowledge of data, data analysis in the field of biological research.

Course Contents

Semester I

	Title	15 Practicals
Practical 1	**Statistics and biology**	**2 Practical**
	• Data, what it is, data types. Displaying data, • Principles of graphical summary. Types of study; population and sample; sampling. • Measures of location: proportion, mean, median, mode. Measures of spread: quartiles, IQR, SD, Variance	
Practical 2	**Introduction to probability**	**1 Practical**
	• Conditional probability and independence. Random variables and probability distributions. Common pdfs for biological data + CLT	
Practical 3	**Point estimation**	**1 Practical**
	• Sampling and estimation. • Sampling and standard errors.	

	• Confidence intervals	
Practical 4	**Sampling distribution**	**2 practical**
	• Sampling distributions and interval estimation (z) and (t). • Bootstrap inference. • Inference and Models • NHST. Hypotheses with numerical data: One sample z-test	
Practical 5	**NHST in perspective**	**1 Practical**
	• Goodness of fit. • Contingency analysis. • Comparing means from paired data. • Comparing population means	
Practical 6	**Experimental design**	**2 Practical**
	• Experimental design: space, time; blocking and randomisation; controls, bias, replication, and balance. Precision and Power	
Practical 7	**Analysis of variance**	**1 Practical**
	The linear model. Analysis of variance. Comparing models (likelihood)	
Practical 8	**Correlation**	**2 Practical**
	• Correlation covariance. Linear regression. Inference for regression. Extending the regression model (Multiple regression). Multiple regression (interactions, polynomials). Analysis of covariance. Two-way ANOVA w interactions. Shrinkage estimation methods	
Practical 9	**Logistic regression**	**1 Practical**
	• GLM. Logistic regression	
Practical 10	**Model selection**	**1 Practical**
	• Model selection: AIC; BIC; Stepping; CrossValidation	
Practical 11	**Probability**	**1 Practical**
	• Law of total probability, and Bayes.	

	• Introduction to Bayesian inference	

Suggested Reference books:

1) Dutta, N. K. (2004). Fundamentals of Biostatistics, Kanishka Publishers.
2) Gurumani N. (2005). An Introduction to Biostatistics, MJP Publishers.
3) Daniel, W. W. (2007). Biostatistics- A Foundation for Analysis in the Health Sciences,Wiley.
4) Rao, K. V. (2007). Biostatistics – A Manual of Statistical Methods for use in Health Nutrition and Anthropology.
5) Pagano, M.& Gauvreau, K. (2007). Principles of Biostatistics.
6) Rohatgi, V.K.& Saleh, A.K.Md. (2001). An Introduction to Probability and Statistics,John Wiley & Sons.
7) Sundaram, K.R.(2010) Medical Statistics-Principles & Methods, BI Publications,New Delhi

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(2024 Course under NEP 2020) Semester V

Course Code: 24ScBleU5302 **Course Name: Methods in Biology**
Teaching Scheme: TH: 2 Hours/Week **Credit: 2T**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: Basic knowledge of biology, chemistry, physics.

Course Objectives:

- Students will be given the basic information of techniques used in biology

Course Outcomes:

On completion of the course, student will be able to–

- Apply the basic knowledge of techniques and methods in the field of biology

Course Contents

Semester V

Chapter	Title	Lectures
Chapter-1	**Molecular Biology and recombinant DNA technology Methods**	**6 Lectures + 2 Tutorials**
	• Gene cloning and transformation of cells(Suitable example) • DNA and protein sequencing methods • Polymerase chain reaction and Genomesequencing: genomic and cDNA libraries.	
Chapter-2	**Histochemical and Immunological techniques**	**4 Lectures+1Tutorials**
	• Detection of molecules in living cells: ▪ FISH and GISH *in situ* localization ▪ Immunofluorescence microscopy ▪ Flow cytometry and cell sorting	
Chapter-3	**Biophysical Methods**	**5 Lectures+ 1 tutorials**
	• Molecular structure determination by X-ray and NMR studies • ESR, Circular Dichroism and mass spectrometry	

Chapter-4	**Radiolabelling Techniques**	**4 Lectures + 1 Tutorials**
	• Safety guidelines • Addition of radioisotopes in biological cells and tissues • Measurement and detection of radioisotopes in biological samples by autoradiography	
Chapter-5	**Electrophysiological Methods**	**5 Lectures + 1 Tutorials**
	• CAT,MRI,PET,ECG, Brain activity recording • Patch clamp recording	

