ADADAMAS UNIVERSITY

SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY

Department of Biological Sciences

B.Sc. (Biochemistry) Program

Program Code: BIC3405

(2026-30)

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF BIOLOGICAL SCIENCES

VISION OF THE UNIVERSITY

To be an internationally recognized university through excellence in inter-disciplinary education, research and innovation, preparing socially responsible well-grounded individuals contributing to nation building.

MISSION STATEMENTS OF THE UNIVERSITY

M.S 01: Improve employability through futuristic curriculum and progressive pedagogy with cutting-edge technology

M.S 02: Foster outcomes-based education system for continuous improvement in education, research and all allied activities

M.S 03: Instill the notion of lifelong learning through culture of research and innovation

M.S 04: Collaborate with industries, research centres and professional bodies to stay relevant and up-to-date

M.S 05: Inculcate ethical principles and develop understanding of environmental and social realities

CHANCELLOR / VICE CHANCELLOR

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF BIOLOGICAL SCIENCES

VISION OF THE SCHOOL

To achieve global standard and **excellence in research** on various **interdisciplinary and multidisciplinary domains** of biological sciences through **biotechnological innovation** along with **producing global citizens** as graduates by **intensive teaching learning process** who would be vanguard to **sustainable societal development**.

MISSION STATEMENTS OF THE SCHOOL

M.S 01: To disseminate knowledge of life science and biotechnology for scholarly progression, intellectual development and strive for innovation.

M.S 02: To enable latest skill sets in the domain of microbiology, biotechnology, biochemistry (biological sciences) with ability to evolve and engage in learn-unlearn and relearn, being a lifelong learner.

M.S 03: To establish state of art infrastructure and research ambiance in attracting the best minds to serve under the single roof of school of life science and biotechnology in undertaking scientific investigation of social relevance.

M.S 04: To inculcate values, culture along with scientific knowledge to foster the spirit of self-reliance and entrepreneurship development.

Rudrapasad Saha

DEAN / SCHOOL CONCERNED

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF BIOLOGICAL SCIENCES

VISION OF THE DEPARTMENT

To achieve **excellence in education and research in biochemistry** for **societal development** through **innovation** and producing **technologically sound graduates** as **global citizen** fostering **life-long learning.**

MISSION STATEMENTS OF THE DEPARTMENT

M.S 01: Adopt and implement latest curriculum in biochemistry with futuristic approach and innovative pedagogy fostering knowledge, intellectual and skill development.

M.S 02: To enable and enhance skill sets in biochemistry through rigorous training and research through multidisciplinary approach.

M.S 03: To cater professional and societal need of cutting-edge research in biochemistry through collaboration and industry-academic partnership.

M.S 04: To inculcate values, culture along with microbiological knowledge to foster the spirit of self-reliance and entrepreneurship development.

HOD **DEAN / SCHOOL CONCERNED**

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF BIOLOGICAL SCIENCES

Name of the Programme: B.Sc. (Biochemistry)

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 01 : Acquire basic theoretical and practical domain knowledge.

PEO 02 : Acquainted with tools and technology related to the field of study.

PEO 03 : Ability to do identify research gaps, comprehend fundamentals and specialize in the domain.

PEO 04 : Develop as professional aspirants and sustainable learners.

PEO 05 : Global outlook with imbibed human values

HOD | **DEAN / SCHOOL CONCERNED**

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
DEPARTMENT OF BIOLOGICAL SCIENCES

Name of the Programme: B.Sc. (Biochemistry)

GRADUATE ATTRIBUTE / PROGRAMME OUTCOME (PO)

GA 01/ PO 01: Strong fundamental knowledge in basic and applied field of biochemistry.
GA 02/ PO 02: Ability to correlate between courses and develop critical/logical thinking.
GA 03/ PO 03: Develop skill set related to biochemistry and allied fields.
GA 04/ PO 04: Familiarized with classical as well as modern tools and techniques in biochemistry.
GA 05/ PO 05: Ability to identify scientific research gaps and problems pertaining to biochemistry and allied fields.
GA 06/ PO 06: Explore the acquired knowledge and skills of biochemistry to identify approaches for suitable solution.
GA 07/ PO 07: Ability to retrieve biological data for a meaningful solution.
GA 08/ PO 08: Decide upon career path, force the challenges and develop professional aspirations.
GA 09/ PO 09: Uphold integrity and collaborative approach in workplace.
GA 10/ PO 10: To accept and implement learning towards sustainable development.
GA 11/ PO 11: Practice ethical philosophies and systems in creating and partnering a progressive society.
GA 12/ PO 12: Develop as global citizen to contribute to the greater benefits of humanity.

HOD **DEAN / SCHOOL CONCERNED**

SCHOOL OF LIFE SCIENCE AND BIOTECHNOLOGY
UNDERGRADUATE COURSE STRUCTURE
B.Sc. (BIOCHEMISTRY)
AYs: 2026-30

S. No	Type of Course		Code	Title of the Course	Credit Distribution			Credits	Remarks
					L	T	P		
SEMESTER I									
1	1	CC	BIC101	Molecules of Life	2	1	1	4	CC – 1
2	2	CC	BIC109	Principles of Human Physiology	2	1	1	4	CC – 2
3	3	Minor	IKS101	Introduction to Indian Knowledge System (IKS)	4	0	0	4	General Minor – 1
4	4	MDC		To be chosen from a pool of Multidisciplinary courses	2	0	1	3	MDC – 1
5	5	AEC	AEC101	Communicative English I	2	0	0	2	AEC – 1
6	6	SEC	GEN103	AI for Science	2	0	0	2	AI Basics
7	7	VAC	VAC101	Environmental Education-I	2	0	0	2	VAC – 1
8	8	SEC	CLL151	Soft Skills & Aptitude I	0	0	1	1	General SEC - 1
9	9	AEC	AEC107 / AEC108 / AEC109	Foreign Language: French I / Foreign Language: German I / Foreign Language: Spanish I	1	1	0	2	Foreign Language – 1
Total courses	9	**Semester Credits**						24	
SEMESTER II									
10	1	CC	BIC103	Cell Science	2	1	1	4	CC – 3
11	2	CC	MIB107	Bacteriology and Virology	2	1	1	4	CC – 4
12	3	Minor	GEN104	Basic Cyber Security and Internet of Things (IoT)	4	0	0	4	General Minor – 2
13	4	MDC		To be chosen from a pool of Multidisciplinary courses	2	0	1	3	MDC – 2
14	5	AEC	AEC102	Communicative English II	2	0	0	2	AEC – 2
15	6	SEC	SEC147	AI in Biology	1	0	1	2	SEC – 1
16	7	VAC	VAC105	Community Engagement and Social Responsibility	1	0	1	2	VAC – 2
17	8	AEC	AEC110 / AEC111 / AEC112	Foreign Language: French II / Foreign Language: German II/ Foreign Language: Spanish II	2	0	0	2	Foreign Language – 2
18	9	SEC	CLL152	Soft Skills & Aptitude II	0	0	1	1	General SEC – 2
Total courses	9	**Semester Credits**						24	

SEMESTER III									
S. No	Type of Course		Code	Title of the Course	Credit Distribution			Credits	Remarks
					L	T	P		
19	1	CC	BIC201	Metabolism of Carbohydrate and Lipid	2	1	1	4	CC – 5
20	2	CC	BIC205	Basics of Plant and Animal Sciences	2	1	1	4	CC – 6
21	3	Minor		To be chosen from a pool of Minor courses				4	Discipline Specific Minor – 1
22	4	MDC		To be chosen from a pool of Multidisciplinary courses				3	MDC – 3
23	5	SEC	SEC140	Biophysics and Bioenergetics	1	0	1	2	SEC – 2
24	6	VAC	VAC102	Human Values and Ethics	2	0	0	2	VAC – 3
25	7	SEC	CLL251	Soft Skills and Aptitude III	0	0	1	1	General SEC – 3
26	8	PDC	PDC201	Professional Development Course – I	0	0	1	1	PDC – 1
Total courses	**8**	**Semester Credits**						**21**	
SEMESTER IV									
27	1	CC	BIC203	Advanced Microbiology	2	1	1	4	CC – 7
28	2	CC	MIB205	Molecular Biology	2	1	1	4	CC – 8
29	3	CC	BIC206	Biomolecular Interactions	2	1	1	4	CC – 9
30	4	SEC	SEC144	Clinical Biochemistry	1	0	1	2	SEC – 3
31	5	Minor		To be chosen from a pool of Minor courses				4	Discipline Specific Minor – 2
32	6	VAC	VAC107	Ayurveda and Nutrition	2	0	0	2	VAC – 4
33	7	SEC	CLL252	Soft Skills and Aptitude IV	0	0	1	1	General SEC – 4
34	8	PDC	PDC202	Professional Development Course – II	0	0	1	1	PDC – 2
Total courses	**8**	**Semester Credits**						**22**	

SEMESTER V									
S. No	**Type of Course**		**Code**	**Title of the Course**	**Credit Distribution**			**Credits**	**Remarks**
					L	**T**	**P**		
35	1	CC	MIB301	Immunology	2	1	1	4	CC – 10
36	2	CC	BIC303	RDT and Genetic Engineering	2	1	1	4	CC – 11
37	3	CC	BIC309	Metabolism of Amino acids and Nucleic acids	2	1	1	4	CC – 12
38	4	Minor		To be chosen from a pool of Minor courses				4	Discipline Specific Minor – 3
39	5	SEC	SEC142	IPR and Biosafety	1	1	0	2	SEC – 4
40	6	INT	BIC304	Internship	0	0	4	4	Internship
41	7	SEC	CLL351	Soft Skills and Aptitude V	0	0	1	1	General SEC – 5
42	8	PDC	PDC301	Professional Development Course – III	0	0	1	1	PDC – 3
Total courses	8	**Semester Credits**						24	
SEMESTER VI									
43	1	CC	MIB305	Bioinformatics	2	1	1	4	CC – 13
44	2	CC	BIC307	Nutrition and Toxicology	2	1	1	4	CC – 14
45	3	CC	BIC311	Medical and Forensic Biochemistry	2	1	1	4	CC – 15
46	4	Minor		To be chosen from a pool of Minor courses				4	Discipline Specific Minor – 4
47	5	SEC	SEC146	Molecular Diagnostics	1	0	1	2	SEC – 5
48	6	Project	BIC308	Project Work on Biochemistry	0	0	4	4	Project
49	7	SEC	CLL352	Soft Skills and Aptitude VI	2	0	0	1	General SEC – 6
50	8	PDC	PDC302	Professional Development Course – IV	0	0	1	1	PDC – 4
Total courses	8	**Semester Credits**						24	

SEMESTER VII

S. No	Type of Course		Code	Title of the Course	Credit Distribution L	T	P	Credits	Remarks
51	1	CC	BIC401	Plant Biochemistry	2	1	1	4	CC – 16
52	2	CC	BIC402	Developmental Biology	2	1	1	4	CC – 17
53	3	CC	BIC403	Genomics and Proteomics	2	1	1	4	CC – 18
54	4	CC (For *With Research*)	BIC411	Research Methodology and Data Analysis *(should start working on dissertation topic)*	3	1	0	4	CC – 19 (*Research*)
		CC (For *Without Research*)	MIB405	Modern Techniques and Bioinstrumentation					CC – 19 (*Without Research*)
55	5	Minor		To be chosen from a pool of Minor courses				4	Discipline Specific Minor – 5
56	6	PDC	PDC401	Professional Development Course – V	0	0	1	1	PDC – 5
Total courses	6	**Semester Credits**						21	

SEMESTER VIII

S. No	Type of Course		Code	Title of the Course	L	T	P	Credits	Remarks
57	1	CC	MIB406	Biostatistics and Biomathematics	2	1	1	4	CC – 20
58	2	CC (For *Without Research*)	BIC410	Plant and Animal Tissue Culture	2	1	1	4	CC – 21 (*Without Research*)
59	3	CC (For *Without Research*)	MIB408	Biomedical Nanotechnology	2	1	1	4	CC – 22 (*Without Research*)
60	4	Minor (For *With/ Without Research*)		To be chosen from a pool of Minor courses				4	Discipline Specific Minor – 6 (*With / Without Research*)
61	5	Minor (For *Without Research*)		To be chosen from a pool of Minor courses				4	Discipline Specific Minor – 7 (*Without Research*)
62	6	Dissertation (For *With Research*)	BIC409	Dissertation on Biochemistry	0	0	12	12	Dissertation (*With Research*)
Total courses	3	*With Research*		**Semester Credits**				20	
	5	*Without Research*							
Total Credits of Program after 4 Years (8 Semesters)								**180**	

NOTE: *With Research* is only allowed for students who secure ***75% marks and above in the first six semesters***

Course Distribution Across Semesters

Course Type		CC	Minor	MDC	SEC	AEC	VAC	SEC (CLL)	PDC	General: Minor: IKS	General: Minor: Cyber Security	General: SEC: AI	Internship/ Project	Courses per Semester	Total Credits
Course Credits		**4**	**4**	**3**	**2**	**2**	**2**	**1**	**1**	**4**	**4**	**2**	**4**		
Semester	**I**	2	-	1	-	2	1	1	-	1	-	1	-	**9**	**24**
	II	2	-	1	1	2	1	1	-	-	1	-	-	**9**	**24**
	III	2	1	1	1	-	1	1	1	-	-	-	-	**8**	**21**
	IV	3	1	-	1	-	1	1	1	-	-	-	-	**8**	**22**
	V	3	1	-	1	-	-	1	1	-	-	-	1	**8**	**24**
	VI	3	1	-	1	-	-	1	1	-	-	-	1	**8**	**24**
	VII	4	1	-	-	-	-	-	1	-	-	-	-	**6**	**21**
		19	5	3	5	4	4	6	5	1	1	1	2	**56**	**160**

Semester	Course Distribution: CC	Course Distribution: Minor	Course Distribution: Dissertation	Course Pattern	Courses	Total Credits
VIII	**4**	**4**	**12**			
	1	1	1	(*With Research*)	**3**	**20**
	3	2	-	(*Without Research*)	**5**	
Total Credits of Program after 4 Years (8 Semesters)						**180**

Criteria to be fulfilled for Credit Transfer to B.Sc. (Biochemistry)

Semester	Year	Entry Level (NCrF)	Minimum Credits Earned / Year	Minimum Cumulative Credits Earned	Eligibility
UG Semester 1 UG Semester 2	1st	4.5	40		Completion of 10th+2-Yr NTC/NAC/CITS, NSQF Level 4 STT
UG Semester 3 UG Semester 4	2nd	5.0	40	40	Completion of 10th+3-Yr NTC/NAC/CITS, 12th+1-Yr NTC/NAC/CITS, NSQF Level 4.5 STT
UG Semester 5 UG Semester 6	3rd	5.5	40	80	Completion of 10th+4-Yr NTC/NAC/CITS, 12th+2-Yr NTC/NAC/CITS, NSQF Level 5 STT
UG Semester 7 UG Semester 8	4th	6.0		120	Completion of 10th+5-Yr NTC/NAC/CITS, 12th+3-Yr NTC/NAC/CITS, NSQF Level 5.5 STT

Minor Courses offered by the Department of Biological Sciences

Semester	Course Code	Course Title	Credit Distribution			Credit
			L	T	P	
III	BIC253	Introduction to Biomolecules and Metabolism	3	0	1	4
IV	MIB254	Introduction to Cell and Molecular Biology	3	0	1	4
V	MIB353	Basics of Microbiology	3	0	1	4
VI	BIC352	Basics of Nutrition and Toxicology	3	0	1	4
VII	MIB453	Fundamentals of Recombinant DNA Technology	3	0	1	4
VIII	MIB452	Fundamentals of Nanobiotechnology	3	0	1	4
	BIC453	Drug Design and Development	3	0	1	4

Skill Enhancement Courses (SEC) offered by the Department of Biological Sciences

Semester	Course Code	Course Title	Credit Distribution			Credit
			L	T	P	
II	SEC147	AI in Biology	1	0	1	2
III	SEC140	Biophysics and Bioenergetics	1	0	1	2
IV	SEC144	Clinical Biochemistry	1	0	1	2
V	SEC142	IPR and Biosafety	2	0	0	2
VI	SEC146	Molecular Diagnostics	1	0	1	2

Multidisciplinary Courses offered by the Department of Biological Sciences

Semester	Course Code	Course Title	Credit Distribution			Credit
			L	T	P	
I	MIB105	Sustainable Energy Solutions	2	0	1	3
II	BIC110	Chemical and Biocatalysis	2	0	1	3
III	MIB203	Biomaterial Sciences	2	0	1	3

BIC101	Molecules of Life	L	T	P	C
Version	3.0	2	1	1	4
Pre-requisites/Exposure	Knowledge of 10+2 Basic Chemistry and Biology				
Co-requisites					

Course Objectives

1. To provide an overview of the chemical principles and biomolecules that form the basis of life.
2. To describe the structure, properties and roles of carbohydrates, proteins, lipids and nucleic acids in living systems.
3. To highlight the significance of water, pH, buffers and molecular interactions in biological processes.
4. To familiarise students with common laboratory methods for identifying and studying biomolecules.
5. To establish a foundational understanding of biomolecular structure – function relationships for future studies in life sciences and biotechnology.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Remember** the chemical nature of biomolecules essential for life.
CO2 : **Understand** the structure and function of carbohydrates, proteins, lipids, and nucleic acids.
CO3 : **Apply** understanding of water, pH, and buffer systems to analyze their roles in biological stability and function.
CO4 : **Analyze** molecular structure function relationship in a biological context.
CO5 : **Evaluate** connections between basic biochemical principles and cellular and physiological processes.

Catalogue Description

This course explores the essential chemical principles and biomolecules that underpin all living systems, providing foundational insight into the structure, function and interactions of molecules critical to life. It focuses on the structure, properties and biological roles of major biomolecules including carbohydrates, proteins, lipids and nucleic acids. Students will study molecular interactions, the unique role of water as a biological solvent, and the principles of pH, buffers and homeostasis. Learners will develop skills in qualitative biochemical analysis, buffer preparation and enzyme activity assays. The course equips students with fundamental biochemical knowledge and practical skills for further studies in life sciences and biotechnology.

Course Content

Unit 1 Introduction to Biomolecules **7 hours**
Overview of life's chemical basis; Types of biomolecules: organic and inorganic; Bonds and interactions in biological molecules (covalent, ionic, hydrogen bonds, van der Waals forces); Water as a biological solvent: properties and significance

Unit 2 Carbohydrates **8 hours**
Classification: monosaccharides, disaccharides, oligosaccharides, polysaccharides; Structure and function of glucose, fructose, sucrose, lactose, starch, glycogen, cellulose; Biological significance of carbohydrates in energy storage and structural roles

Unit 3 Proteins **10 hours**
Amino acids: structure, classification, properties; Peptide bond formation; Levels of protein structure (primary, secondary, tertiary, quaternary); Protein functions: enzymes, transport, structural, regulatory; Protein denaturation and renaturation

Unit 4 Lipids **8 hours**
Classification: simple, compound, and derived lipids; Structure and function of fatty acids, triglycerides, phospholipids, steroids; Role of lipids in membrane structure and energy storage

Unit 5 Nucleic Acids **8 hours**
Structure of nucleotides and nucleosides; DNA and RNA: structure, types, and functions; Chargaff's rules, Watson-Crick model; Central dogma: replication, transcription, translation (brief overview)

Unit 6 pH, Buffers, and Biological Relevance **4 hours**
Concept of pH and pKa; Buffer systems in biological fluids; Henderson-Hasselbalch equation, Role of buffers in maintaining pH homeostasis

Unit 7 Lab exercises **30 hours**
Basic understanding of different instruments in lab (microscopy, washing, autoclaving etc.).
Properties of water.
Buffer preparation.
Qualitative analysis of Carbohydrates.
Qualitative analysis of Carbohydrates.
Qualitative analysis of proteins.
Qualitative analysis of Lipids.
Study of Salivary amylase.

Experiential Learning

1. Perform virtual biochemical tests (Benedict's, Biuret) on unknown samples to identify carbohydrates, proteins, and lipids, interpreting colour changes.
2. Use interactive tools to model biomolecules (amino acids, DNA, lipids), assemble structures, and identify functional groups.

Textbooks

1. Nelson, D.L. and Cox, M.M. (2013). *Lehninger's Principles of Biochemistry*. 6th Edition. W.H. Freeman.
2. Campbell, M.K. (2012). *Biochemistry*. 7th Edition. Cengage Learning.

Reference Books

1. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2011). *Biochemistry*. 7th Edition. W.H. Freeman.
2. Voet, D. and Voet, J.G. (2004). *Biochemistry*. 3rd Edition. John Wiley and Sons.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	1	1	1	1	1	1	3	2	3
CO2	3	3	2	2	2	1	1	1	2	3	2	3
CO3	3	3	3	2	2	2	2	1	2	3	2	3
CO4	3	3	3	3	3	3	2	1	2	3	2	3
CO5	2	3	3	3	3	3	3	2	3	3	2	3
Average	2.8	2.8	2.6	2.2	2.2	2.0	1.8	1.2	2.0	3.0	2.0	3.0

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC109	Principles of Human Physiology	L	T	P	C
Version	**1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Knowledge of Biology at Plus Two Level				
Co-requisites					

Course Objectives

1. To introduce students to the structural and functional organization of the human body and its major physiological systems.
2. To explain the physiological mechanisms that regulate cardiovascular, respiratory, gastrointestinal, renal, musculoskeletal, nervous, endocrine, and reproductive functions.
3. To develop practical skills for measuring and analyzing key physiological parameters through laboratory experiments.
4. To foster an understanding of hormonal and neuroendocrine regulation in maintaining homeostasis and integrating body systems.
5. To cultivate the ability to critically evaluate physiological data and relate biochemical principles to human health and disease.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts of human physiology, major organ systems, and hormonal regulation.
CO2 : **Understand** the mechanisms of major physiological systems and their role in homeostasis.
CO3 : **Apply** basic laboratory techniques to assess physiological functions.
CO4 : **Analyse** data on cardiac, renal, hormonal, and sensory physiology.
CO5 : **Evaluate** physiological responses and experimental findings in health and disease contexts.

Catalogue Description

This course offers an integrated study of human physiology, emphasizing hormonal and neuroendocrine regulation across organ systems. It covers cardiovascular, respiratory, gastrointestinal, renal, musculoskeletal, nervous, endocrine, and reproductive functions, focusing on homeostasis, energy balance, and fluid-electrolyte equilibrium. By connecting biochemical principles with physiological functions, the course enhances understanding of molecular mechanisms in the context of whole-body systems, providing essential knowledge for applying biochemical insights to health, disease, and biomedical research.

Course Content

Unit 1 General, Cardiovascular and Pulmonary Physiology 14 hours

Human physiology and homeostasis; Cardiovascular anatomy and function; Cardiac cycle and output regulation; Vascular system and blood pressure control; Pulmonary structure and ventilation; Gas exchange and respiratory control; Hormonal and neuroendocrine regulation of cardiovascular and respiratory systems

Unit 2 Gastrointestinal Physiology 7 hours

GI tract structure and motility; Digestive secretions and nutrient absorption; Liver structure and functions; GI hormones; Regulation of metabolism and energy balance; Neuroendocrine control of digestion; Defaecation and Emesis.

Unit 3 Neurophysiology and Musculoskeletal Physiology 7 hours

Organisation of the nervous system; Motor and sensory pathways; Neural conduction and synaptic transmission; Muscle contraction and metabolism; Bone physiology and Calcium homoeostasis; Sensory systems; Neuroendocrine regulation of neural and musculoskeletal functions

Unit 4 Renal Physiology 9 hours

Renal structure and filtration; Urine formation and micturition; Fluid, electrolyte, and acid-base balance; Hormonal control of renal function; Neuroendocrine regulation of renal physiology

Unit 5 Endocrine and Reproductive Physiology 8 hours

Endocrine glands and hormone mechanisms; Hypothalamic-pituitary axis and feedback control; Major hormones and their roles; Reproductive physiology in males and females; H-P-G axis in males and females; Pregnancy, parturition, and lactation; Neuroendocrine control of reproduction

Unit 6 Experiments in Human Physiology 30 hours

Recording of Blood Pressure using Sphygmomanometer
Estimation of Bleeding Time and Clotting Time
Introduction to Hemocytometry and RBC Count
WBC: Total Count (TC) and Differential Count (DC)
Determination of Blood Group
Introduction to Slide Preparation and Staining of Epithelial Cells

Experiential Learning

1. Analysis and Interpretation of Liver Function Test (LFT) results in pathological conditions
2. Analysis of published or recorded ECG tracings to interpret cardiac electrical activity
3. Analysis and Interpretation of Renal Biochemistry reports

Textbooks

1. Guyton, Arthur C. and Hall, John E. (2000). *Textbook of Medical Physiology*. 10th Edition. Elsevier.
2. Ganong, William F. (2005). *Review of Medical Physiology*. 27th Edition. McGraw-Hill.
3. Harper, H.A., Rodwell, V.W., Mayes, P.A. and Murray, R.K. (2009). *Harper's Illustrated Biochemistry*. 28th Edition. McGraw-Hill.

Reference Books

1. Waugh, Anne and Grant, Allison. (2010). *Ross and Wilson Anatomy and Physiology in Health and Illness*. Elsevier.
2. Widmaier, Eric P., Raff, Hershel and Strang, Kevin T. (2008). *Vander's Human Physiology*. 11th Edition. McGraw Hill International Publications, New York.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	1	1	1	1	1	1	3	2	3
CO2	3	3	2	2	1	1	1	1	2	3	2	3
CO3	2	3	3	3	3	3	2	1	2	3	2	3
CO4	3	3	3	3	3	3	2	1	2	3	2	3
CO5	2	3	3	3	3	3	3	2	3	3	2	3
Average	2.6	2.8	2.6	2.4	2.2	2.2	1.8	1.2	2.0	3.0	2.0	3.0

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

GEN103	AI for Science	Credits
Total duration	**30 hours**	**2**

Course Outcomes

On completion of the course, the students will be able to

CO1	:	Demonstrate an understanding of foundational concepts of Artificial Intelligence and its relevance across diverse non-STEM domains.
CO2	:	Apply no-code AI tools and basic programming to solve simple real-world problems through use cases in fields like commerce, sociology, psychology, and humanities.
CO3	:	Analyze ethical, social, and psychological implications of AI, including concerns related to data bias, privacy, and automation.
CO4	:	Collaborate in teams to conceptualize and present an AI-based solution or prototype relevant to their field of study using structured problem-solving approaches.

Module wise syllabus

Module 1 Introduction to AI and Project Cycle **2 hours**

Introduction to Artificial Intelligence; AI vs Human Intelligence; AI Project Lifecycle (Intel Framework)

Module 2 AI in Everyday Life and Society **3 hours**

AI applications in Commerce, Social Media, Education, and Psychology; Case studies from History, Literature, and Language; Examples: Chatbots, Recommendation Systems, Voice Assistants

Module 3 No-Code AI Tools and Use Cases **6 hours**

Hands-on with GUI-based AI tools; Use cases: Predictive Maintenance, Image Classification, Viral Post Prediction, Employee Attrition Prediction

Module 4 Ethics, Data & Society **3 hours**

How AI learns from Data; Bias and Fairness in AI; Ethical concerns: Privacy, Surveillance, Job Displacement; Classroom Debate or Discussion

Module 5 Introduction to Python for AI (Guided) **4 hours**

Python Basics: Syntax, Variables, Loops; Using Python Libraries: NumPy, Pandas; Simple Data Visualization using Matplotlib

Module 6 AI for Non-STEM Domains **4 hours**

Psychology: Emotion Recognition, Sentiment Analysis; History: Archiving, OCR, Text Classification; Sociology: Behavioral Analysis, Surveys; Commerce: Recommendation Engines, Fraud Detection

Module 7 Mini-Project (Team-Based) 5 hours
Select a real-world domain-specific problem, Use a no-code tool or basic Python to propose a solution, Create a dashboard or concept prototype

Module 8 Career Growth & AI Skills 3 hours
Design Thinking for AI Projects; Entrepreneurial Thinking in AI Age; Future Skills and AI Readiness

Reference Books

1. Goswami, Saptarsi. *AI for Everyone: A Beginner's Handbook for Artificial Intelligence*. Pearson Education.
2. Peter, Dinesh and Rana, Ajay. *Introduction to Artificial Intelligence*. Cengage Learning.
3. Behera, H. S. *Artificial Intelligence: Made Simple*. BPB Publications.
4. Konar, Amit. *Artificial Intelligence Simplified*. New Age International.

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	1			2	2	1			1		2
CO2	2	2	3	1	3					2	1	2
CO3		1			1	3	3	3		2		2
CO4		2	2		2	1		1	3	3	2	3

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

VAC101	Environmental Education I	L	T	P	C
Version	**1.0**	**2**	**0**	**0**	**2**
Pre-requisites/Exposure	Basic knowledge of science				
Co-requisites					

Course Objectives

1. To understand the intrinsic relationship between humans and the environment, and our position in the ecosystem.
2. To comprehend the significance of biodiversity and the importance of conserving it.
3. To understand the need for energy resources, including various sources of energy, renewable and non-renewable, conventional and unconventional.
4. To learn basic concepts of sustainability, human dependence on nature, and consequences of overexploitation.
5. To appreciate the importance of earth systems for human survival.
6. To gain basic knowledge of pollution types and mitigation procedures.
7. To understand the environmental legal framework in the country, including Environmental Impact Assessment (EIA) and related procedures.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key environmental concepts, terminology, and basic principles.
CO2 : **Understand** the interrelationships between humans, biodiversity, and the environment.
CO3 : **Apply** sustainable practices and responsible use of resources in daily life.
CO4 : **Analyse** case studies of environmental issues, including pollution, energy use, and ecosystem degradation.
CO5 : **Evaluate** the effectiveness of environmental policies, legal frameworks, and mitigation strategies.

Catalogue Description

This course introduces students to the fundamentals of ecosystems, biodiversity, and the intrinsic relationship between humans and nature, emphasizing conservation strategies. Students learn to identify and evaluate air and water pollutants, understand their environmental significance, and explore prevention and mitigation measures. The course covers basic water chemistry, wastewater treatment principles, and solid waste generation, classification, management, and environmental impact. Students are trained to apply sustainable practices in daily life, including the 5Rs of waste management, waste minimization, and resource conservation, fostering environmental awareness, responsible behavior, and appreciation for the interconnectedness of natural systems.

Course Content

Unit 1 Environmental Resources and Energy **10 hours**

Multidisciplinary nature of environmental sciences; scope and importance; need for public awareness; concept of sustainability and sustainable development; **Forest resources**: functions, causes and effects of deforestation, case studies; **Water resources**: distribution, hydrological cycle, over-utilization, floods, droughts, conflicts, dams – benefits and problems; **Mineral resources**: use, exploitation, environmental effects, case studies; **Food resources**: world food problems, environmental concerns, food security, case studies; **Energy resources**: concept of energy, SI units of work, heat and power, global and Indian energy consumption, environmental aspects; renewable and non-renewable sources; fossil fuels – types and impacts; solar energy – passive and active systems, flat plate and concentrating collectors, solar photovoltaic fundamentals, advantages/disadvantages, status in India; wind energy – site selection, turbine principles, advantages/disadvantages, status in India; hydroelectric power – generation, advantages/disadvantages; biomass energy – types, biofuels, biogas, biodiesel; geothermal energy – source, advantages/disadvantages; nuclear power – fission, moderation, pressurized water reactor, advantages/disadvantages.

Unit 2 Ecosystems **4 hours**

Concept of ecosystem, structure and function, producers, consumers, decomposers; food chains, food webs, ecological pyramids; energy flow; ecological succession.

Unit 3 Biodiversity and Conservation **5 hours**

Levels of biodiversity: genetic, species, and ecosystem diversity; biogeographical classification of India; values of biodiversity; biodiversity at global, national, and local levels; India as a mega-diverse nation; biodiversity hotspots; threats to biodiversity; *in-situ* and *ex-situ* conservation.

Unit 4 Environmental Pollution and Waste Management **6 hours**

Types, causes, effects, and controls of environmental pollution: air, water, soil, noise, marine pollution; nuclear hazards and human health risks; sources, generation, characterization, chemical composition, and classification of solid wastes; methods of disposal and management (including hospital and hazardous wastes); recycling and waste minimization technologies; Hazardous Wastes Management and Handling Rules, 1989.

Unit 5 Global Issues and Environmental Acts **5 hours**

Global environmental issues: climate change, global warming, acid rain, ozone layer depletion, nuclear accidents; **Environment Laws**: Environment Protection Act, Air (Prevention & Control of Pollution) Act, Water (Prevention & Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act; **International Agreements**: Montreal Protocol, Kyoto Protocol, Convention on Biological Diversity (CBD).

Textbooks

1. Cunningham, W.P. and Cunningham, M.A. (2002). *Principles of Environmental Science*, 4th Edition. Tata McGraw-Hill Publishing Company, New Delhi.
2. Patra, M. and Singha, R.K. *Basic Environmental Engineering & Elementary Biology*. Aryan Publishing House.
3. Masters, G.M. *Introduction to Environmental Engineering and Science*, Second Indian Reprint. Prentice Hall of India.

Reference Books

1. Metcalf and Eddy, Inc. (2002). *Wastewater Engineering: Treatment and Reuse*, 4th Edition. McGraw-Hill, New York.
2. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. *Environmental Engineering*. McGraw-Hill Education (India) Private Limited, New Delhi.
3. Davis, M.L. and Cornwell, D.A. *Introduction to Environmental Engineering*, 2nd Edition. McGraw Hill, Singapore.
4. Jackson, A.R.W. and Jackson, J.M. *Environmental Sciences: The Environment and Human Impact*. Longman Publishers.

Modes of Evaluation

Components	**Class Assessment (including lab)**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	1	1	1	1	1	1	2	2	2	2
CO2	2	3	2	2	2	2	2	2	3	3	3	3
CO3	2	3	3	2	3	2	2	2	3	3	3	3
CO4	2	3	2	3	3	3	3	2	3	3	3	3
CO5	2	3	2	3	3	3	3	2	3	3	3	3
Average	2.2	2.8	2.0	2.2	2.4	2.2	2.2	1.8	2.8	2.8	2.8	2.8

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC103	Cell Science	L	T	P	C
Version	**2.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	**Basic knowledge of Biology at Plus Two level**				
Co-requisites					

Course Objectives

1. To provide students with a detailed understanding of eukaryotic cell structure and function.
2. To explain the organisation, morphology, and dynamics of chromosomes and their aberrations.
3. To impart knowledge of the eukaryotic cell cycle, mitosis, meiosis, and mechanisms of programmed cell death.
4. To explore the molecular basis of intracellular transport and protein sorting.
5. To develop practical skills in microscopy, cytological preparations, and experimental demonstrations in cell biology.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** fundamental concepts of cell structure, chromosome organization, and cell cycle.

CO2 : **Understand** the mechanisms governing cell cycle regulation, transport pathways, and chromosomal behaviour.

CO3 : **Apply** knowledge of cell biology techniques in preparing and interpreting cytological specimens.