Suggested Reference books:

4. Wilson K. and Walker J. Seventh Ed.Principals and Techniques of Biochemistry and Molecular Biology
5. Ghatak 2011Techniques and methods in Biology PHI learning Private Limited.
6. Jost J. 2014 Mathematical Methods in Biology and NeurobiologySpringer-Verlag London

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Third Year of B.Sc. Blended (Bioscience)

(NEP2020under2024Pattern) SemesterV

Course Code: 24ScBleU5001 **Course Name: Field Project I**

Credit: 2C (2P)

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**
Project work, Thesis Submission & presentation

- Project work / Thesis / Dissertation shall be carried out under the supervision of a qualified teacher in the concerned Department./Research Institute/Industry
- Project work / Thesis / Dissertation shall be pursued for a minimum of 12 weeks during the final semester.
- The Project Report/Thesis / Dissertation report is to be prepared as per standard scientific research methodology and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the department.
- The assessment (Internal and external) of the project work will be as per guidelines.

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(2024 Pattern Under NEP 2020)
Semester VI

Course Code: 24ScBLEU6101Credit: 2 C (30 L)

Course Name: Evolutionary Developmental Biology Teaching Scheme: 2 Hours/Week
Examination scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Pre requisite for course-Basic knowledge of Evolution required that will help to study of its other divisions.

Course Objectives:

CO no.	Course Outcomes	Bloom's cognitive Taxonomy level

CO 1	Understanding Concepts of Evolutionary developmental biology - ontogeny and phylogeny	1
CO 2	To give the students an understanding of the concept of development on the genetic content of a species	2
CO 3	The understanding of the role of evolution on the different aspects of how species have evolved to present times	3
CO 4	The role of conserved genes and epigenetics in development during evolution	6
CO 5	Theories put forward to explain the mechanism of development	5
CO 6	Homeobox genes and the Gene Toolkit	4

Chapter	Title	Lectures
Chapter 1	**Ontogeny and phylogeny**	**2 Lectures+1Tutorial**
	Ontogeny of some animal and plant groups, as well as their organ systems, in a phylogenetic perspective Steven J. Gould – Ontogeny and Phylogeny	
Chapter 2	**Concepts of Evolutionary developmental biology**	**3 Lectures + 1 Tutorial**
	Concepts of Evolutionary developmental biology Introduction to developmental biology from a historical and evolutionary perspective	
Chapter 3	**Ontogeny, Recapitulation and Epigenesis**	**3 Lectures+1 Tutorial**
	Haeckel, von Baer, the biogenetic law,	
Chapter 4	**Evolutionary morphology**	**3 Lectures + 1 Tutorial**
	Fritz Muller (using embryology to discover relationships) Implications of similarity in early developmental stages (eg Barnacle larvae are arthropod-like, not molluscan; Tunicates are Chordates) D'Arcy Thomson – On Growth and Form (minor changes	

	in shape lead to major changes in morphology)	
Chapter 5	**The Modern Synthesis (early 20thC)**	**4 Lectures + 1 Tutorial**
	Ronald Fischer: Integration of Darwin's Theory of Natural Selection with Mendel's laws of genetics Gene-protein-structure; Gene mutation-change in biochemical pathway Gavin deBeer: Changes in timing of developmental events - Heterochrony, neoteny	
Chapter 6	**Second Synthesis and Deep Homology**	**4 Lectures + 1 Tutorial**
	Steven J. Gould – Ontogeny and Phylogeny Homeotic genes in *Drosophila* and the emergence of developmental genetics Homeobox genes as a eukaryotic feature The concept of Deep Homology Highly conserved genes control dissimilar organs in different organisms; eg pax-6 in eyes of insects, cephalopods and vertebrates.	
Chapter 7	• **Homeobox genes and the Gene Toolkit**	**6 Lectures + 1 Tutorial**
	Regulation of transcription factors HOX genes in animals – axis development and segmentation MADS-box genes in plants and the ABC model of flower development Hen's Teeth	

Chapter 8	• **Embryo regulatory networks and epigenetics**	**6 Lectures + 1 Tutorial**
	Pleiotropy Origins of novelty are not mutations in genes, but	

	variation in the toolkit-Case-studies (eg.*Distal-less* affecting snake's legs, fruit fly antennae, butterfly wing spots, vertebrate mandibles) Epigenetics	
Chapter 9	• **Origins** of novel features	**5 Lectures + 1 Tutorial**
	Variations in the toolkit Consolidation of epigenetic changes Developmental bias and constraint	

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Course Code: 24ScBLEU6102 Credit: 2 C (30 L)

Course Name: Systematics and Evolution Examination Scheme: CIA: 20 Marks
Teaching Scheme: TH: 2 Hours/Week End-Sem: 30 Marks

Prerequisite Courses:

Course Objectives:

- To Study the systematics, classification and evolution.