CO4 : **Analyse** cellular processes such as mitosis, meiosis, and intracellular transport in relation to cellular physiology

CO5 : **Evaluate** the role of cellular processes in maintaining homeostasis and their significance in broader biological contexts.

Catalogue Description

This course introduces the fundamental concepts of cell biology, covering the structure, organisation, and functions of eukaryotic cells and their organelles. Topics include chromosome morphology, the cell cycle, mechanisms of mitosis, meiosis, and programmed cell death, along with detailed insights into intracellular transport processes. Through a combination of theory and practical work, students will gain a strong foundation in cellular organisation, regulation, and experimental techniques that underpin modern molecular and developmental biology.

Course Content

Unit 1 Chromosome Structure and Aberrations **15 hours**

Structure of chromosome: morphology, structural Organization - centromere, secondary construction, telomere, chromonema, euchromatin and heterochromatin, components of chromosomes (histones and nonhistone), specialized chromosomes (Polytene, Lamp brush), Chromosomal aberrations- structural and numerical. (cell wall, cell membrane, cell membrane models and permeability, nucleus, mitochondria, chloroplast, endoplasmic reticulum, Golgi apparatus, vacuoles, ribosome, lysosome, peroxisome). Assembly, organization and movement of cilia and flagella.

Unit 2 Cell Cycle and Cell Death **10 hours**

Ultrastructure and functions of Cytoskeletal structures (Microtubules, Microfilaments and Intermediate filaments), Cell cycle: Eukaryotic cell cycle –phases. Mitosis - Stages significance. Meiosis- Stages significance. Senescence and cell death.

Unit 3 Cellular Transport Mechanisms **5 hours**

Cellular transport: Selective transport of proteins to and from the nucleus. Export of proteins and lipids from ER and into ER. Protein sorting and export from Golgi. Mechanism of vesicular transport, cargo selection, coat proteins and vesicle budding, vesicle fusion.

Unit 4 Cell Biology Techniques **10 hours**

Light and fluorescence microscopy (including phase-contrast, confocal, and super-resolution methods like STED or PALM), electron microscopy (TEM and SEM). cell culture and manipulation—including sterile technique, transfection, and CRISPR delivery. Biochemical fractionation (differential centrifugation) and immunoassays (Western blot, Co-IP, and proximity ligation), live-cell dynamics (FRAP, FRET), high-resolution structural methods (cryo-EM), and high-throughput omics (single-cell RNA-seq, spatial transcriptomics, and proximity labeling like BioID). Biophysical techniques (AFM, optical tweezers, microfluidics).

Unit 5 Lab exercises in cell biology **20 hours**

Microscopic observation of cells: bacteria, fungi, plant and animal.
Preparation of different stages of Mitosis (onion root tips)
Preparation of different stages of Meiosis (grasshopper testis)
Study of Polytene chromosome from *Drosophila* salivary gland.
Demonstration of Plasmolysis.
Demonstration of Osmosis.

Experiential Learning

1. Create a flowchart or infographic illustrating organelle interactions in a living cell
2. Case study or literature-based group discussion on unique features and significance of specialized chromosomes

3. Create a flowchart or infographic linking all aspects of cell division and cell fate; peer-reviewed presentations or concept boards
4. In small groups, students design a working model (physical or digital) of vesicular transport (ER → Golgi → Membrane).

Textbooks

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P. (2002). *Molecular Biology of the Cell*. 4th Edition. Garland Science.
2. Cooper, G.M. and Hausman, R.E. (2007). *The Cell: A Molecular Approach*. 5th Edition. ASM Press & Sinauer Associates.

Reference Books

1. Alberts, B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P. (2009). *Essential Cell Biology*. 3rd Edition. Garland Science.
2. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D., and Darnell, J. (2012). *Molecular Cell Biology*. 7th Edition. W.H. Freeman and Company.

Modes of Evaluation

Components	**Class Assessment (including lab)**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	1	2	1	-	-	-	-	-	-	-
CO2	3	3	1	2	2	2	1	-	-	-	-	-
CO3	2	2	3	3	2	2	2	1	1	-	-	-
CO4	3	3	2	3	3	2	3	1	1	1	-	-
CO5	3	3	3	3	3	3	3	2	1	1	1	1
Average	2.8	2.6	2.0	2.6	2.2	2.25	2.25	1.0	0.6	0.4	0.2	0.2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

MIB107	Bacteriology and Virology	L	T	P	C
Version	**2.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Basic knowledge of biology and microbiology				
Co-requisites					

Course Objectives

1. To introduce the morphology, structure, and classification of bacteria and viruses.
2. To impart knowledge of bacterial and viral physiology, genetics, and replication mechanisms.
3. To understand the pathogenic mechanisms and host-microbe interactions.
4. To expose students to diagnostic tools, antimicrobial agents, and vaccination strategies.
5. To encourage inquiry-based, hands-on, and interdisciplinary learning in medical microbiology.

Course Outcomes

On completion of the course, the students will be able to

CO1	:	**Recall** and describe the basic structure and classification of bacteria and viruses**.**
CO2	:	**Understand** and Explain bacterial growth, nutrition, and viral replication processes.
CO3	:	**Apply** microbiological principles in identifying pathogens and performing diagnostics.
CO4	:	**Analyze** mechanisms of microbial pathogenesis, immunity, antimicrobial resistance and bacterial secretary systems
CO5	:	**Evaluate** the roles of bacteriology and virology in public health and biotechnology

Catalogue Description

This course introduces the fundamental principles of bacteriology and virology, with emphasis on microbial structure, physiology, genetics, and pathogenic mechanisms. Students will learn about bacterial morphology, classification, growth requirements, and genetic exchange processes, alongside viral structure, classification, and replication strategies including bacteriophages. The course also covers microbial pathogenesis, host immune responses, and modern vaccine strategies. Practical components include microscopy, staining, bacterial culture methods, growth measurement, antibiotic sensitivity assays, and bacteriophage plaque studies. Through an integrated approach combining theory and laboratory exercises, students will gain foundational knowledge and hands-on skills essential for microbiology and biomedical sciences.

Course Content

Unit 1 Introduction to Bacteriology **10hours**

History and scope of bacteriology, Morphology and ultrastructure of bacteria, Bacterial classification (Bergey's Manual), Growth phases and physical/chemical requirements, Culture media and techniques

Unit 2 Bacterial Physiology and Genetics **15hours**

Bacterial metabolism: respiration, fermentation, Genetic mechanisms: transformation, conjugation, transduction, plasmids, Mutation and antibiotic resistance, Regulation of gene expression in prokaryotes, Overview of Bacterial Secretory systems.

Unit 3 Introduction to Virology **10 hours**

Structure and classification of viruses (DNA & RNA viruses), Baltimore classification, Viral replication: lytic and lysogenic cycles, Cultivation: cell lines, embryonated eggs, animal models, Structure and lifecycle of bacteriophages

Unit 4 Pathogenesis and Immune Response **10hours**

Bacterial and viral pathogenesis, Virulence factors: exotoxins, endotoxins, Host defense mechanisms: innate and adaptive immunity, Vaccine types: live attenuated, inactivated, mRNA, vector-based

Unit 5 Lab Experiments **30hours**

Simple (Negative staining) and differential staining (Gram's staining, Endospore and acid fast staining) techniques of Bacterial culture.
Culture media preparation and different plating techniques
Measurement of bacterial growth curve (spectrophotometry)
Antibiotic sensitivity testing (Kirby-Bauer method)
Study of bacteriophage plaque formation
Microscopy

Experiential Learning

1. Field Visit and/or Lab Visits
2. Mini-projects and case studies on recent outbreaks or AMR surveillance and pandemics
3. Flip Classrooms and group presentation and Quiz
4. **I**nterdisciplinary Discussion**:** Virology in biotechnology and medicine

Textbooks

1. Willey, J.M., Sherwood, L.M., and Woolverton, C.J. (2017). *Prescott's Microbiology*. 10th Edition. McGraw-Hill Education.

2. Tortora, G.J., Funke, B.R., and Case, C.L. (2019). *Microbiology: An Introduction*. 13th Edition. Pearson.
3. Madigan, M.T., Bender, K.S., Buckley, D.H., and Stahl, D.A. (2020). *Brock Biology of Microorganisms*. 16th Edition. Pearson.
4. Flint, S.J., Enquist, L.W., Racaniello, V.R., and Skalka, A.M. (2020). *Principles of Virology*. 5th Edition. ASM Press.

Reference Books

1. Murray, P.R., Rosenthal, K.S., and Pfaller, M.A. (2020). *Medical Microbiology*. 9th Edition. Elsevier.
2. Carroll, K.C., Morse, S.A., Mietzner, T.A., and Miller, S. (2019). *Jawetz, Melnick & Adelberg's Medical Microbiology*. 28th Edition. McGraw-Hill Education.
3. Whitman, W.B., Goodfellow, M., Kämpfer, P., Busse, H.J., Trujillo, M.E., Ludwig, W., Suzuki, K.I., and Parte, A. (2012). *Bergey's Manual of Systematic Bacteriology*. 2nd Edition, Vols. 1–5. Springer.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Average												

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

SEC147	AI in Biology	L	T	P	C
Version	**V1.2**	**1**	**0**	**1**	**2**
Pre-requisites/Exposure	Biology at Plus Two Level				
Co-requisites	Basics of computer application				

Course Objectives

1. To provide students with a basic understanding of Artificial Intelligence in Biology.
2. Types and data analysis of various AI algorithms.
3. Combining Biology and Artificial Intelligence.
4. General overview of Artificial Intelligence in revolutionizing health care.
5. Use of AI in biological data analysis

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall:** Demonstrate a foundational understanding of artificial intelligence principles and techniques, including machine learning, neural networks, and data mining.

CO2 : **Understand:** Utilize AI tools and software to analyze biological data, including nucleotide and amino acid sequences.

CO3 : **Apply** AI methodologies to solve complex biological problems, such as predicting protein structures.

CO4 : **Analyse:** Integrate knowledge from biology and computer science to develop innovative solutions for research and practical applications in fields like bioinformatics, medical diagnostics, and personalized medicine.

CO5 : **Evaluate:** Critically evaluate existing research and case studies that utilize AI in biology, assessing their methodologies, results, and implications for the field.

Catalogue Description

The core course AI in Biology enhances understanding of Artificial Intelligence and its growing role in life sciences. It explores fundamental AI principles, algorithms, and tools while examining their applications in bioinformatics, systems biology, diagnostics, drug discovery, and precision medicine. Students gain practical skills in handling biological data, image analysis, sequence feature identification, and protein structure prediction using AI. The course also addresses ethical concerns, preparing learners to critically evaluate research and apply AI in solving complex biological problems.

Course Content

Unit 1 Introduction to AI in biology **3 hours**

Biological Intelligence *vs* Artificial Intelligence. AI Basics: concepts of generative and discriminative AI- terminologies and workflow, ML, DL.

Unit 2 Learning and AI-algorithms **4 hours**

Neural Networks (NN), Basics of deep Learning, decision tree and random forest, SVM, K-mean clustering. Exploratory data analysis, Plotting and data visualization, Handling big-data sets, Unsupervised learning and clustering, concept of reinforcement learning.

Unit 3 AI and Bioinformatics **4 hours**

AI in bioinformatics analysis- analyzing sequence and structures. AI in systems biology, microbiome and data mining. Artificial Intelligence and Synthetic Biology.

Unit 4 Application of AI in health and pharmaceuticals **4 hours**

AI in health diagnostics / Confluence of AI and Smart Devices for Monitoring Health and Disease. AI in medical imaging. applications of AI in medical imaging and neural engineering. AI-driven applications for drug design, lead optimization, and clinical trials. Artificial Intelligence for Biomarker Discovery. AI in Precision Medicine. AI in biology: Risks involved and ethical concerns. Future Prospects of AI in healthcare and research

Unit 5 Practical **30 hours**

1. Biological data and data structure
2. Image analysis though AI
3. Identifying sequence features by NN
4. AI assisted protein structure prediction

Experiential Learning

1. Tutorial VDO on machine learning
2. Articles on data analysis using AI

Textbooks

1. Hamadani, Ambreen., Ganai, Nazir A., Henna, Hamadani., and Bashir, J. (2024). *A Biologist's Guide to Artificial Intelligence: Building the Foundations of Artificial Intelligence and Machine Learning for Achieving Advancements in Life Sciences*. 1st Edition. Academic Press.

Reference Books

1. Badar, Mohammad "Sufian" (Ed.). (2023). *A Guide to Applied Machine Learning for Biologists*. Springer.
2. Aceves-Fernández, Marco Antonio., and Engelbrecht, Andries. (2019). *Artificial Intelligence – Applications in Medicine and Biology*. IntechOpen.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	1	1	1	1	1	2	1	1
CO2	2	3	3	3	2	1	1	1	2	2	1	1
CO3	2	2	3	3	2	1	1	2	2	3	1	1
CO4	2	2	3	3	3	2	1	2	2	3	2	2
CO5	2	2	2	3	3	2	2	2	2	3	2	2
Average	2.2	2.2	2.6	2.8	2.2	1.4	1.2	1.6	1.8	2.6	1.4	1.4

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

VAC105	Community Engagement and Social Responsibility	L	T	P	C
Version	**1.0**	**1**	**0**	**1**	**2**
Pre-requisites/Exposure	None				
Co-requisites					

Course Objectives

1. To gain a deeper understanding of community, social structure, social needs, and ecological balance.
2. To acquire knowledge of different communities and their responsibilities for societal development.
3. To acquire knowledge about the importance of communication between communities and social work.
4. To gain knowledge about social responsibilities and their importance.
5. To understand the need for social help (through human activities) for the benefit of all living beings, including humans, animals, and plants.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts related to community engagement, social responsibility, and ecological balance.

CO2 : **Understand** the importance of community involvement, communication, and social responsibility in societal development.

CO3 : **Apply** principles of social responsibility and community engagement through participation in community service activities.

CO4 : **Analyse** case studies of community engagement initiatives to identify success factors and challenges.

CO5 : **Evaluate** the impact of social responsibility programs on communities and ecological systems.

Catalogue Description

This course introduces students to the principles and practices of community engagement, social responsibility, and sustainable development. Students explore social structures, urbanization, community groups, and the roles of individuals in addressing societal challenges. The course emphasizes planning and executing community programs, promoting ecological balance, supporting social and animal welfare, and creating livelihood and educational opportunities. Through case studies, fieldwork, and practical projects, students develop skills in communication, leadership, and ethical decision-making.

Course Content

Unit 1 Introduction to Community Service 9 hours

Introduction to community service, social structure, groups, communities, and social work; understanding urbanization, urban social problems, slums and types of slums, urban poor; understanding urban power structure, identifying community resources (community mapping), and modules for community service.

Unit 2 Community and Groups 9 hours

Identifying community groups such as women, children, youth, elders, and persons with disabilities; equipping with skills to address issues related to education, health, sanitation, environment, and livelihood; special needs for environmental support; importance of plantation.

Unit 3 Community Programme Planning 9 hours

Orientation on community programs, event process: identifying issues, need-based analysis, invitations, pamphlets, inviting participants, content design, selection of tools, venue arrangements, resource mobilization; awareness and advocacy for identified issues; group-wise programs for social and environmental support.

Unit 4 Social Support and Ecological Balance 9 hours

Importance of social support along with ecological balance; helping animals and birds; relation between social support and social security; social needs for specific animal species (e.g., building nests for small birds); campaigns against alcoholism and substance abuse; pros and cons of social media for young adults.

Unit 5 Community Learning and Social Help 9 hours

Importance of education, child rights, special coaching (basic English, computer, and communication skills); understanding government schemes for urban poor; creating livelihood opportunities, marketing, entrepreneurial skills, access to digital money (ATM, E-corner, apps); rights of women, children, and others.

Experiential Learning

1. Designing strategies to organize a digital event to create awareness on social issues
2. Visiting a social forest/ urban greenery initiative to understand its social and ecological impacts

Textbooks

1. Blanchard, F.L. (2015). *Community Service*. Kessinger Publishing
2. McNaught, A. *Managing Community Health Services*.
3. Dasgupta, B., et al. *In Quest of Humane Development*.
4. Opacic, A. (Springer). *Practicing Social Work in Deprived Communities*.
5. Gardinier, L. *Service Learning Through Community Engagement*.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	1	1	1	1	1	2	2	2	2
CO2	2	3	2	2	2	2	2	2	3	3	3	3
CO3	2	3	3	2	3	2	2	2	3	3	3	3
CO4	2	3	2	3	3	3	3	2	3	3	3	3
CO5	2	3	2	3	3	3	3	2	3	3	3	3
Average	2.2	2.8	2.0	2.2	2.4	2.2	2.2	1.8	2.8	2.8	2.8	2.8

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC201	Metabolism of Carbohydrate and Lipid	L	T	P	C
Version	**2.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	**Knowledge of Basic Biochemistry**				
Co-requisites					

Course Objectives

1. To understand the fundamental principles of metabolism and bioenergetics.
2. To explore the biochemical pathways of carbohydrate and lipid metabolism in detail.
3. To examine the regulatory mechanisms governing metabolic pathways under physiological and pathological conditions.
4. To integrate knowledge of carbohydrate and lipid metabolism to explain energy balance in health and disease.
5. To develop practical skills in biochemical laboratory techniques related to metabolic processes.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts, pathways, and terminology in metabolism.
CO2 : **Understand** the biochemical basis of energy generation and regulation.
CO3 : **Apply** knowledge of metabolic pathways to solve numerical and experimental problems.
CO4 : **Analyse** knowledge of metabolic pathways to solve numerical and experimental problems.
CO5 : **Evaluate** the biochemical basis of metabolic disorders and interpret related clinical data.