Course Outcomes:

CO no.	Course Outcomes	Bloom's cognitive Taxonomy level
CO 1	Principles of classification of organisms at species rank	1
CO 2	Method for phylogenetic inference from morphological and molecular data	2
CO 3	Analysis of phylogenetic data, including the use of computer programs for assembling and analysing morphological and molecular datasets	3
CO 4	Importance of biological collections to the discipline of systematics and familiarity with common curatorial practices and use of specimen data	6
CO 5	Inference of evolutionary and biogeographic patterns within and between species	5
CO 6	Biogeographic patterns in the Indian biota	4

Course Contents

Chapter	Title	Lectures
Chapter 1	**Principles of classification of organisms at species rank**	**5 Lectures + 1 Tutorial**
	• purpose of classification, • monophyly/paraphyly/polyphyly, • species concepts,	

	• practical approaches to species delimitation (molecular/morphological/behavioural), • Rules of nomenclature	
Chapter 2	**Method for phylogenetic inference from morphological and molecular data**	**6Lectures + 2 Tutorial**
	• Homology/analogy, synapomorphy, • Parsimony v. likelihood and Bayesian methods • types of molecular markers, including sequencing/genotyping methods/technology (Sanger, high throughput etc.), • properties of nuclear and organellar genomes, • some processes of molecular evolution (transitions/transversions, gene duplications, indels, polyploidy)	
Chapter 3	**Analysis of phylogenetic data, including the use of computer programs for assembling and analyzing morphological and molecular datasets**	**6 Lectures + 1 Tutorial**
	• Gene trees vs species trees: paralogy/orthology, incomplete lineage sorting • "capture" of organellar genomes through introgression, • concatenation vs concordance approaches to phylogenetic analysis	
Chapter 4	**Importance of biological collections to the discipline of systematics and familiarity with common curatorial practices and use of specimen data**	**7 Lectures + 2 Tutorial**
	• collecting methods, • vouchering, • specimens as objects for classifying, • distribution mapping, • databasing of specimens and name information, • ancient DNA techniques	
Chapter 5	**Inference of evolutionary and biogeographic patterns withinand between species**	**6 Lectures + 2 Tutorial**
	• Use of phylogenies to infer rates of speciation and extinction • Historical biogeography: cf. ecological biogeography, vicariance/dispersal, molecular dating, patterns of diversity, endemism, phylogenetic diversity (focus on broad scale/higher-level patterns) • Phytogeography(focus on within-species	

	patterns; could tie back to species delimitation, introgression etc.)	
Chapter 6	**Biogeographic patterns in the Indian biota**	**6 Lectures + 1 Tutorial**
	• Biogeographic patterns in the Indian biota	

References:

1. M. Anji Reddy Textbook of Remote sensing and GIS (Third edition, 2006) by BS Publication,Hyderabad
2. George Joseph Fundamentals of remote sensing (Second edition, 2005) by Universities press (India) Private Ltd., Hyderabad.
3. 3. John R. Jensen Remote sensing of the environment (2000), Dorling Kindersley India Pvt. Ltd.
4. G.J. Rau and C.D. Weeten, "Environmental Impact Analysis Handbook, McGraw Hill, 1980.
5. E.P. Odum. 1996. Fundamentals of Ecology. Natraj Publishing, Dehradun.
6. Daubenmire.R.F. 1974. Plants and Environment- A Text Book of Plant Ecology (3rd edition). John Wiley & Sons. New York.
7. Kumar.H.D. 1996. Modern Concepts of Ecology (3rd edition). Vikas Publishing House Pvt., Ltd. Delhi.
8. Kumar.H.D. 1997. General Ecology. Vikas Publishing Pvt. Ltd., Delhi. 12.KermondyF.J. 1996. Concepts of Ecology.Prentice Hall of India Pvt. Ltd.,New Delhi.
9. Smith.L.R. 1996. Ecology and Field Biology (5th edition). Harper Collns College Publishers, USA.
10. Weaver. J.E. and Clements. S.E. 1966. Plant Ecology. Tata McGraw Publishing Co. Ltd. Bombay.

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(2024 Course under NEP 2020) Semester VI

Course Code: 23ScBleU6103
Course Name: Microorganisms and Disease
Teaching Scheme: TH: 2 Hours/Week **Credit: 2C(2T)**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

Course Objectives:

- To Study the microorganisms belonging to various groups.
- To understand the pathogenesis of disease caused by these organisms.
- To study the immunity mechanisms developed by higher animals and plants to counteract these pathogens.

Course Outcomes:

On completion of the course, student will be able to–

- Understand the mechanism using which the microorganisms cause disease.

Course Contents

Chapter	Title	Lectures
Unit1	**Prokaryote diversity and biology**	**5 Lectures**
	• Bacteria and Archaea; Bacterial growth, reproduction, and genetics; Transformation • Pathogenic examples (selected examples as case studies)	
Unit2	**Protist diversity and biology**	**6 Lectures**
	• Major groups of protists (emphasis on major pathogenic lineages) • Protist cell biology (eukaryotic); Evolution of protistan parasitism (from autotrophy); Obligate v. Facultative parasites • Pathogenic examples (selected examples as case studies): Animal Blood and tissue - *Plasmodium*, *Toxoplasma*, *Babesia* (Apicomplexans); *Trypanosoma*,	

	Leishmania (Kinetoplastids); *Naegleria* (Amoebae); Dinoflagellates (in fish, crustacea, bivalves). Animal gut and digestive - *Entamoeba* (Amoebae); *Balantidium* (Ciliate); *Giardia* (Diplomonad); *Trichomonas* (Parabasalids); *Cryptosporidium*, *Cystoisospora* (Apicomplexa). Plants - *Phytomonas* (Kinetoplastid disease of coconuts and oil palms); *Phytopthora* (Oomycete – potato blight). Red alga on red alga (substitution of nuclei).	
Unit3	**Fungal diversity and biology**	**3 Lectures**
	● Fungal diversityand life cycles, major lineages ● Pathogenic examples (selected examples ascase studies): Microsporidians; Chytrids - *Batrachochytrumdendrobatidis* (chytridiomucosis in amphibians), *Synchytriumendobioticum* (potato disease). Fungal Pathogens of animals - *Pneumocystis jiroveci*, other respiratory tract fungi; *Candida albicans*; Tinea. Fungal pathogens of plants	
Unit4	**Helminth diversity and biology**	**4 Lectures**
	● Nematodes; Trematodes (flukes); Cestodes (tapeworms)	
Unit5	**Animal responses (immunology)**	**6 Lectures**
	● Immune system and its evolution; Immunisation in mammals	
Unit6	**Plant responses**	**6 Lectures**
	● Inducible defense; Microbe-associated molecular pattern (MAMP)-triggered immunity; R-genes (resistance to intracellular effectors) ● Hypersensitive response; Phytoalexins ● Plant Systemic Immunity: Systemic Acquired Resistance (SAR): Induced Systemic Resistance (ISR)	

References:

1. Kuby immunology, Judy Owen , Jenni Punt , Sharon Stranford., 7th edition (2012), Freeman and Co., NY
2. Textbook of basic and clinical immunology, 1st edition (2013), Sudha Gangal and Shubhangi Sontakke, University Press, India
3. Immunology, 7th edition (2006), David Male, Jonathan Brostoff, David Roth, Ivan Roitt, Mosby, USA.
4. Paniker's Textbook of Medical Parasitology,8th Edition, The health Sciences Publisher.

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(2024Course under NEP 2020) Semester VI

Course Code: 24ScBleU6104 **Course Name: Computational Biology**
Teaching Scheme: TH: 2Hours/Week **Credit: 2T**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: Basics of molecular biology, gene sequencing techniques and computer science.

Course Objectives:

- To Study history, methods and softwares of computational biology.

Course Outcomes:

On completion of the course, student will be able to–

- Obtain the basics of computational biology,biological databases and tools in computational biology.
- Understand the applications of computational biology.