Catalogue Description

This course provides an in-depth study of the biochemical basis of metabolism, focusing on carbohydrate and lipid pathways, energy production, and regulation. It introduces the principles of bioenergetics and explores how metabolic reactions are coordinated to maintain cellular and organismal homeostasis. The course emphasises the integration of pathways during physiological states such as fasting, feeding, and exercise, as well as the biochemical basis of metabolic disorders including diabetes and hyperlipidaemia. Laboratory exercises provide hands-on experience with enzyme kinetics, metabolite estimation, and analysis of biomolecules, equipping students with both theoretical knowledge and practical skills in metabolic biochemistry.

Course Content

Unit 1 Introduction to Metabolism and Bioenergetics **6 hours**

Overview of metabolism: anabolism and catabolism; Principles of bioenergetics: Gibbs free energy, ATP, and energy coupling; Role of NADH, $FADH_2$, and coenzymes in energy transfer
Metabolic regulation: control points and hormonal regulation

Unit 2 Carbohydrate Metabolism **15 hours**

Glycolysis: Pathway, key enzymes, regulation, and energy production; Gluconeogenesis: Mechanism and regulatory control; Citric Acid Cycle (TCA Cycle): Steps, key enzymes, and regulation; Glycogen Metabolism: Glycogen synthesis and degradation, hormonal regulation; Pentose Phosphate Pathway: Importance in cellular metabolism and NADPH production; Regulation of carbohydrate metabolism: Allosteric regulation, covalent modification, and hormonal control (insulin, glucagon)

Unit 3 Lipid Metabolism **12 hours**

Fatty Acid Metabolism: β-oxidation, activation of fatty acids, and regulation; Fatty Acid Synthesis: Acetyl-CoA carboxylase, regulation of fatty acid synthesis; Triacylglycerol Metabolism: Synthesis and degradation of triglycerides, lipolysis; Ketogenesis and Ketone Bodies: Formation of ketone bodies, regulation, and physiological relevance; Phospholipid Metabolism: Synthesis and role in membrane structure; Cholesterol Metabolism: Synthesis, regulation, and role in cellular processes

Unit 4 Integration of Carbohydrate and Lipid Metabolism **6 hours**

Coordination of glycolysis, gluconeogenesis, and fatty acid metabolism; Metabolic shifts during fasting, feeding, and exercise; Role of liver and adipose tissue in metabolism; Interactions between carbohydrate and lipid metabolism: lipogenesis *vs.* lipolysis; Disorders related to carbohydrate and lipid metabolism (*e.g.*, diabetes, hyperlipidemia)

Unit 5 Clinical Aspects of Carbohydrate and Lipid Metabolism **6 hours**

Metabolic diseases: Diabetes mellitus, glycogen storage diseases; Disorders of lipid metabolism: Familial hypercholesterolemia, fatty liver disease; Diagnosis and biomarkers in metabolic disorders; Current trends in the treatment of metabolic disorders

Unit 6 Lab Exercises **30 hours**

Estimation of Glucose in a solution
Acid value estimation of an oil
Study of Fermentation
Isolation and Identification of Starch
Isolation of Calcium citrate from lemon
Estimation of Sucrose
Estimation of lipid
Isolation of lipid

Experiential Learning

1. Interpretation of Case studies of Metabolic disorders
2. Analysis of contribution of gut microbiota to systemic metabolism from literature

Textbooks

1. Nelson, D.L. and Cox, M.M. (2013). *Lehninger Principles of Biochemistry*. 6th Edition. W.H. Freeman and Company.
2. Berg, J.M., Tymoczko, J.L., and Stryer, L. (2011). *Biochemistry*. 7th Edition. W.H. Freeman and Company.

Reference Books

1. Campbell, M.K. (2012). *Biochemistry*. 7th Edition. Cengage Learning.
2. Voet, D. and Voet, J.G. (2004). *Biochemistry*. 3rd Edition. John Wiley & Sons.

Modes of Evaluation

Components	**Class Assessment (including lab)**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	1	1	1	-	-	-	-	-	-	-
CO2	3	3	2	1	1	-	-	-	-	-	-	-
CO3	2	3	3	2	2	1	-	-	-	-	-	-
CO4	2	3	3	3	2	2	1	-	1	1	-	-
CO5	1	2	3	3	3	2	1	1	2	2	1	-
Average	2.2	2.6	2.4	2.0	1.8	1.2	0.4	0.2	0.6	0.6	0.2	0.0

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC205	Basics of Plant and Animal Sciences	L	T	P	C
Version	**1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Knowledge of Biology at Plus Two level				
Co-requisites					

Course Objectives

1. To provide foundational knowledge of plant and animal structure, function, and adaptations.
2. To explain key physiological processes and developmental mechanisms in plants and animals.
3. To introduce evolutionary concepts and their relevance to biodiversity and classification.
4. To familiarise students with ecological interactions and the influence of environmental changes.
5. To develop basic practical skills in observing, identifying, and experimenting with plant and animal systems.

Course Outcomes

On completion of the course, the students will be able to

CO1	:	**Recall** fundamental concepts in plant and animal biology, including structure, function, and adaptations.
CO2	:	**Understand** physiological processes, evolutionary principles, and ecological interactions in plants and animals.
CO3	:	**Apply** experimental methods in plant and animal biology to obtain and interpret results.
CO4	:	**Analyse** structural, functional, and developmental features across plant and animal groups to infer evolutionary relationships.
CO5	:	**Evaluate** the impact of environmental changes and biotechnological applications on plant and animal systems.

Catalogue Description

This course provides a foundational understanding of plant and animal biology, encompassing physiological processes, growth, development, reproduction, and adaptations to diverse environments. It covers comparative biological systems, ecological interactions, and the effects of environmental change, with an emphasis on biotechnological applications. As a core building block, it equips students with the essential knowledge and skills needed for advanced studies and specialised fields within the life sciences. The programme combines theoretical learning with practical laboratory experience, including microscopy, specimen study, and enzymatic assays, ensuring a strong base for future academic and professional pursuits.

Course Content

Unit 1 Overview of Plant and Animal Diversity 12 hours

Taxonomy – Introduction to Taxonomy, Kingdoms and Domains, Hierarchy and Binomial Nomenclature;

Animal Taxonomy and Morphology - Key features of major phyla, body symmetry and coelom of non-chordates, distinguishing features and key adaptations of vertebrate classes;

Plant Taxonomy and Morphology - Overview of plant groups, angiosperm anatomy, pollination and dispersal

Unit 2 Organismal Development and Evolution 12 hours

Developmental Biology - Gametogenesis and fertilisation in plants and animals, cleavage patterns in animals, endosperm development in plants, overview of *Hox* gene function in animals and ABC model of development in plants

Evolution - Theories of Evolution, Evidences of Evolution (morphological, embryological, palaeontological and molecular), speciation and natural selection

Unit 3 Systems Physiology: Plant and Animal 12 hours

Physiology of Plants - Plant cell structure; Mechanisms of Transport, Trasnpiration and Photosynthesis, Plant Movements and Photoperiodism

Human Physiology - Animal Cell structure; Organisation and function of Digestive, Circulatory, Respiratory, Excretory and Nervous Systems in humans.

Unit 4 Ecology and Biotechnology 9 hours

Ecology - Basic concepts, population ecology, organismal interactions, energy flow in ecosystems

Biotechnology - Introduction to Model Organisms; Plant tissue culture and transgenic plants; Recombinant protein production and transgenic animals; Economic importance of plants and animals.

Unit 5 Experiments in Plant and Animal Biology 30 hours

Study of plant cells and tissues under the microscope

Study of biomolecules in plant and animal tissues.

Observation of plant responses to environmental changes

Identification and characterisation of plant and animal specimens

Experiments on enzyme activity in plants and animals

Experiential Learning

1. Visit to national park/ museum/ zoological garden and observing plant and animal diversity and evolutionary changes
2. Comparative analysis of Plant and Animal adaptations in Natural Habitats

Textbooks

1. Chaki, K.K., Kundu, G. and Sarkar, S. (2008). *Introduction to General Zoology*: Vol. I and II. New Central Book Agency (P) Ltd., Kolkata.
2. Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A. (2015). *Plant Physiology and Development*. 6th Edition. Oxford University Press.
3. Rastogi, V.B. (2024). *Organic Evolution: Evolutionary Biology*. 15th Edition. Medtech Science Press.
4. Guyton, A.C. and Hall, J.E. (2015). *Textbook of Medical Physiology*. 13th Edition. Elsevier.

Reference Books

1. Campbell, N.A. and Reece, J.B. (2005). *Biology*. Pearson Benjamin Cummings.
2. Jordan, E.L. and Verma, P.S. (2013). *Chordate Zoology*. S. Chand & Company Pvt. Ltd., New Delhi.
3. Kardong, K.V. (2011). *Vertebrates: Comparative Anatomy, Function, Evolution*. 6th Edition. McGraw-Hill Education.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	1	1	1	1	1	1	1	1	1
CO2	3	3	1	1	2	1	1	1	1	2	2	2
CO3	2	2	3	3	2	2	2	1	1	1	1	1
CO4	2	3	2	2	3	3	3	1	1	2	2	2
CO5	2	2	1	1	2	2	2	2	2	3	3	3
Average	2	2	2	2	2	2	2	1	1	2	2	2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

SEC140	Biophysics and Bioenergetics	L	T	P	C
Version	**1.0**	**1**	**0**	**1**	**2**
Pre-requisites/Exposure	Science at Plus Two Level				
Co-requisites					

Course Objectives

1. To introduce students to the fundamental concepts of biophysics and bioenergetics.
2. To understand the physical principles underlying biological systems and processes.
3. To explore energy transformation in biological systems.
4. To provide insight into membrane transport, redox reactions, and ATP synthesis.
5. To develop an integrated understanding of thermodynamics in biological contexts.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** the fundamental laws and principles of biophysics and bioenergetics.
CO2 : **Understand** thermodynamic principles applied to biological systems.
CO3 : **Apply** principles to explain energy flow in cellular metabolism.
CO4 : **Analyze** bioenergetics pathways and their regulation.
CO5 : **Evaluate** the efficiency of biological energy conversion and membrane functions.

Catalogue Description

This course introduces the fundamental principles of biophysics and their applications in biological systems. Students will explore molecular forces, thermodynamic principles, and bioenergetics, including ATP synthesis, energy coupling, and standard free energy changes. Membrane biophysics is examined through transport mechanisms, ion channels, electrochemical gradients, and mitochondrial electron transport. Photosynthesis and energy transduction are studied with emphasis on light absorption, photophosphorylation, and comparison with oxidative phosphorylation. Practical sessions develop hands-on skills in protein viscosity measurement, spectrophotometry, membrane permeability assays, redox potential evaluation, and the effects of pH and temperature on enzymatic activity, reinforcing theoretical concepts.

Course Content

Unit 1 Introduction to Biophysics **3 hours**
Scope of biophysics, importance in biological sciences; molecular forces and interactions in biological systems.

Unit 2 Thermodynamics in Biology **3 hours**
Basic concepts: system, surroundings, state functions; first and second laws of thermodynamics; free energy and biological spontaneity.

Unit 3 Bioenergetics Principles **3 hours**
High-energy compounds; ATP – structure, role, synthesis; energy coupling; standard free energy changes in biochemical reactions.

Unit 4 Membrane Biophysics **3 hours**
Structure and dynamics of biological membranes; membrane transport – passive and active; ion channels and electrochemical gradients. Redox potential, NAD^+/NADH, FAD/$FADH_2$; mitochondrial electron transport chain; proton gradient and chemiosmosis.

Unit 5 Photosynthesis and Energy Transduction **3 hours**
Light absorption, chlorophylls; photophosphorylation; comparison between photosynthesis and oxidative phosphorylation.

Unit 6 List of Experiments **30 hours**

a. **Determination of viscosity of protein solutions** using Ostwald's viscometer.
b. Verification of Beer-Lambert's law and determination of absorption maxima of biomolecules using a UV-Vis spectrophotometer.
c. Demonstration of membrane permeability using dialysis tubing and sucrose solutions.
d. Measurement of redox potential of NADH/NAD^+ using redox dyes.
e. Effect of pH and temperature on enzyme activity (e.g., catalase or succinate dehydrogenase).

Experiential Learning

1. Model-building of membrane transport and ATP synthesis.
2. Case studies on metabolic disorders involving energy imbalance.
3. Analysis of energy flow in glycolysis and Krebs cycle.
4. Demonstration of proton motive force using animations or simulations.

Textbooks

1. Voet, D. & Voet, J.G. (2018). *Voet's Principles of Biochemistry, 5th Edition,* Wiley.
2. Nelson, D.L. & Cox, M.M. (2021). *Lehninger Principles of Biochemistry*. Freeman.
3. Sheehan, D. (2009). *Physical Biochemistry: Principles and Applications*. Wiley.
4. Nicholls, D.G., & Ferguson, S.J. (2013). *Bioenergetics 4th Edition*. Academic Press.
5. Wilson, K. & Walker, J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.

Reference Books

1. Parke W.C. (2020). *Biophysics A Students Guide To The Physics Of The Life Sciences And Medicine*. Springer.
2. Campbell, M.K., & Farrell, S.O. (2014). *Biochemistry*. Cengage Learning.
3. Kondepudi, D. (2008). *Introduction to Modern Thermodynamics*. Wiley.
4. Banerjee, P.K. (2024). *Introduction to Biophysics*. S. Chand.
5. Sadasivam, S. & Manickam, A. (2008). Biochemical Methods. New Age International.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	1	1	1	1	1	1	-	-	-
CO2	3	3	2	2	2	2	1	1	1	-	-	-
CO3	3	3	3	2	2	3	2	1	1	-	-	-
CO4	2	3	3	3	3	3	2	1	1	-	-	-
CO5	2	3	3	3	3	3	2	1	1	-	-	-
Average	2.6	2.8	2.6	2.2	2.2	2.4	1.6	1	1	-	-	-

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

VAC102	Human Values and Ethics	L	T	P	C
Version	**1.0**	**2**	**0**	**0**	**2**
Pre-requisites/Exposure	None				
Co-requisites					

Course Objectives

1. To facilitate the development of a holistic perspective among students towards life, profession, happiness, and prosperity based on a correct understanding of human reality and existence.
2. To achieve sustainable development goals by fostering a sense of responsibility and awareness among students about the impact of their actions on the world around them.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts and terminology related to human values, ethics, and societal responsibilities.
CO2 : **Understand** various ethical theories and explain their implications in real-life situations.
CO3 : **Apply** ethical decision-making frameworks in hypothetical or practical scenarios.
CO4 : **Analyse** case studies to identify ethical dilemmas, conflicts of values, and consequences of actions.
CO5 : **Evaluate** policies, actions, or societal practices based on ethical principles and sustainability considerations.

Catalogue Description

This course introduces students to the principles and practices of human values, ethics, and societal responsibility. It covers value education, love, compassion, truth, non-violence, righteousness, and peace, emphasizing their relevance in personal, family, societal, and environmental contexts. Students explore harmony within self, family, society, and nature, and examine ethical decision-making, personal and professional conduct, and leadership. Through historical examples, case studies, and practical exercises, the course fosters critical thinking, empathy, and awareness of the impact of actions on others. It aims to equip students with skills for a value-based life and responsible, ethical professional practice.

Course Content

Unit 1 Value Education, Love, Compassion and Truth 7 hours

Understanding value education; love and its forms: love for self, parents, family, friends, spouse, community, nation, humanity, and other beings—living and non-living; affect theory; love and compassion and inter-relatedness: relationship with empathy, sympathy, and non-violence; value education to achieve SDGs; historical figures remembered for practicing compassion and love, such as the Buddha and Jesus Christ; truth: universal truth, truth as value (artha), truth as fact (satya), veracity, sincerity, honesty; historical figures remembered for practicing truth: Raja Harishchandra, Dharmaraja Yudhishthira, Gautama Buddha, Socrates, Mahatma Gandhi.

Unit 2 Non-Violence, Righteousness and Peace 5 hours

Non-violence and its need; Ahimsa: non-violence and non-killing; individuals and organizations known for commitment to non-violence; righteousness: righteousness and dharma, righteousness and propriety; historical figures remembered for practicing righteousness; peace and its need: peace, harmony, and balance; individuals and organizations known for commitment to peace, such as Mahatma Gandhi and the United Nations.

Unit 3 Harmony in the Family and Society 7 hours

Harmony in the human being, understanding harmony in the self; family: meaning, constitution, importance of family relationships, characteristics of a strong family, building strong family relationships; trust and respect as foundational values of relationships: meaning of trust, difference between intention and competence, meaning of respect, difference between respect and differentiation, other salient values in relationships; society: meaning, social roles, individual as a social being, responsibilities, role conflict versus role strain; harmony in society as an extension of family, visualizing universal harmonious order from family to world family.

Unit 4 Love and Sensitivity for Nature and Environment 5 hours

Harmony in nature; interconnectedness and mutual fulfillment among the four orders of nature; recyclability and self-regulation in nature; understanding existence as co-existence of mutually interacting units in all-pervasive space.

Unit 5 Ethics and Integrity 6 hours

Ethics and its importance; ethical decision-making; personal and professional moral codes of conduct; competence in professional ethics; ethical human conduct; strategies for transition towards value-based life and profession; creating a harmonious life; understanding what makes an individual great; persona of a leader for deriving holistic inspiration.

Experiential Learning

1. Analyse case studies to understand ethical dilemmas and conflicting values
2. Peer discussions on values of ethics and morality in harmonious family ties

Textbooks

1. Gaur, R.R., Asthana, R., & Bagaria, G.P. (2019). *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi.

Reference Books

1. Bajpai, B.L. (2004). *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow.
2. Tripathy, A.N. (2003). *Human Values*, New Age International Publishers.
3. Dhar, P.L., & Gaur, R.R. *Science and Humanism*, Commonwealth Publishers.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	1	1	1	1	1	2	2	2	2
CO2	2	3	2	2	2	2	2	2	3	3	3	3
CO3	2	3	3	2	3	2	2	2	3	3	3	3
CO4	2	3	2	3	3	3	3	2	3	3	3	3
CO5	2	3	2	3	3	3	3	2	3	3	3	3
Average	2.2	2.8	2.0	2.2	2.4	2.2	2.2	1.8	2.8	2.8	2.8	2.8

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

PDC201	Professional Development Course I	L	T	P	C
Version	**1.0**	**0**	**0**	**1**	**1**
Pre-requisites/Exposure	Completion of Semester II				
Co-requisites					

Course Objectives

1. To prepare students with essential skills for effective resume, cover letter writing, and professional communication.
2. To develop aptitude, technical, and interview skills required for campus and competitive placements.
3. To enhance teamwork, group discussion, and personal branding for professional success.
4. To provide industry insights, career guidance, and mock assessments for confident job readiness.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts and principles of professional development.
CO2 : **Understand** the importance of lifelong learning and continuous improvement in a professional context.
CO3 : **Apply** effective communication strategies in professional interactions.
CO4 : **Analyse** personal strengths and weaknesses to create a targeted development plan.
CO5 : **Evaluate** case studies of successful professional development initiatives.

Catalogue Description

This pre-placement training module equips students with essential career skills, including resume and cover letter writing, interview preparation, aptitude and technical practice, and group discussion. It emphasises professional skills, personal branding, industry awareness, and job search strategies, concluding with mock assessments to build confidence for successful career placement.

Course Content

1. Introduction to Pre-Placement Training
2. Resume Building & Cover Letter Writing
3. Interview Skills
4. Aptitude and Technical Skills
5. Group Discussion and Communication Skills
6. Personal Branding and Online Presence
7. Professional Skills
8. Industry Insights and Company Presentations
9. Career Guidance for Competitive Entrance Exams and Job Search Strategies
10. Mock Tests and Assessments

Modes of Evaluation

Components	**Regular Evaluation**	**End Term**
Weightage (%)	**50**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	2	1	2	2	1	1	2	2	1	2	2
CO2	2	3	1	2	3	2	1	2	2	2	1	3
CO3	1	2	2	1	2	2	1	3	2	2	2	2
CO4	2	2	1	2	2	1	2	2	2	1	2	2
CO5	1	2	1	1	3	2	1	2	2	2	1	3
Average	1.60	2.20	1.20	1.60	2.40	1.60	1.20	2.20	2.00	1.60	1.60	2.40

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC203	Advanced Microbiology	L	T	P	C
Version	**1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Basic knowledge of biology and microbiology				
Co-requisites					

Course Objectives

1. To explore advanced concepts and technologies in modern microbiology.
2. To understand microbial genomics, proteomics, and system biology tools.
3. To analyze host–microbe interactions and emerging infectious diseases.
4. To apply microbiological techniques in diagnostics, therapeutics, and biotechnology.
5. To develop scientific communication, critical thinking, and lab-based problem-solving skills.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** and describe recent advances in microbial structure, physiology, and genetics.
CO2 : **Understand** and interpret microbial genomic data and regulatory pathways.
CO3 : **Apply** molecular tools and microbiological assays in solving real-world problems.
CO4 : **Analyze** microbial pathogenesis and resistance mechanisms.
CO5 : **Evaluate** the impact of microbial biotechnology in healthcare, agriculture, and environment.

Catalogue Description

This course provides an advanced exploration of modern microbiology, emphasizing microbial genomics, systems and synthetic biology, and metagenomics. Students will study the evolution of microbial genomes, functional genomics, regulatory networks, and quorum sensing, gaining insight into microbial diversity, pathogenesis, and resistance mechanisms. Emphasis is placed on integrating bioinformatics tools with experimental techniques, including genome annotation, CRISPR-Cas applications, and metagenomic analysis. Practical exercises and experiential learning such as antibiotic screening, biofilm assays, and field visits equip students to apply theoretical knowledge to real-world problems in healthcare, biotechnology, and environmental microbiology.

Course Content

Unit 1 Evolution of Microbial Genomes 10 hours

Salient features of sequenced microbial genomes, core genome pool, flexible genome pool and concept of pangenome, Horizontal gene transfer (HGT), Basic concept of transformation, conjugation and transduction, Evolution of bacterial virulence – Genomic islands, Pathogenicity islands (PAI) and their characteristics, next generation sequencing techniques

Unit 2 Microbial Genomics and Systems Biology 15 hours

Next-generation sequencing and genome annotation, Functional genomics: transcriptomics and proteomics, CRISPR-Cas systems and genome editing, Metabolic and regulatory network modeling

Unit 3 Metagenomics 10 hours

Brief history and development of metagenomics, Understanding bacterial diversity using metagenomics approach, Prospecting genes of biotechnological importance using metagenomics. Basic knowledge of viral metagenomics, metatranscriptomics, metaproteomics and metabolomics.

Unit 4 Systems and Synthetic Biology 10 hours

Networking in biological systems, Quorum sensing in bacteria, Co-ordinated regulation of bacterial virulence factors, Basics of synthesis of poliovirus in laboratory, Future implications of synthetic biology with respect to bacteria and viruses

Unit 5 Lab Exercises 30 hours

Metagenomic DNA Isolation and Purity Analysis
PCR Amplification of 16S rRNA from Environmental Samples
Antibiotic Sensitivity Testing and MIC Determination
Biofilm Formation Assay using Crystal Violet Staining
Primary screening of antibiotic/vitamin/ enzyme producing microorganisms from soil sample.

Experiential Learning

1. Field Visit and/or Lab Visits
2. Guest Lecture/Industry Webinar on microbiome therapeutics
3. Flip Classrooms and group presentation and Quiz
4. Case Study: Antimicrobial resistance outbreak

Textbooks

1. Fraser, C. M., Read, T. D., & Nelson, K. E. (2004). *Microbial Genomes*. Humana Press.
2. Miller, R. V., & Day, M. J. (2004). *Microbial Evolution: Gene Establishment, Survival, and Exchange*. ASM Press.
3. Bull, A. T. (2004). *Microbial Diversity and Bioprospecting*. ASM Press.
4. Selected research articles from journals such as *Nature Microbiology*, *PLoS Pathogens*, and *Trends in Microbiology*.

Reference Books

1. Madigan, M. T., Martink, J. M., Dunlap, P. V., and Clark, D. P. (2014). *Brook's Biology of Microorganisms*, 14th Edition. Pearson.
2. Wilson, B. A., Salyers, A. A., Whitt, D. D., & Winkler, M. E. (2011). *Bacterial Pathogenesis*.
3. Bouarab, K., Brisson, N., and Daayf, F. (2009). *Molecular Plant Pathology*.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	1	1	1	1	1	1	1	2	1
CO2	2	3	2	2	2	1	1	1	1	1	2	1
CO3	2	2	3	2	2	2	2	1	1	1	2	1
CO4	2	2	2	3	3	2	1	1	1	1	2	1
CO5	2	2	2	2	3	2	1	1	1	1	3	1
Average	2.2	2.2	2.0	2.0	2.2	1.6	1.2	1.0	1.0	1.0	2.2	1.0

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

MIB205	Molecular Biology	L	T	P	C
Version	**V1.2**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Biology and Chemistry at Plus Two Level				
Co-requisites	Basics of biomacromolecules				

Course Objectives

1. To understand the structural aspects of DNA, RNA, and Chromosomes.
2. To study the basic concepts of central dogma of molecular biology (process of replication, transcription and translation)
3. To be able to compare between the processes *w.r.t.* prokaryotes and eukaryotes
4. To develop an in-depth concept of gene regulatory circuits.
5. To analyse experimental results on molecular biology.

Course Outcomes

On completion of the course, the students will be able to

CO1	:	**Recall** the fundamental concepts of molecular biology, including DNA structure, replication, transcription, and translation.
CO2	:	**Understand** the molecular mechanisms that regulate gene expression and cellular processes.
CO3	:	**Apply** concepts derived from classical experiments of early days of molecular biology
CO4	:	**Analyse** the roles of various molecular components in cellular functions, including signal transduction pathways and regulatory networks.
CO5	:	**Evaluate** the impact of molecular biology in developing techniques in research, medicine, and biotechnology, including gene therapy and diagnostic tools.

Catalogue Description

This course provides an in-depth study of molecular biology, emphasizing the structure, function, and regulation of nucleic acids and proteins. Topics include DNA and RNA structures, genome organization, and principles of denaturation, renaturation, and topology. Students explore mechanisms of DNA replication, recombination, repair, and mutagenesis in prokaryotes and eukaryotes. Transcription, RNA processing, translation, and the genetic code are examined in detail. Gene expression regulation, including operon models and epigenetic modifications, is discussed. The course integrates theoretical knowledge with experimental insights to build a comprehensive understanding of molecular mechanisms underlying cellular information flow and gene regulation.

Course Content

Unit 1 Structures of DNA, RNA, and Genetic Material 9 hours

DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation of DNA, cot curves. DNA topology - linking number, topoisomerases; Organization of genomic DNA in Prokaryotes, Viruses, Eukaryotes (chromosomes); RNA Structure, Organelle DNA - mitochondria and chloroplast DNA.

Unit 2 Replication of DNA, recombination, DNA damage and repair (Prokaryotes and Eukaryotes) 9 hours

Bidirectional and unidirectional replication, semi- conservative, semi- discontinuous replication; Meselson-Stahl experiment, Mechanism of DNA replication: Enzymes and proteins involved in DNA replication. Various models of DNA replication including rolling circle, D- loop (mitochondrial), Ɵ (theta) mode of replication. Replication in eukaryotes. Homologous and site specific recombination, Mutation, DNA damage, and genomic instability. Mismatch and excision repairs, Photoreactivation, Translesion, DSB, NHEJ repair systems

Unit 3 Transcription and RNA biology 9 hours

Transcription: Definition, difference from replication, promoter - concepts. Sigma factor, RNA Polymerase and the transcription unit. Transcription in Eukaryotes: RNA polymerases, general Transcription factors Post-Transcriptional Processing: Split genes, concept of introns and exons, RNA splicing, spliceosome machinery, concept of alternative splicing, Polyadenylation and capping.

Unit 4 Translation 9 hours

Translational machinery, Charging of tRNA, aminoacyl-tRNA synthetases, Mechanisms of initiation, elongation and termination of polypeptides in both prokaryotes and eukaryotes, Fidelity of translation, Inhibitors of protein synthesis in prokaryotes and eukaryote, clover leaf structure of tRNA, Genetic Code – Concept and Characteristics, Wobble hypothesis, Post-translational modifications

Unit 5 Regulation of gene expression 9 hours

Principles of transcriptional regulation, regulation at initiation with examples from *lac* and *trp*-operons. Inducible and repressible operons. Gene expression circuit of lambda phage. Outline of epigenetic regulation: histone modification.

Unit 6 Experiments in Molecular Biology 30 hours

Isolation of genomic and plasmid DNA from bacteria
Isolation of total RNA from bacteria
Assessing purity of DNA and RNA using spectrophotometry
Electrophoresis of DNA and RNA

Experiential Learning

1. Study: Articles on discovery of molecular processes: Flip classes
2. Demonstration of live cell imaging data
3. Group discussion on application of molecular biology in developing techniques

Textbooks

1. Tropp, B. E. (2011). *Molecular Biology: Genes to Proteins*. Jones & Bartlett.
2. Weaver, R. (2011). *Molecular Biology* (4th ed.). McGraw-Hill.

Reference Books

1. Watson, J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., & Losick, R. *Molecular Biology of the Gene*.(7th Edition). Pearson.
2. Krebs, J. E., Goldstein, E. S., & Kilpatrick, S. T. (2018). *Lewin's Genes* (12th Edition). Jones & Bartlett.

Modes of Evaluation

Components	**Class Assessment (including lab)**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	3	2	3	3	-	-	3	-	-	1	3
CO2	3	3	2	3	3	-	-	3	-	-	1	3
CO3	3	3	2	3	3	-	-	3	-	-	1	3
CO4	3	3	2	3	3	-	-	3	-	-	1	3
CO5	3	3	2	3	3	-	-	3	-	-	1	3
Average	3	3	2	3	3	-	-	3	-	-	1	3

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC206	Biomolecular Interactions	L	T	P	C
Version	**1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Fundamental knowledge of biomolecules, chemical bonding, and principles of biophysics.				
Co-requisites					

Course Objectives

1. To introduce the fundamental principles governing non-covalent interactions among biomolecules.
2. To explore the mechanisms and thermodynamics of protein-ligand, protein-DNA/RNA, and protein-protein interactions.
3. To provide hands-on experience with spectroscopic, calorimetric, and surface-based biophysical techniques.
4. To enable students to interpret interaction data using modern analysis tools.
5. To instill skills in experimental design and result validation for studying molecular interactions.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** different types of biomolecular interactions and their biological relevance.

CO2 : **Understand** the theoretical basis and parameters describing biomolecular affinity and specificity.

CO3 : **Apply** appropriate tools and methods to study specific types of molecular interactions.

CO4 : **Analyze** kinetic and thermodynamic data generated from interaction studies.

CO5 : **Evaluate** binding models and critically interpret experimental findings.

Catalogue Description

This course explores the fundamental principles governing biomolecular interactions, focusing on protein–protein, protein–nucleic acid, protein–lipid, and protein–small molecule associations. Students will examine the forces driving these interactions, including hydrogen bonding, hydrophobic effects, ionic interactions, and van der Waals forces, along with the thermodynamic and kinetic parameters that define binding affinity and specificity. The course covers DNA- and RNA-binding motifs, transcription factor interactions, and enzyme-inhibitor systems. Experimental techniques such as SPR, ITC, EMSA, and fluorescence-based assays are introduced alongside computational modeling approaches like molecular docking and protein-protein interaction network analysis.

Course Content

Unit 1 Introduction to Biomolecular Interactions **9 hours**
Protein-protein, protein-nucleic acid, protein-lipid, protein-small molecule interactions. Forces involved: Hydrogen bonding, hydrophobic interactions, van der Waals forces, ionic interactions. Thermodynamic principles: ΔG, ΔH, ΔS, binding isotherms

Unit 2 Protein-Ligand Interactions **8 hours**
Binding kinetics and affinity, Scatchard, Lineweaver-Burk, and Hill plots.
Case studies: Enzyme-inhibitor, receptor-ligand models

Unit 3 Protein-Protein and Protein-DNA/RNA Interactions **10 hours**
DNA-binding motifs: Helix-turn-helix, zinc finger, leucine zipper. Transcription factor-DNA interaction models. Methods to probe specificity and sequence recognition

Unit 4 Experimental Techniques **10 hours**
Surface Plasmon Resonance (SPR), Isothermal Titration Calorimetry (ITC), Electrophoretic Mobility Shift Assay (EMSA), Fluorescence spectroscopy (FRET, anisotropy), Co-immunoprecipitation and pull-down assays

Unit 5 Computational Approaches and Interaction Modelling **8 hours**
Molecular docking, Interaction interfaces and binding energy prediction, Protein-protein interaction networks (PPI)

Unit 6 List of Experiments **30 hours**
Demonstration of solubility and precipitation of proteins using salts and solvents.
UV-Vis absorption studies to assess binding between a small molecule (e.g., caffeine) and DNA.
Study of heat denaturation of BSA or casein to understand hydrophobic and hydrogen bonding forces.
Experiment on ionic interaction using albumin and charged dyes (e.g., bromophenol blue binding).

Experiential Learning

1. **Calculation of ΔG, ΔH, and ΔS** using temperature-dependent binding data.
2. Binding assay using fluorescence quenching (protein-ligand interaction).
3. DNA-protein interaction assay using EMSA.
4. Analysis of thermodynamic data from ITC.

Textbooks

1. Voet, D. & Voet, J.G. (2018). *Voet's Principles of Biochemistry, 5th Edition,* Wiley.
2. Nelson, D.L. & Cox, M.M. (2021). *Lehninger Principles of Biochemistry*. Freeman.

3. Freifelder, D. (2000). *Physical Biochemistry*, W.H. Freeman.
4. Fuxreiter, M. (2018). Computational Approaches to Protein Dynamics, CRC Press.
5. Berg, J.M., Gatto, G., Hines, J., Tymoczko, J.L. and Stryer, L. (2023) Biochemistry, 10th edition, Macmillan.

Reference Books

1. Schreiber, G. *Protein-Protein Interaction Assays*, Springer.
2. Lakowicz, J.R. *Principles of Fluorescence Spectroscopy*, Springer.
3. Cooper, A. *Biophysical Chemistry*, Royal Society of Chemistry.
4. Rhodes, G. *Crystallography Made Crystal Clear*, Academic Press.

Modes of Evaluation

Components	**Class Assessment (including lab)**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	1	1	1	-	-	-	-	-	-	-
CO2	2	3	2	2	1	-	-	-	-	-	-	-
CO3	1	2	3	2	2	-	-	-	-	-	-	-
CO4	1	2	2	3	2	-	-	-	-	-	-	-
CO5	1	2	2	3	3	-	-	-	-	-	-	-
Average	1.6	2.2	2.0	2.2	1.8	-	-	-	-	-	-	-

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

SEC144	Clinical Biochemistry	L	T	P	C
Version	**V1.2**	**1**	**0**	**1**	**2**
Pre-requisites/Exposure	Basic Biochemistry, Cell Biology				
Co-requisites	Human Physiology				

Course Objectives

1. To understand the fundamentals of clinical biochemistry and the role of biomolecules in health and disease.
2. To familiarize students with biochemical tests used for diagnosis of common diseases.
3. To develop skills in interpreting organ function test reports and biochemical markers.
4. To introduce quality control practices in clinical laboratories.
5. To strengthen analytical and diagnostic thinking using clinical case studies.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** the types and significance of biological specimens and understand the organization of clinical laboratories.
CO2 : **Understand** biochemical markers related to liver, kidney, heart, and metabolic disorders.
CO3 : **Apply** principles of quality control and assurance in clinical biochemistry.
CO4 : **Analyse:** basic biochemical tests used in disease diagnosis.
CO5 : **Evaluate** biochemical data to assess health status and infer probable disorders.