Course Contents

Chapter	Title	Lectures
Unit 1	**Introduction to Bioinformatics and computational biology**	**5 Lectures**
	• Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics	
Unit 2	**Databases in Bioinformatics**	**4 Lectures**
	• Introduction, Biological Databases, • Classification format of Biological Databases, Biological Database Retrieval System.	
Unit 3	**Biological and Sequence Databases**	**6 Lectures**
	• National Center for Biotechnology Information (NCBI): Tools and Databases of NCBI, Database Retrieval Tool, Sequence Submission to NCBI, Basic local alignment search tool (BLAST) • Nucleotide Database, Protein Database, Gene Expression Database. EMBL Nucleotide Sequence Database (EMBL-Bank): Introduction, Sequence Retrieval, Sequence Submission to EMBL, Sequence analysis tools. DNA Data Bank of Japan Introduction, Resources at DDBJ, Data Submission at DDBJ. • Protein Information Resource (PIR): About PIR, Resources of PIR, Databases of PIR, Data Retrieval in	

	PIR. Swiss-Prot: Introduction and Salient Features.	
Unit 4	**Sequence Alignments**	**6 Lectures**
	• Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), MSA by CLUSTALW, Scoring Matrices, Percent Accepted Mutation (PAM), • Blocks of Amino Acid Substitution Matrix (BLOSUM).	
Unit 5	**Molecular Phylogeny**	**4 Lectures**
	• Analyses Methods of Phylogeny, • Software for Phylogenetic Analyses, • Consistency of Molecular Phylogenetic Prediction.	
Unit 6	**Applications of Bioinformatics**	**5 Lectures**
	• Drug Design, Microbial genome applications, Crop improvement, RNA-sequencing and transcriptomics, • Infectious disease modelling, • Analysis of complex ecological networks, Bayesian inference in systems biology	

References:

1. Robbe W. 2004 Computational Biology: Unix/Linux, Data Processing and Programming Springer-Verlag New York.

2. Fall C., MarlandE.,Wagner J., Tyson J. 2002 Computational cell biology Springer Verlag New York.

3. 3. Voit E. 2000 Computational Analysis of Biochemical Systems: A Practical Guide for Biochemists and Molecular Biologists Cambridge University Press.

4. CloteP.,Backofen R. 2000 Computational Molecular Biology: An Introducation John Wiley and Sons.

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Course Code: 24ScBLEU6105Credit: 2 C

Course Name: Lab course based on evolutionary developmental biology and Systematic and Evolution
Teaching Scheme: TH: 4 Hours/Week
Examination Scheme: CIA: 20 MarksEnd-Sem: 30 Marks

Sr.No	Name of Practical	No.ofpracticals(15)
1.	Understanding phylogenetic tree	2
2.	Reconstructing phylogenetic tree	1
3.	Collection and identification of Ants	2
4.	Preparation of Data table to study the diverse morphological characteristics of hibiscus plants	1
5.	Examine and compare species richness of Island and mainland. (Species area relationship)	1
6.	The Study of Fossils: Archaeopteryx and Study of Models of Dinosaurs: Ichthyosaurus, Tyrannosaurus, Brontosaurus, Stegosaurus & Triceratops.	1
7.	STUDY OF HOMOLOGOUS ORGANS: Forelimbs of Frog & Bird, Mouth Parts of Cockroach & Mosquito & Serial Homology in Crustacea (Appendages):	1
8.	STUDY OF ANALOGOUS ORGANS: Vertebrae & Cephalopod Eye, Wing of Bird & Insect.	1
9.	Study of Vestigial Organs: Vermiform Appendix, Wisdom Teeth (Molar Teeth in Man), Coccyx (Tail Bone), Tonsils	1
10.	Study of adaptive radiations in feet of birds and mouth parts of insects:	1
11.	Study of models of fossils horse:	1
12.	Study of Aquatic, Arboreal and Volant Adaptations With Suitable Examples: Shark, Turtle, Chameleon, Loris, Exocoetus, Bat, Pigeon & Draco	1
13.	**StudyofthestagesofdevelopmentofFrog: StructureofEgg, Cleavagestages, Blastula, Gastrula, Neurula stages (whole mount) and various stages of tadpole.**	1

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Course Code: 24 ScBleU6106 **Course Name: Lab course based on 24ScBleU6103& 24ScBleU6104**