Catalogue Description

This course introduces students to clinical biochemistry, emphasizing the principles and practices of medical diagnostics. It covers laboratory setup, safety protocols, and handling of clinical specimens such as blood, urine, CSF, and saliva. Core biochemical techniques, including spectrophotometry, electrophoresis, and automated assays, are taught alongside quality control, GLP, and accreditation standards. Students explore biochemical markers for liver, kidney, cardiac, pancreatic, and bone function, as well as metabolic and endocrine disorders such as diabetes, thyroid dysfunction, and lipid abnormalities. Practical interpretation of test results, clinical correlation, diagnostic decision-making, and emerging biomarker technologies are integral components of the course.

Course Content

Unit 1 Introduction to Clinical Biochemistry and Laboratory Practices 3 hours
Role of clinical biochemistry in medical diagnostics. Laboratory setup and safety protocols. Types of clinical specimens: blood, urine, CSF, saliva. Sample collection, transport, preservation, and rejection criteria.

Unit 2 Biochemical Techniques and Quality Control 3 hours
Colorimetry, spectrophotometry, electrophoresis, centrifugation. Automation and dry chemistry techniques. Internal and external quality control; accuracy, precision, specificity, and sensitivity. Good Laboratory Practices (GLP) and accreditation systems (e.g., NABL).

Unit 3 Biochemical Markers and Tests for Organ Function 4 hours
Liver Function Tests (LFT): ALT, AST, ALP, bilirubin. Renal Function Tests (RFT): urea, creatinine, uric acid, electrolytes. Cardiac Markers: CK-MB, LDH, Troponins. Pancreatic and bone markers: amylase, lipase, calcium, phosphate.

Unit 4 Metabolic and Endocrine Disorders 3 hours
Diabetes mellitus: glucose, HbA1c, insulin. Thyroid function tests: T3, T4, TSH. Lipid profile: total cholesterol, triglycerides, HDL, LDL. Gout and amino acid metabolism disorders.

Unit 5 Clinical Case Evaluation and Applications 2 hours
Interpretation of test reports. Clinical correlation with diseases (e.g., jaundice, renal failure, myocardial infarction). Diagnostic flowcharts and decision-making. Emerging technologies: biosensors, POC diagnostics, omics-based biomarkers.

Unit 5 Clinical Case Evaluation and Applications 30 hours
Collection of blood and storage
Separation and storage of serum
Estimation of uric acid
Urine Benedict's test
Microscopic observation of urine components
LDL & HDL estimation
Estimation of blood glucose by glucose oxidase – peroxidase method
Estimation of triglycerides
Estimation of bilirubin (direct and indirect).
Assessment of hypertension by blood pressure measurement

Experiential Learning

1. Case study evaluation using clinical data sheets.
2. Hospital/lab field visit and reporting.
3. Group presentation on biochemical basis of a common disorder

Textbooks

1. Vasudevan, D. M., & Sreekumari, S. *Textbook of Biochemistry for Medical Students*. Jaypee.
2. Satyanarayana, U., & Chakrapani, U. *Essentials of Biochemistry*. Elsevier.

Reference Books

1. Tietz, N. W. *Fundamentals of Clinical Chemistry*. Elsevier.
2. Devlin, T. M. *Textbook of Biochemistry with Clinical Correlations*. Wiley.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	1	1	1	1	1	1	1	1	1
CO2	3	3	2	2	2	1	1	1	1	1	1	1
CO3	2	3	3	2	2	1	1	1	1	1	1	1
CO4	2	2	2	3	2	1	1	1	1	1	1	1
CO5	2	2	2	2	3	1	1	1	1	1	1	1
Average	2.4	2.4	2.2	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

VAC107	Ayurveda and Nutrition	L	T	P	C
Version	**1.0**	**2**	**0**	**0**	**2**
Pre-requisites/Exposure	Knowledge of Biology at Plus Two Level				
Co-requisites					

Course Objectives

1. To introduce the fundamental concepts of Ayurvedic nutrition, including Prakriti, Doshas, Agni, and Ama.
2. To explain the principles of macro- and micronutrients, dietary requirements, and digestion from both modern and Ayurvedic perspectives.
3. To develop understanding of Ayurvedic dietary guidelines, food classification, and lifestyle management.
4. To enable students to critically assess food habits and regional dietary patterns using Ayurvedic principles.
5. To foster experiential learning through surveys, market analysis, and practical application of Ayurvedic dietetics.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** the basic Ayurvedic concepts, terminologies, and types of Prakriti.
CO2 : **Understand** the modern nutritional principles, classification of nutrients, and dietary requirements across life stages.
CO3 : **Apply** Ayurvedic principles to assess diet quality, Dosha balance, and lifestyle practices.
CO4 : **Analyse** food habits and dietary patterns using Ayurvedic and modern nutritional perspectives.
CO5 : **Evaluate** dietary interventions and lifestyle modifications for health promotion, disease prevention, and stress-related dietary behaviors.

Catalogue Description

This course introduces students to the principles of Ayurvedic nutrition and its integration with modern dietary science. Students will learn key Ayurvedic concepts such as Prakriti, Doshas, Agni, Ama, and food classification (Sattvic, Rajasi, Tamasic). The course covers macro- and micronutrients, dietary requirements, digestion, absorption, and energy regulation. Emphasis is placed on Ayurvedic dietary guidelines, incompatible foods (Viruddha Ahara), and lifestyle management through Dincharya and Ritucharya. Experiential learning includes market surveys, household dietary assessments, and analysis of food behavior.

Course Content

Unit 1 Introduction to Ayurvedic Nutrition 7 hours
Ayurvedic concepts, terminologies (Agnibala, Jatharagni, Ama); Prakriti: types and significance. Regional food traditions of India

Unit 2 Concept of Nutrition, Malnutrition, and Digestive System 9 hours
Nutrition, malnutrition, and health; scope of nutrition; Classification of food and nutrients: carbohydrate, lipid, protein, vitamins, minerals, dietary fiber, water balance; Minimum nutritional requirement, RDA, BMR, SDA; Growth and development across lifespan; Digestive system: GI tract, liver, gallbladder, pancreas; digestion and absorption processes.

Unit 3 Basic Principles of Food, Nutrition, and Ayurveda 7 hours
Rich sources of nutrients; Concept of Doshas and assessment; Ayurvedic principles of food habits (Ahara Vidhi Visheshaayatana); FSSAI regulations on Ayurvedic Aahar.

Unit 4 Ayurvedic Diets and Lifestyle Management 7 hours
Principles of diet: Sattvic, Rajasi, Tamasic foods; Incompatible foods (Viruddha Ahara), Pathya, Apathya, Viprita Ahara; Lifestyle management: Dincharya and Ritucharya; Application of Ayurvedic diets to stress-linked food behavior.

Experiential Learning

1. Market survey and classification of foods as Sattvic, Rajasi, Tamasic.
2. Household survey to assess food behavior, consumption of incompatible foods, and lifestyle practices.

Textbooks

1. Rastogi, S. (2014). *Ayurvedic Science of Food and Nutrition.* Springer. ISBN: 978-1461496274
2. Rastogi, S. (2010). Building bridges between Ayurveda and modern science. *Int J Ayurveda Res*, 1(1):41–46.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	1	1	1	1	2	1	1	1	1
CO2	2	3	2	2	2	2	2	3	2	2	1	1
CO3	2	2	3	2	2	2	2	2	2	2	2	2
CO4	2	3	2	2	3	3	3	2	2	2	2	2
CO5	2	3	2	2	3	3	2	2	2	3	3	3
Average	2.2	2.6	2	1.8	2.2	2.2	2	2	1.8	2	2	2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

PDC202	Professional Development Course II	L	T	P	C
Version	**1.0**	**0**	**0**	**1**	**1**
Pre-requisites/Exposure	Completion of Professional Development Course I				
Co-requisites					

Course Objectives

1. To prepare students with essential skills for effective resume, cover letter writing, and professional communication.
2. To develop aptitude, technical, and interview skills required for campus and competitive placements.
3. To enhance teamwork, group discussion, and personal branding for professional success.
4. To provide industry insights, career guidance, and mock assessments for confident job readiness.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts and principles of professional development.
CO2 : **Understand** the importance of lifelong learning and continuous improvement in a professional context.
CO3 : **Apply** effective communication strategies in professional interactions.
CO4 : **Analyse** personal strengths and weaknesses to create a targeted development plan.
CO5 : **Evaluate** case studies of successful professional development initiatives.

Catalogue Description

This pre-placement training module equips students with essential career skills, including resume and cover letter writing, interview preparation, aptitude and technical practice, and group discussion. It emphasises professional skills, personal branding, industry awareness, and job search strategies, concluding with mock assessments to build confidence for successful career placement.

Course Content

1. Introduction to Pre-Placement Training
2. Resume Building & Cover Letter Writing
3. Interview Skills
4. Aptitude and Technical Skills
5. Group Discussion and Communication Skills
6. Personal Branding and Online Presence
7. Professional Skills
8. Industry Insights and Company Presentations
9. Career Guidance for Competitive Entrance Exams and Job Search Strategies
10. Mock Tests and Assessments

Modes of Evaluation

Components	**Regular Evaluation**	**End Term**
Weightage (%)	**50**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	2	1	2	2	1	1	2	2	1	2	2
CO2	2	3	1	2	3	2	1	2	2	2	1	3
CO3	1	2	2	1	2	2	1	3	2	2	2	2
CO4	2	2	1	2	2	1	2	2	2	1	2	2
CO5	1	2	1	1	3	2	1	2	2	2	1	3
Average	1.60	2.20	1.20	1.60	2.40	1.60	1.20	2.20	2.00	1.60	1.60	2.40

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

MIB301	Immunology	L	T	P	C
Version	**2.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Basic knowledge of Microbiology and Life Science				
Co-requisites	Fundamental concepts of Cell and Molecular Biology				

Course Objectives

1. To introduce the fundamental concepts of innate and adaptive immunity and their historical development.
2. To explain the structure, function, and interactions of immune cells, organs, and molecules including antibodies, antigens, and complement system.
3. To familiarize students with immunological techniques for research and diagnostics, including ELISA, immunodiffusion, and flow cytometry.
4. To explore immune disorders, hypersensitivity reactions, and autoimmunity.
5. To develop practical skills in laboratory-based immunology experiments and data interpretation.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts, immune cells, organs, and molecular components of the immune system.
CO2 : **Understand** antigen-antibody interactions, complement activation, and MHC functions.
CO3 : **Apply** immunological techniques to analyze immune responses and diagnostic assays.
CO4 : **Analyze** immune disorders, hypersensitivity, and autoimmune conditions.
CO5 : **Evaluate** experimental data and interpret immune mechanisms in clinical and research contexts.

Catalogue Description

This course provides a comprehensive introduction to immunology, covering innate and adaptive immune responses, immune cells, organs, and molecular components. It explores antigen-antibody interactions, complement pathways, and the structure and function of MHC molecules. Students will learn mechanisms underlying humoral and cell-mediated immunity, immune memory, and regulatory processes. The course also addresses hypersensitivity reactions, autoimmunity, and other immunological disorders. Through theory and hands-on experiments, students gain skills to analyze immune responses, perform diagnostic assays, and interpret immunological data in research and clinical settings.

Course Content

Unit 1 Introduction to Innate & adaptive immunity and components of the immune system — 10 hours

Concept of Innate and Adaptive immunity; Contributions of following scientists to the development of field of immunology - Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Rodney Porter, Louis Pasteur and Susumu Tonegawa; Structure, Functions and Properties of: Immune Cells and Immune Organs, hematopoietic stem cells; Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals); Killing Mechanisms by CTL and NK cells

Unit 2 Antigen, Antibody, Ag-Ab interaction — 12 hours

Characteristics of an antigen; Haptens; Epitopes (T & B cell epitopes); Adjuvants – complete and incomplete; Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Monoclonal and Chimeric antibodies; Antigen processing and presentation (Cytosolic and Endocytic pathways), isotype switching, affinity maturation; Ag-Ab interaction, Affinity, Avidity, Cross-reactivity, Precipitation, Agglutination, Widal Test

Unit 3 Complement system & Major Histocompatibility Complex — 6 hours

Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement Activation; Organization of MHC locus (Mice and Human); Structure and Functions of MHC I & II molecules

Unit 4 Immunological Techniques — 8 hours

Immunodiffusion, Immunoelectrophoresis, ELISA, RIA, ELISPOT, Western blotting, Immunofluorescence, Flow cytometry, Immunoelectron microscopy, Vaccines

Unit 5 Immunological Disorders — 9 hours

Types of Autoimmunity and Hypersensitivity with examples

Unit 6 Practical application of Immunology — 30 hours

Identification of human blood groups.
Total and Differential Leukocyte Count of the given blood sample.
Separation of serum from blood sample (demonstration).
Immunodiffusion by Ouchterlony and Mancini’s method.
Immunoelectrophoresis

Experiential Learning

1. Analyze patient case studies to identify the type of hypersensitivity or autoimmunity, interpret symptoms, and propose diagnostic methods.
2. Design and Critique of Vaccine Strategies.

Textbooks

1. Goldsby RA, Kindt TJ, Osborne BA. (2007). *Kuby's Immunology*, 6th edition, W.H. Freeman and Company, New York.
2. Abbas AK, Lichtman AH, Pillai S. (2007). *Cellular and Molecular Immunology*, 6th edition, Saunders Publication, Philadelphia.

Reference Books

1. Delves P, Martin S, Burton D, Roitt IM. (2006). *Roitt's Essential Immunology*, 11th edition, Wiley-Blackwell Scientific Publication, Oxford.
2. Murphy K, Travers P, Walport M. (2008). *Janeway's Immunobiology*, 7th edition, Garland Science Publishers, New York.

Modes of Evaluation

Components	**Class Assessment (including lab)**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	2	2	2	1	2	1	1	1	1	1
CO2	3	3	2	2	2	1	2	1	1	1	1	1
CO3	2	3	3	3	3	2	3	2	2	1	1	1
CO4	2	3	2	2	3	2	2	2	2	1	1	1
CO5	2	2	2	2	2	2	2	2	2	1	2	2
Average	2.4	2.6	2.2	2.2	2.4	1.6	2.2	1.6	1.6	1.0	1.2	1.2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC303	RDT and Genetic Engineering	L	T	P	C
Version	**1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Basic knowledge of Microbiology and Molecular Biology				
Co-requisites					

Course Objectives

1. To introduce the foundational principles and tools used in recombinant DNA technology.
2. To familiarize students with classical and modern cloning vectors and strategies for gene isolation and manipulation.
3. To train students in techniques for analyzing nucleic acids and proteins, including gel electrophoresis and blotting.
4. To equip students with skills in designing, executing, and interpreting molecular cloning experiments.
5. To develop a critical understanding of transcriptional analysis, gene expression, and ethical issues related to genetic manipulation.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts, terminology, and methodologies in recombinant DNA technology.

CO2 : **Understand** the principles underlying cloning, gene expression, and molecular analysis techniques.

CO3 : **Apply** molecular techniques such as PCR, gel electrophoresis, and transformation in practical settings.

CO4 : **Analyse** experimental results, troubleshoot cloning workflows, and interpret gene expression data.

CO5 : **Evaluate** molecular biology protocols, design experimental approaches, and assess ethical implications in genetic research.

Catalogue Description

This course provides an in-depth understanding of the principles and methodologies of Recombinant DNA Technology. Students will explore DNA cloning, gene expression, library construction, transcriptomics, and modern analytical techniques. Emphasis is placed on both classical and advanced tools such as site-directed mutagenesis, protein overexpression strategies, and the use of various vectors. Ethical considerations and applications in biotechnology and medicine are also covered. The course prepares students for advanced research in molecular biology, genetic engineering, and allied life science disciplines.

Course Content

Unit 1 Basics of DNA Cloning **10 hours**
Basic, directional, and non-directional cloning; Linkers, adaptors, gene isolation; Cloning vectors including plasmids, phages, phagemids, cosmids, PACs, BACs, YACs; Shuttle vectors, expression vectors; Advanced cloning strategies; Site-directed mutagenesis; Clone screening using reporter genes

Unit 2 DNA and Protein Analysis **8 hours**
DNA electrophoresis; Southern, Northern, Western blotting; Probe labeling; DNA isolation and purification; RFLP, RAPD, DNA fingerprinting; Native PAGE, SDS-PAGE, two-dimensional PAGE; Capillary electrophoresis, microfluidics; Mass spectrometry for proteomics, phosphoproteomics; Next-generation sequencing for DNA and RNA analysis

Unit 3 Polymerase Chain Reaction (PCR) **8 hours**
Principles of PCR, thermophilic enzymes; PCR variants; Primer design and tools; PCR cloning methods; Long PCR, Inverse PCR, RT-PCR, RACE; Real-time PCR; Multiplex PCR, differential display, RAPD; Ligation chain reaction, overlap PCR, rolling circle amplification; Digital PCR, droplet digital PCR; Isothermal amplification techniques

Unit 4 Library Construction and Screening **7 hours**
Construction of genomic and cDNA libraries using appropriate vectors, enzymes; Screening by colony hybridisation, colony PCR, expression screening; Enrichment by positive selection, subtractive hybridisation; Gene identification using direct selection, exon trapping; Library preparation for RNA-seq, whole-genome sequencing, single-cell cDNA; CRISPR-based functional screening libraries; Protein overexpression in bacterial, yeast, insect, mammalian systems

Unit 5 Gene Expression and Transcriptomics **12 hours**
Gene expression analysis using Northern blotting, RT-PCR, ESTs, reporter genes; Enzymatic, bioluminescent, localisation reporters; Promoter analysis; Transcription start site mapping; Transcriptome analysis; Epigenetic profiling by ChIP-Seq, ATAC-Seq

Unit 6 Experiments in Recombinant DNA Technology **30 hours**
Competent cell preparation and transformation efficiency optimization
Isolation of plasmid DNA using high-purity methods
Restriction digestion analysis by agarose gel electrophoresis
PCR

Experiential Learning

1. *In Silico* Primer and Cloning Design
2. Analysis of Cloning Strategies and Gene Expression Analyses from research articles

Textbooks

1. Primrose, S.B. and Twyman, R.M. (2006). *Principles of Gene Manipulation and Genomics*. 7th Edition. Wiley-Blackwell.
2. Brown, T.A. (2016). *Gene Cloning and DNA Analysis: An Introduction*. 7th Edition. Wiley-Blackwell.