Teaching Scheme: P: 4 Hours/Week **Credit: 2C(2P)**

Examination Scheme: CIA: 20 Marks ESE- 30 Marks

	Practicals in Immunology and Microbiology	
Sr. No.	**Title**	**Practicals**
1	Introduction to Microbiology Laboratory To study the instruments used in the microbiology laboratory	1
2	Preparation of media To prepare bacterial and fungal media	1
3	Plate count method To isolate and enumerate isolated viable organisms by standard plate count method	1
4	Monochrome staining To study the morphology of bacteria and yeast by performing membrane staining (positive and negative staining)	1
5	Differential staining To stain the organisms in the given suspension by a Gram staining method	1
6	Differential staining To stain the organisms in the given suspension by a Gram staining method	1
7	IMViC test To perform IMViC test for *E. coli*	1
8	Study of pathogenic organism	1
9	Study of Blood Groups	1

10	Study of Immunoprecipitation technique	1
11	Study of Ouchterlony immunodiffusion technique	1
	Practicals in Computational Biology	
12	Study of Publicly available biological database: Study and searching of information from : 1) PubMed, 2) NCBI 3) DDBJ 4) EMBL 5) Uniport 6) PDB	1
13	Retrieval of sequences and sequence analysis by FASTA and BLAST	1
14	Multiple sequence analysis: Clustal W, MUSCLE, T-Coffee	1
15	Phylogenetic tree construction by molecular phylogeny	1

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Course Code: 23ScBleU6201
Course Name: Scientific Writing
Teaching Scheme: TH: 2 Hours/Week **Credit: 2 C(2T)**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: Basics of English, English Grammar, Research Methodology.
Course Objectives:

- To Study methods and types of research communication.

Course Outcomes:

On completion of the course, student will be able to–

- Obtain the basics of scientific writing and scientific communication.
- Use the methods for project proposal writing, project thesis writing and publications.

Course Contents

Chapter	Title	Lectures
Unit1	Analysis and presentation data	**4L**
	• Using graphs, presenting data in tables, Hints for solving numerical problems	
Unit2	The Internet and World Wide Web	**8L**
	• internet resources for biosciences, using spreadsheets, word processors, databases and other packages, finding and citing information	
Unit3	Communicating information	**8 L**
	• General aspects of scientific writing, writing essays, reporting practical and project work, writing literature surveys and reviews, organizing a poster display, giving an oral presentation examinations and preparation of scientific papers	
Unit4	Research Report	**7L**
	• Format of the research report, style of writing the report, references and bibliography	
Unit5	Structure and Components of Research Report	**2L**
	• Types of Report: research papers, thesis. Research Project Reports, Pictures and Graphs, citation styles,	

Unit6	Seminars and presentation skills	**1L**

Suggested References

Research Methodology. Methods and Techniques: C. R. Kothari

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Third Year of B.Sc. (Blended Biosciences)

(NEP 2020 under 2024 Pattern) Semester VI

Course Code: 24ScBLEU6202 **Course Name: Lab course on scientific writing**

Teaching Scheme: P: 4 Hours/Week **Credit: 2C (15 P)**

Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses:

- Basics of English, English Grammar
- Basic Knowledge of scientific research concepts and scientific literature

Course Objectives:

- To Study methods and types of research communication.
- Understand different scientific research designs and methods
- Learn how to set up a research study
- Understand correct ways to refer to and cite from scientific literature

Course Outcomes:

Course Contents:

Practical	Title	No. of Practical
Practical 1	**Introduction**	
	• What is Critical Thinking? ▪ What is Scientific Writing? ▪ Significance ▪ Need ▪ Applications	**1**
Practical 2	**Scientific Communication**	
	• Introduction ○ Significance ○ Need ○ Types (Oral and Written)	**2**
Practical 3	**Forms of Scientific Communication and Publications:**	
	• Case Study • Short Communication • Research Articles • Technical Reports	**1**
Practical 4	**IMRAD format:**	
	• Research and Review Papers, • Project Reports, • Dissertation Report	**2**
Practical 5	**Literature Review - Review Paper or Chapter in**	

	Report:	
	• Process • Significance • Example	**2**
Practical 6	**Result Analysis: Data Analysis and Data Representation:**	**2**
	• Tables • Graphs • Statistical tests	
Practical 7	**Bibliography and Citation Styles:**	
	▪ Citation Styles ▪ Soft ware for reference management	**1**
Practical 8	**Plagiarism and Ethics in Research:**	
	• Concept and Types of Plagiarism • Soft ware for plagiarism checking • Ethics	**2**
Practical 9	**Journals in Biotechnology:**	**1**
	7. How to search a good journal? 8. Good journal vs. Bad journal 9. Important links on Journal Website - Instruction to Authors as well as Aim and Scope	
Practical10	**Power Point Presentation:**	
	• Evaluation of any research	**1**

References:

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C.R.Kothari
4. Health informatics research methods: principles and practice *Layman, Elizabeth; Watzlaf, Valerie J.*Chicago, Ill. : American Health Information Management Association, c2009. - xiii, 439 p. ISBN:978-1-58426-181-0 : $85.95 LIBRIS-ID:12452928 Library search
5. *Denscombe, Martyn.* The good research guide [Elektroniskresurs] : for small-scale social research projects 4th ed. : Maidenhead : Open University Press, cop.2010. - 373 p. ISBN:9780335241408 (electronic bk.) LIBRIS-:12194897 Library search

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Third Year of B.Sc. Blended Bioscience

(2024 pattern under NEP 2020) Semester VI

Course Code : 24ScBleU6203

Course Name: Biodiversity

Teaching Scheme: TH: 2 Hours/Week **Credit : 4C (2T+2P)**

Examination Scheme: CIA : 40 Marks **End-Sem : 60 Marks**

Prerequisite Courses:

- Knowledge of plants & animals ecology in India.

Course Objectives:

- To Study Biodiversity and Ecosystems.
- To learn Conservation and Laws of Biodiversity.

Course Outcomes:

On completion of the course, student will be able to–

- Research in Biodiversity and Environment.
- Field study make a really understand Biodiversity and Hot Spots in India.

Course Contents

Chapter	**Topic**	**Total Lectures 30**
Chapter 1	**Understanding Biodiversity**	**3 lectures**
.	• Concept of biodiversity , • Definition , Taxonomic, ecological and genetic perspectives of biodiversity, • Change in Biodiversity over time and space, • Magnitude of biodiversity.	
Chapter 2	**Ecosystem diversity**	**3 lectures**
	• Species diversity • Genetic diversity • Ecosystem Community Diversity. • Indices of biodiversity analysis. (Plant and	

	Animal)	
Chapter 3	**Biodiversity in Ecosystem**	**3 lectures**
	▪ Biodiversity in India : Habitats, Niche, Hot spots of biodiversity in India and around the world. ▪ Biomes of the world: Animals, plants and microorganism. ▪ Microbial Biodiversity.	
Chapter 4	**Population diversity**	**5 lectures**
	• Population growth forms, • age class distribution and carrying capacity • Population Structure and interactions	
Chapter 5	**Conservation of Biodiversity**	**5 lectures**
	• Need for conservation of biodiversity • Strategies for conservation , • Methods for conservation –*Ex situ* and *In situ* • Biodiversity conservation of India – Governmental and N.G.Os	
Chapter 6	**International efforts for conserving biodiversity**	**4 lectures**
	10. Status of biodiversity. 11. Earth summit 12. Rio conference 13. Wild life protection acts & Forest conservation acts	
Chapter 7	**Biodiversity Utilization**	**3 lectures**
	• Management, documentation and databases of biodiversity • Domesticated animal and agricultural diversity • Socio- economic importance of biodiversity	
Chapter 8	**Biological Systematic**	**4 Lectures**
	• Concept of species and variation • Need for taxonomy and nomenclature • Introduction to classification systems • Techniques in morphological, anatomical analysis and Molecular tools in taxonomy	

Reference Books:

1. An advanced text book on biodiversity – practices (2004) krishnamurthuy K V Oxford and Publishing , Delhi.
2. Environmental biotechnology (2010) Rana Rastogi Publications, Meerut.
3. Environmental science (2011) Santra S.C. New central book agency , Kolkata
4. Fundamental of ecology (2009) Dash 3 rd edition , Tata McGraw-Hill Education, New Delhi.