Reference Books

1. Brown, T.A. (2006). *Genomes*. 3rd Edition. Garland Science.
2. Glick, B.R., Pasternak, J.J. and Patten, C.L. (2017). *Molecular Biotechnology: Principles and Applications of Recombinant DNA*. 5th Edition. ASM Press.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	2	1	2	1	1	1	1	1
CO2	3	3	2	3	2	1	2	2	1	1	1	1
CO3	2	3	3	3	3	2	3	2	2	1	1	1
CO4	2	3	2	3	3	2	2	2	2	1	1	1
CO5	2	2	2	3	2	2	2	2	2	1	2	2
Average	2.4	2.6	2.2	2.8	2.4	1.6	2.2	1.8	1.6	1.0	1.2	1.2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC309	Metabolism of Amino acids and Nucleic acids	L	T	P	C
Version	**2.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Knowledge of Biology and Chemistry at Plus Two level				
Co-requisites	Structure and Function of Amino acids and Nucleic acids				

Course Objectives

1. To understand the biosynthesis and degradation of amino acids and nucleotides.
2. To explore the regulation and integration of nitrogen metabolism.
3. To analyze the clinical implications of metabolic disorders.
4. To learn about the role of cofactors and coenzymes in metabolic reactions.
5. To examine the interconnection of amino acid and nucleotide metabolism with central metabolic pathways.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** pathways of amino acid and nucleotide biosynthesis and catabolism.
CO2 : **Understand** the regulatory mechanisms governing these pathways.
CO3 : **Apply** knowledge to identify metabolic defects and their biochemical basis.
CO4 : **Analyse** interrelations between metabolism and physiological processes.
CO5 : **Evaluate** therapeutic strategies for inborn errors of metabolism.

Catalogue Description

This course provides an in-depth study of nitrogen and nucleotide metabolism, emphasizing the biochemical pathways, regulatory mechanisms, and clinical significance. Students will explore amino acid catabolism and biosynthesis, nitrogen balance, transamination, deamination, and the urea cycle, alongside disorders such as PKU, maple syrup urine disease, and urea cycle defects. Purine and pyrimidine metabolism, including biosynthesis, salvage pathways, degradation, and interconnections with central metabolism, are examined with therapeutic implications. Practical laboratory exercises include estimation of urea, SGOT/SGPT, uric acid, bilirubin, and bioinformatic analysis of key enzymes, integrating theoretical knowledge with experimental skills and clinical relevance.

Course Content

Unit 1 Overview of Nitrogen Metabolism 9 hours

Nitrogen Balance: Concept of nitrogen intake and excretion; positive and negative nitrogen balance. Amino Group Transfer: Role of aminotransferases, coenzymes (pyridoxal phosphate), and reaction mechanisms. Ammonia Transport and Detoxification: Glutamine and alanine as nitrogen carriers; formation and transport of ammonia in tissues. Urea Cycle: Steps, enzymes, regulation, and link with the TCA cycle; disorders of the urea cycle (e.g., OTC deficiency).

Unit 2 Amino Acid Catabolism 9 hours

Transamination and Deamination: Enzymes and cofactors involved, oxidative and non-oxidative deamination. Decarboxylation Reactions: Production of amines (*e.g.*, histamine, serotonin) and their physiological roles. Classification: Glucogenic *vs.* ketogenic amino acids
Pathways: Specific degradation pathways for phenylalanine, tyrosine, tryptophan, branched-chain amino acids. Metabolic Disorders: PKU, maple syrup urine disease, alkaptonuria, homocystinuria—causes, symptoms, biochemical basis.

Unit 3 Amino Acid Biosynthesis 9 hours

Synthesis of Non-Essential Amino Acids: Pathways for alanine, aspartate, glutamate, serine, etc. Essential Amino Acids: Overview of pathways for synthesis in microorganisms and plants (educational reference). Biosynthetic Precursors: Intermediates from glycolysis, TCA cycle, and PPP as precursors. Regulation: Feedback inhibition and allosteric regulation in biosynthetic pathways. Amino Acid Derivatives: Formation of biologically important molecules (e.g., nitric oxide from arginine, catecholamines from tyrosine).

Unit 4 Nucleotide Biosynthesis 9 hours

Purine Biosynthesis: De novo pathway: Stepwise synthesis from PRPP to IMP, including the roles of glycine, glutamine, aspartate, CO_2, and N^{10}-formyl-THF. Conversion of IMP to AMP and GMP; regulatory feedback mechanisms. Salvage pathways: Role of HGPRT and APRT enzymes, significance in energy economy.
Pyrimidine Biosynthesis: Stepwise synthesis of UMP from carbamoyl phosphate and aspartate; role of CAD complex. Conversion to UTP, CTP, and TMP (*via* dUMP and thymidylate synthase). Regulation at the level of carbamoyl phosphate synthetase II (CPSII). Folate Cycle and One-Carbon Metabolism: Role of tetrahydrofolate (THF) derivatives in purine and thymidine synthesis. Interrelation with amino acid metabolism (serine, glycine, methionine cycles). Therapeutic relevance of antifolate drugs (methotrexate, trimethoprim).

Unit 5 Catabolism of Nucleotides, Integration and Disorders 9 hours

Purine Degradation: Breakdown of AMP and GMP to inosine and guanosine, leading to xanthine and uric acid. Role of xanthine oxidase; production of reactive oxygen species.
Clinical relevance: Gout, Lesch-Nyhan syndrome, SCID (ADA deficiency). Pyrimidine Degradation: Degradation of cytosine and uracil to β-alanine, and thymine to β-aminoisobutyric acid. Water-soluble end products; no accumulation like in purines.

Disorders and Inhibitors: Gout treatment using allopurinol (xanthine oxidase inhibitor). Deoxyribonucleotide metabolism defects and their impact on DNA synthesis. Interconnection with Central Metabolism: Linkage of nucleotide metabolism to glycolysis, PPP, and amino acid metabolism. PRPP as a key metabolic node; roles of ribose-5-phosphate and ATP. Inborn Errors of Nucleotide Metabolism: Lesch-Nyhan syndrome, orotic aciduria, adenosine deaminase deficiency. Genetic basis, diagnostic biomarkers, and treatment strategies. Therapeutic Targets and Applications: Use of antimetabolites (5-FU, 6-MP) in cancer and immunosuppression. Nucleotide analogs in antiviral therapies (e.g., acyclovir, AZT).

Unit 6 Lab Exercises **30 hours**

Estimation of blood Urea and BUN
Estimation of SGOT and SGPT
Estimation of serum Uric acid
Estimation of serum Bilirubin
Bioinformatics and structure analysis of enzymes in amino acid and nucleic acid metabolism

Experiential Learning

1. Metabolic Pathway Mapping with Case-Based Disorders
2. Food Diary and Energy Metabolism Calculation
3. Simulated Metabolic Flux Analysis (MFA)
4. Interactive Role-Play: Hormonal Regulation of Metabolism

Textbooks

1. **Lehninger, A.L., Nelson, D.L. & Cox, M.M. (2017).** *Lehninger Principles of Biochemistry*, W.H. Freeman and Company.
2. **Voet, D. & Voet, J.G. (2010).** *Biochemistry*, John Wiley & Sons.
3. **Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. & Weil, P.A. (2018).** *Harper's Illustrated Biochemistry*, McGraw Hill Education.
4. **Satyanarayana, U. & Chakrapani, U. (2020).** *Biochemistry*, Elsevier India.

Reference Books

1. **Berg, J.M., Tymoczko, J.L., Gatto, G.J. & Stryer, L. (2019).** *Biochemistry*, W.H. Freeman and Company.
2. **Devlin, T.M. (2010).** *Textbook of Biochemistry with Clinical Correlations*, Wiley-Liss.
3. **Garrett, R.H. & Grisham, C.M. (2016).** *Biochemistry*, Cengage Learning.
4. **Campbell, M.K. & Farrell, S.O. (2012).** *Biochemistry*, Brooks/Cole, Cengage Learning.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	1	1	1	1	1	1	1	1	1
CO2	3	3	2	2	1	1	1	1	1	1	1	1
CO3	3	3	3	3	2	1	1	1	2	2	2	2
CO4	3	2	3	3	2	1	1	2	2	2	2	2
CO5	3	3	3	2	3	2	2	2	3	2	2	2
Average	3	2.6	2.6	2.2	1.8	1.2	1.2	1.4	1.8	1.4	1.4	1.4

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

SEC142	IPR and Biosafety	L	T	P	C
Version	**2.0**	**1**	**1**	**0**	**2**
Pre-requisites/Exposure	Basic knowledge of molecular biology and biotechnology.				
Co-requisites					

Course Objectives

1. To introduce the concept and types of Intellectual Property Rights (IPR).
2. To provide knowledge of national and international IPR laws.
3. To create awareness about biosafety issues in biotechnology and microbiology.
4. To discuss guidelines and regulatory frameworks regarding biosafety.
5. To prepare students for handling biological research responsibly.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key IPR terminologies and biosafety principles.
CO2 : **Understand** the need and significance of IPR and biosafety in biological sciences.
CO3 : **Apply** IPR laws in research and publication ethics.
CO4 : **Analyse** biosafety concerns in laboratory and industrial practices.
CO5 : **Evaluate** policies and case studies related to IPR violations and biosafety breaches.

Catalogue Description

This course provides a comprehensive overview of Intellectual Property Rights (IPR), biosafety, and ethical considerations in biotechnology. It introduces the fundamentals and types of IPR, focusing on patents, copyrights, trademarks, and trade secrets, along with historical developments. Emphasis is placed on patents and procedures, including filing processes, patentability criteria, and prior art searches. Special attention is given to IPR issues in biotechnology, such as gene patents, GMOs, and biopiracy. The course further explores biosafety principles, guidelines, and international protocols, while highlighting ethical and regulatory frameworks governing animal, human, and biotechnological research in national and global contexts.

Course Content

Unit 1 Fundamentals of IPR **5 hours**

Types of IPR – Patents, Copyrights, Trademarks, Trade Secrets. History and evolution of IPR.

Unit 2 Patents and Procedures **5 hours**

Filing of patents, patentable and non-patentable items, patent specification, prior art search.

Unit 3 IPR in Biotechnology **5 hours**

IPR issues in biotech research – gene patents, GMOs, biopiracy, case studies.

Unit 4 Biosafety Principles **5 hours**

Introduction to biosafety, levels of biosafety (BSL-1 to BSL-4), biosafety symbols and labeling.

Unit 5 Biosafety Guidelines and Protocols **5 hours**

Institutional biosafety committees, national and international biosafety guidelines (DBT, Cartagena Protocol, OECD).

Unit 6 Ethics and Regulatory Affairs **5 hours**

Ethical issues in biotechnology, animal and human experimentation ethics, regulatory frameworks (ICMR, CPCSEA).

Experiential Learning

1. Case study analysis on patent filing.
2. Group discussion on GMOs and biopiracy.
3. Simulation of biosafety level lab setup.
4. Review of IPR and biosafety policies from global organizations.

Textbooks

1. Sateesh, M.K. (2008). *Bioethics and Biosafety*. I.K. International Publishing House Pvt. Ltd.
2. Bouchoux, D.E. (2012). *Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets*. 4th Edition. Cengage Learning.
3. CDC/NIH (2020). *Biosafety in Microbiological and Biomedical Laboratories (BMBL).* 6th Edition. U.S. Department of Health and Human Services.

Reference Books

1. Benson, S.R. (2019). *Intellectual Property: Everything the Digital-Age Librarian Needs to Know*. Rowman & Littlefield Publishers.
2. Thomas, J.A. and Fuchs, R.L. (2002). *Biotechnology and Safety Assessment*. 3rd Edition. Academic Press.
3. Gheorghe, N.F. (2010). *Bioethics*. Editura Universitară.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2	2	2	3	-	-	2	-	2
CO2	2	3	2	3	3	3	2	1	2	2	1	2
CO3	2	3	3	3	3	3	2	1	2	2	1	-
CO4	3	3	3	2	2	3	3	2	-	2	2	3
CO5	3	2	3	2	2	3	2	2	3	3	3	3
Average	2.6	2.8	2.6	2.1	2.1	2.8	2.1	1.2	1.4	2.1	1.2	2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC304	Internship	L	T	P	C
Version	**2.0**	**0**	**0**	**4**	**4**
Pre-requisites/Exposure	Knowledge of microbiological and biochemical techniques				
Co-requisites					

Course Objectives

1. Provide students with hands-on exposure to industrial environments relevant to microbiology and biotechnology.
2. Bridge the gap between academic learning and real-world industrial applications, workflows, and quality standards.
3. Train students in the use of industry-specific instruments, laboratory practices, documentation systems, and safety protocols.
4. Build professional competencies including teamwork, communication, time management, and problem-solving in an industrial setting.
5. Enable students to document, present, and critically assess their internship experience through a structured report and presentation.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key microbiological and biochemical techniques, industrial workflows, safety norms, and standard operating procedures observed during the internship.

CO2 : **Understand** the principles behind industrial processes, instrumentation, quality control systems (GLP/GMP), and the relevance of classroom concepts in industrial settings.

CO3 : **Apply** microbiological and biochemical skills, analytical methods, and good laboratory practices to perform assigned tasks in wet lab and/or dry lab industrial environments.

CO4 : **Analyse** industrial data, workflows, troubleshooting strategies, and the differences between academic and industrial research practices.

CO5 : **Evaluate** their overall internship experience by assessing process efficiency, data quality, limitations, and industry–academia linkages through a structured report and presentation.

Catalogue Description

This course provides students with practical exposure to industrial settings through a structured internship. Students undergo training in wet lab and/or dry lab environments depending on the hosting organization, such as pharmaceutical companies, diagnostic laboratories, fermentation industries, food testing facilities, or biotechnology firms. During the internship, they experience real-world workflows, instrumentation, quality control processes, biosafety standards, and industrial documentation practices. Students are required to maintain a work log, prepare an internship report, and present their key learnings. The course aims to enhance employability, technical competence, and understanding of the interface between academia and industrial research.

Modes of Evaluation

Components	Internship Report	End Term
Weightage (%)	50	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	1	3	3	3	3	3	-	-	3
CO2	3	3	3	1	3	3	3	3	3	-	-	3
CO3	3	3	3	1	3	3	3	3	3	-	-	3
CO4	3	3	3	1	3	3	3	3	3	-	-	3
CO5	3	3	3	1	3	3	3	3	3	-	-	3
Average	3	3	3	1	3	3	3	3	3	-	-	3

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

PDC301	Professional Development Course III	L	T	P	C
Version	**1.0**	**0**	**0**	**1**	**1**
Pre-requisites/Exposure	Completion of Professional Development Course II				
Co-requisites					

Course Objectives

1. To prepare students with essential skills for effective resume, cover letter writing, and professional communication.
2. To develop aptitude, technical, and interview skills required for campus and competitive placements.
3. To enhance teamwork, group discussion, and personal branding for professional success.
4. To provide industry insights, career guidance, and mock assessments for confident job readiness.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts and principles of professional development.
CO2 : **Understand** the importance of lifelong learning and continuous improvement in a professional context.
CO3 : **Apply** effective communication strategies in professional interactions.
CO4 : **Analyse** personal strengths and weaknesses to create a targeted development plan.
CO5 : **Evaluate** case studies of successful professional development initiatives.

Catalogue Description

This pre-placement training module equips students with essential career skills, including resume and cover letter writing, interview preparation, aptitude and technical practice, and group discussion. It emphasises professional skills, personal branding, industry awareness, and job search strategies, concluding with mock assessments to build confidence for successful career placement.

Course Content

1. Introduction to Pre-Placement Training
2. Resume Building & Cover Letter Writing
3. Interview Skills
4. Aptitude and Technical Skills
5. Group Discussion and Communication Skills
6. Personal Branding and Online Presence
7. Professional Skills
8. Industry Insights and Company Presentations
9. Career Guidance for Competitive Entrance Exams and Job Search Strategies
10. Mock Tests and Assessments

Modes of Evaluation

Components	Regular Evaluation	End Term
Weightage (%)	**50**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	1	2	2	1	1	2	2	1	2	2
CO2	2	3	1	2	3	2	1	2	2	2	1	3
CO3	1	2	2	1	2	2	1	3	2	2	2	2
CO4	2	2	1	2	2	1	2	2	2	1	2	2
CO5	1	2	1	1	3	2	1	2	2	2	1	3
Average	1.60	2.20	1.20	1.60	2.40	1.60	1.20	2.20	2.00	1.60	1.60	2.40

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

MIB305	Bioinformatics	L	T	P	C
Version	**V1.2**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	UG level Biology and Mathematics of Plus Two Level				
Co-requisites	Basics of computer application				

Course Objectives

1. To provide those students with apt understanding of informatics for biological data.
2. To provide in depth knowledge of data basses, sequence analysis, alignment and phylogeny.
3. To offer an outline of basic prediction methods for biological system
4. To enhance understanding of structure prediction for proteins and RNA.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** and describe the basic databases used in bioinformatics.
CO2 : **Understand** the concepts of sequence alignment and its importance in bioinformatics
CO3 : **Apply** prediction models in bioinformatics to make inferences about biological data.
CO4 : **Analyze** the quality of structure prediction models and interpret the results.
CO5 : **Evaluate** the effectiveness of various bioinformatics tools in performing sequence alignment, phylogenetic analysis, and structure prediction tasks.