5. Text Book of Biodiversity (2003) Krishnamurthy K V Science Publishers, Jodhpur.

6. Biological Systematics: Principles And Applications (2002) Randall T. Schuh Cornell University Press, USA

7. Genetics Of Populations (2011) Philip Hedrick Jones & Bartlett Learning, Burlington, MA

8. Global Biodiversity Strategies (1992) Courrier Kathleen (Editor) World Resource Institute,USA

9. Introduction To Microbiology (2004) John and Catherin Ingraham Brooks/Cole Pub, USA

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Third Year of B.Sc. Blended Bioscience

(2024 pattern under NEP 2020) Semester VI

Course Code : 24ScBleU6204

Course Name: Lab course on Biodiversity

Teaching Scheme: PR: 4 Hours/Week **Credit : 4C (2T+2P)**

Examination Scheme: CIA : 40 Marks **End-Sem : 60 Marks**

Practical	Topic	15 Practicals
Practical 1	**Study of Species Diversity Using Quadrat Method** • Estimation of species richness and frequency using quadrat sampling method	**2P**
Practical 2	**Calculation of Biodiversity Indices** • Calculation of biodiversity indices such as Shannon-Wiener Index and Simpson's Index	**2P**
Practical 3	**Study of Biodiversity Hotspots of India** • Study of different biodiversity hotspots in India	**1P**
Practical 4	**Study of Microbial Biodiversity** • Isolation and enumeration of soil microorganisms	**2P**
Practical 5	**Study of bird diversity by Point Count Method** • Assessment of bird diversity in a selected region.	**2P**
Practical 6	**Aquatic Biodiversity Assessment** • Study of aquatic biodiversity	**2P**
Practical 7	**Study of Endangered Species of India** • Study of endangered plant and animal species.	**2P**
Practical 8	**Field visit**	**2P**

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(2024 Course under NEP 2020) Semester VI

Course Code: 24 ScBleU6501 **Course Name: Applied Biology**
Teaching Scheme: TH: 2 Hours/Week **Credit: 2T**
Examination Scheme: CIA: 20 Marks **End-Sem: 30 Marks**

Prerequisite Courses: Basic knowledge of all branches of biology.

Course Objectives:

- Students will be given the basic information of applications of biology

Course Outcomes:

On completion of the course, student will be able to–

- Apply the basic knowledge of concepts, techniques, methods in the field of biology

Course Contents

Chapter	Title	Lectures
Chapter-1	**Biodiversity uses and Bioresources**	**6 Lectures**
	• Bioresources and bioresource conservation • Bioresources for food and nutrition • Ethnic knowledge in bioresource conservation • Gene bank and Bioprospecting traditional medicines	
Chapter-2	**Marker Assisted breeding in Plants and Animals**	**5 Lectures**
	▪ Marker Assisted Selection ▪ Types of Markers ▪ QTL mapping, DNA markers in animal and plant breeding	
Chapter-3	**Genomics applications in health**	**5 Lectures**
	• Identification and diagnosis of genetic disorders • Parental diagnosis and testing • Pharmacogenetics and gene therapy • Personalized medicines	
Chapter-4	**Transgenic animals and plants**	**5 Lectures**
	• Transgenic animals in biomedical science	

	• Transgenic animal in livestock maintenance • Transgenic plants in Nutrition improvement • Transgenic plants in high yield • Transgenic plants in disease resistance	
Chapter-5	**Biosensors**	**5 Lectures**

Suggested Reference books:

1. Purohit and S.S. 2010 third edition Biotechnology: Fundamentals And Applications, Student edition.
2. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
3. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edition. Agrobios, India.
4. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
5. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
6. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
7. Robbins S.L. (1974) Pathological basis of Disease. W B Saunders Company
8. Macleod J.: Davidson's Principles & Practice of Medicine: A textbook for students and doctors' 14th Edition. Churchill Livingstone.
9. Guyton A.C. and Hall J.E. (2006) Textbook of Medical Physiology 11th edn. Saunders
10. Hage D S and Carr J D, (2010) Analytical Chemistry & Quantitative Analysis, Prentice Hall

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Third Year of B.Sc. Blended (Bioscience)

(NEP2020under2024Pattern) SemesterVI

Course Code: 24ScBleU6004 **Course Name: On Job Training**

Credit: 4C (4P)

Examination Scheme: CIA: 40 Marks **End-Sem: 60 Marks**

Project work, Thesis Submission & presentation

- On Job Training shall be carried out under the supervision of a qualified teacher in the concerned Department/Research Institute/Industry
- It shall be pursued for a minimum of 120 hours during the final semester.
- The OJT report is to be prepared as per standard scientific research methodology and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the department.
- The assessment (Internal and external) of the OJT will be as per guidelines.