Catalogue Description

The course of 'bioinformatics' will help to understand the basic concept and application of computational biology. This course includes comprehensive approach through studying data bases, sequence alignment and phylogenetic analysis. Furthermore, the application of computation structure prediction will also be elaborated. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will enable the students with problem-solving ability led by the course coordinator. Students will perceive the basic concepts of the subject *via* exercise and discussions with the coordinator.

Course Content

Unit 1 OS and Database **9 hours**

Definition of relational database Mode of data transfer (FTP, SFTP, SCP), advantage of encrypted data transfer. Relational an object oriented data bases. OS, Codes and languages.

Unit 2 Databases, servers, and tools **9 hours**

Nucleic acid, genome, protein sequence and structure, gene expression databases, Database of metabolic pathways, Mode of data storage – File formats - FASTA, Genbank, PDB. Data submission & retrieval from NCBI, EMBL, DDBJ, Uniprot, PDB and specialized databases.

Unit 3 Molecular Phylogeny **9 hours**

Sequence Alignments, Phylogeny and Phylogenetic trees- Local and Global Sequence alignment, pairwise and multiple sequence alignment. Scoring an alignment, Gap penalties, ClustalW, scoring matrices, PAM & BLOSUM series of matrices Types of phylogenetic trees, Different approaches of phylogenetic tree construction - UPGMA, Neighbour joining, Maximum Parsimony, Maximum likelihood

Unit 4 Genome annotation and analysis **9 hours**

Diversity of Genomes: Viral, prokaryotic & eukaryotic genomes, Genome, transcriptome, proteome, Major features of completed genomes: *E. coli*, *S. cerevisiae*, *Arabidopsis*. Genome annotation.

Unit 5 Structure prediction **9 hours**

Hierarchy of protein structure - primary, secondary and tertiary structures, modeling Structural Classes, Motifs, Folds and Domains Protein structure prediction in presence and absence of structure template Energy minimizations and evaluation by Ramachandran plot; Protein structure and rational drug design

Unit 6 Practical **30 hours**

1. Exploring biological databases, downloading sequences and structure data.
2. Pairwise and multiple sequence alignment, BLAST
3. Molecular phylogenetic analysis: NJ and ML trees
4. Outline of gene prediction and genome annotation
5. Homology modelling, structure prediction and evaluation of predicted models

Experiential Learning

1. Case study: building models for pritein structures
3. Using R-studio and Jupyter Notebook

Textbooks

1. Xiong, J. (2006). *Essential Bioinformatics*. Oxford University Press.
2. Mount, D. W. (2004). *Bioinformatics: Sequence and Genome Analysis*, 2nd Edition. Cold Spring Harbor Laboratory Press.

Reference Books

1. Agostino, A. (2013). *Practical Bioinformatics*. Garland Science.
2. Wilson, K., & Walker, J. (2010). *Principles and Techniques of Biochemistry and Molecular Biology*, 7th Edition. Cambridge University Press.

Modes of Evaluation

Components	**Class Assessment (including lab)**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	2	1	1	1	2	1	1	1	1	1
CO2	3	3	2	2	2	1	2	1	1	1	1	1
CO3	2	3	3	2	2	2	3	1	2	1	1	1
CO4	2	3	3	3	3	2	3	1	2	1	1	1
CO5	2	3	3	3	3	2	3	2	2	2	1	1
Average	2.4	2.8	2.6	2.2	2.2	1.6	2.6	1.2	1.6	1.2	1	1

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC307	Nutrition and Toxicology	L	T	P	C
Version	**V1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Basic understanding of Human Physiology and Biochemistry				
Co-requisites	Metabolism, Environmental Biology				

Course Objectives

1. To introduce the fundamentals of human nutrition and essential nutrients.
2. To explain nutrient metabolism and their roles in maintaining health.
3. To explore the basic principles of toxicology and major classes of toxic agents.
4. To understand the biochemical and physiological impact of toxins.
5. To develop awareness of food safety, contaminants, and regulatory frameworks.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** the macro- and micronutrients along with their dietary sources and biological roles.
CO2 : **Understand** nutrient metabolism and the physiological consequences of nutritional deficiencies.
CO3 : **Apply** toxicological principles, including exposure routes and toxicokinetics.
CO4 : **Analyse n**atural and synthetic toxins and their effects on human health.
CO5 : **Evaluate** food contaminants and adulterants, including their health impacts and regulatory controls.

Catalogue Description

This course explores the fundamentals of human nutrition and toxicology, focusing on the biochemical basis of nutrient functions, metabolism, and health impacts. Students will study the classification of nutrients, dietary requirements, and the physiological consequences of deficiencies, obesity, and lifestyle disorders. Core toxicology topics include dose–response, routes of exposure, ADME, and mechanisms of natural and synthetic toxins such as pesticides, heavy metals, and mycotoxins. Food toxicology addresses contaminants, adulterants, microbial toxins, and safety regulations (FSSAI, WHO, Codex). Laboratory work includes nutrient estimation, adulterant detection, haemoglobin assessment, bioassays, and nutrition surveys, integrating theory with practical applications in health and safety.

Course Content

Unit 1 Basics of Nutrition **8 hours**

Overview of nutrition, dietary guidelines, balanced diet; classification of nutrients – carbohydrates, proteins, lipids, vitamins, and minerals.

Unit 2 Nutrient Metabolism and Disorders **10 hours**

Digestion, absorption, and metabolism of major nutrients; nutritional deficiencies – protein-energy malnutrition, anemia, scurvy, rickets; obesity and lifestyle diseases.

Unit 3 Introduction to Toxicology **9 hours**

History and scope; dose-response relationship; LD50; routes of exposure; absorption, distribution, metabolism, and excretion (ADME) of toxins.

Unit 4 Types of Toxins and Mechanisms of Action **9 hours**

Plant and animal toxins, pesticides, heavy metals (lead, mercury, arsenic), mycotoxins, aflatoxins, endocrine disruptors; biochemical targets and toxicity mechanisms.

Unit 5 Food Toxicology and Safety Regulations **9 hours**

Food additives, preservatives, adulterants; foodborne illnesses and microbial toxins; regulatory bodies – FSSAI, WHO, Codex Alimentarius; food safety practices.

Unit 6 Lab Exercises **30 hours**

Estimation of Macronutrients in Food Samples
Detection of Common Food Adulterants
Determination of Hemoglobin and Iron Deficiency Indicators
Toxicity Bioassay Using Plant or Microbial Models
Survey-Based Assessment of Nutritional Intake in a Target Group

Experiential Learning

1. Case study: Impact of iron and iodine deficiency in local communities.
2. Simulation: Calculation of daily nutrient intake using dietary software/tools.
3. Lab demo/project: Detection of adulterants in food samples.
4. Group presentation: Toxicological profile of a common household or environmental chemical.

Textbooks

1. Srilakshmi, B. (2021). *Nutrition Science*, New Age International Publishers.
2. Klaassen, C.D. (2018). *Casarett & Doull's Essentials of Toxicology*, McGraw-Hill.
3. Bamji, M.S., Rao, P.N., Reddy, V. (2019). *Textbook of Human Nutrition*, Oxford & IBH.

Reference Books

1. Shils, M.E. et al. (2017). *Modern Nutrition in Health and Disease*, Lippincott.
2. Hayes, A.W. (2020). *Principles and Methods of Toxicology*, CRC Press.
3. FSSAI Manual and WHO/FAO Guidelines on Food Safety and Toxicology (latest editions).

Modes of Evaluation

Components	**Class Assessment (including lab)**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	2	2	2	1	1	1	1	1	1	1
CO2	3	3	2	3	2	2	2	1	1	1	1	1
CO3	2	3	3	2	3	3	3	2	1	2	1	1
CO4	2	3	3	3	3	3	3	2	2	2	2	1
CO5	2	3	3	3	3	3	3	2	2	3	2	2
Average	2.4	2.8	2.6	2.6	2.6	2.4	2.4	1.6	1.4	1.8	1.4	1.2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC310	Forensic Biochemistry	L	T	P	C
Version	**1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Basic knowledge of molecular biology and biochemistry				
Co-requisites					

Course Objectives

1. To understand the biochemical basis of forensic investigations.
2. To train students in analytical techniques used in crime scene analysis.
3. To explore applications of DNA fingerprinting, toxicology, and biological trace evidence.
4. To inculcate ethical, legal, and societal aspects related to forensic biochemistry.
5. To develop hands-on skills for career readiness in forensics and biosciences.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** and describe the role of biomolecules in forensic investigations.
CO2 : **Understand** principles of forensic toxicology, serology, and DNA fingerprinting.
CO3 : **Apply** biochemical methods in identifying forensic biological samples.
CO4 : **Analyze** and interpret forensic case studies and lab findings.
CO5 : **Evaluate** the reliability, limitations, and ethical implications of forensic biochemical evidence.

Catalogue Description

This course introduces the principles and applications of forensic biochemistry, highlighting its role in criminal investigations and justice. Students learn the scope, history, and organisational framework of forensic science in India and abroad, with emphasis on laboratories and regulatory bodies. Core topics include forensic tools, microscopy, chromatography, and applications in toxicology, serology, and microbiology. Detailed study covers blood typing, stain detection, toxic agents, and DNA fingerprinting methods using STRs, VNTRs, mtDNA, PCR, and electrophoresis. Laboratory sessions provide hands-on training in blood group determination, serological tests, diatom analysis, alcohol detection, DNA extraction, and gel electrophoresis for simulated DNA profiling.

Course Content

Unit 1 Introduction to Forensic Biochemistry 10 hours

Definition of Forensic Science, The Role of the Forensic Laboratory, History and Development of Forensic Science in India & Abroad, Forensic Technology solving crimes with advanced technology, Administration and Organizational Setup: DFSS, CFSL, GEQD, SFSL, RFSL, MFSL, FPB, NICFS, CDTS, NCRB, BPR&D, American Board of Forensic Odontology, Interpol and FBI, Australian Academy of Forensic Sciences. Scope and significance of forensic biochemistry, Biological samples in forensic investigations: blood, semen, saliva, hair, bone, urine, Collection, preservation, and chain of custody

Unit 2 General Forensic Tools and Techniques 15 hours

Meaning and Terminology of Instrumentation; Definition, Need of Instrumentation in Forensic Science, Qualitative and quantitative methods of analysis, Destructive and Non-Destructive Methods. Centrifugation Techniques, Basic principles of sedimentation. and Forensic applications of Compound, Comparison, Fluorescence, Polarized, Stereo-zoom microscope. Electron Microscopy- Theory and basic principles of Electron Microscopy. Introductory Chromatography: Definition, Chromatographic Techniques, History of Chromatography, Theoretical principles of Chromatography. Forensic Toxicology, Serology & Microbiology.

Unit 3 Forensic Serology and Forensic Toxicology 10 hours

Blood typing and hemoglobin identification, Detection of seminal and salivary stains, Immunological tests: precipitin and agglutination, Toxic substances: poisons, drugs, alcohol, heavy metals, Mechanisms of action and detection techniques, Case studies in toxicology

Unit 4 DNA Fingerprinting and Genetic Markers 10 hours

STRs, VNTRs, mtDNA in forensics, PCR-based DNA analysis, Electrophoresis, RFLP, and interpretation of genetic profiles, National DNA databases (e.g., CODIS, Indian DNA Profiling Bill overview)

Unit 5 List of Lab Experiments 30 hours

Blood Group Determination using ABO and Rh systems
Takayama Test – Forensic Serological Analysis of blood
Forensic Diatom Analysis
Detection of Alcohol using colorimetric method
DNA Extraction from Saliva/Onion/Tissue Sample
Agarose Gel Electrophoresis for simulated DNA fingerprinting

Experiential Learning

1. Visit to local forensic lab/crime lab (virtual or physical)
2. Flip Classrooms and group presentation and Quiz
3. Case study presentations on forensic breakthroughs

Textbooks

1. James, S.H. and Nordby, J.J. (2009). *Forensic Science: An Introduction to Scientific and Investigative Techniques*. 3rd Edition. CRC Press.
2. Levine, B. (2020). *Principles of Forensic Toxicology*. 5th Edition. Springer Publishing.
3. Lee, T.D. (2015). *Biochemistry in Forensic Applications*. 1st Edition. CRC Press.

Reference Books

1. Butler, J.M. (2015). *Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers*. 2nd Edition. Elsevier Academic Press.
2. U.S. Department of Justice. (2016). *Handbook of Forensic Science*. Open Resource Publication, DOJ.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	2	1	1	1	1	2	1	1
CO2	3	3	2	3	3	2	2	2	1	2	1	1
CO3	3	2	3	3	3	3	3	2	2	2	1	1
CO4	2	3	2	3	3	2	3	3	2	2	2	2
CO5	2	2	2	2	3	3	2	3	3	3	3	3
Average	2.6	2.4	2.2	2.6	2.8	2.2	2.2	2.2	1.8	2.2	1.6	1.6

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

SEC146	Molecular Diagnostics	L	T	P	C
Version	**1.0**	**1**	**0**	**1**	**2**
Pre-requisites/Exposure	Fundamentals of Biochemistry and Molecular Biology				
Co-requisites					

Course Objectives

1. To familiarize students with molecular diagnostic technologies.
2. To enhance students' intuition and understanding of computational methods used to analyse molecular diagnostic data.
3. To build students' abilities to interpret molecular diagnostic testing and integrate results into clinical decision-making.
4. To develop skills in appropriately choosing and evaluating diagnostic tests for patients.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key techniques and tools used in molecular diagnostics.
CO2 : **Understand** the principles behind molecular diagnostic methods, such as PCR and sequencing.
CO3 : **Apply** molecular diagnostic tests to detect specific pathogens or genetic disorders.
CO4 : **Analyse** test results and evaluate their clinical significance in diagnosis.
CO5 : **Evaluate** the advantages and limitations of various molecular diagnostic technologies.

Catalogue Description

This course introduces the principles and applications of molecular diagnostics with emphasis on biochemistry and forensic relevance. It covers molecular typing methods including PCR variants, microarrays, and sequencing; microbial molecular epidemiology; diagnostic approaches for infectious diseases; and omics-based clinical applications. Students will gain understanding of quality control, ethics, and emerging trends such as nanotechnology, AI, and multi-omics integration. Laboratory exercises provide hands-on training in DNA isolation, PCR primer design, amplification, gel-based analysis, and restriction digestion. By the end, students will develop competence in applying molecular diagnostic tools for research, clinical decision making, and forensic investigations.

Course Content

Unit 1 Molecular Typing Methods **4 hours**

RFLP, AFLP; PCR (fundamentals, RT-PCR, qPCR, Hot start, Touchdown, Nested, Multiplex, Long-range, Single-cell, Fast-cycling, MSP, ddPCR); PCR-based mutation analysis; primers, linkers, adapters, ribotyping; PFGE; Microarray.

Unit 2 Microbial Molecular Epidemiology **3 hours**

Epidemiology, molecular epidemiology; MLST; targets – species, subspecies, strains, clones, genes; DNA analysis in DMD, Sickle Cell Anaemia, Cystic Fibrosis, X-linked CGD; FISH; detection of *M. tuberculosis*, HIV, H5N1, Coronavirus; VNTR.

Unit 3 Infectious Diseases and Diagnosis **3 hours**

Pathogen detection – bacterial, viral, fungal, zoonotic, protozoan; drug susceptibility/resistance testing; point-of-care testing; cellular/functional genomics; serological and ELISA methods; foodborne pathogen discrimination – REP, CRISPR; DNA sequencing, NGS; transcriptome, proteome.

Unit 4 Omics in Diagnostics – Clinical Applications **3 hours**

Proteomics workflows; protein separation – electrophoresis, chromatography; mass spectrometry, label-free/isotope-labelling; metabolomics in diagnosis; advanced proteomics – Shotgun, DIA, single-cell, spatial profiling; post-translational modifications, protein–protein interactions; proteomic data/bioinformatics tools; Luminex multiplex assays, biomarkers.

Unit 5 Quality Control, Ethics and Futuristic Trends **2 hours**

Quality control; ethical concerns; microfluidics, lab-on-chip; AI, ML in diagnostics; nanotechnology; single-cell analysis; multi-omics data integration.

Unit 6 Lab exercises **30 hours**

Isolation of genomic DNA from bacteria
Designing of PCR primers
PCR amplification of 16s rRNA genes
Isolation of DNA fragments from Agarose gel
Study on the restriction digestion pattern of different bacterial DNA on Agarose gel

Experiential Learning

1. Analysis of Clinical Cases from Literature
2. Designing Diagnostic Strategies from clinical data

Textbooks

1. Grody, W.W. and Nakamura, R.M. (2010). *Molecular Diagnostics: Techniques and Applications for the Clinical Laboratory*. Academic Press.
2. Cox, M.M. and Nelson, D.L. (2008). *Lehninger Principles of Biochemistry*. 5th Edition. CBS Publishers.

Reference Books

1. Brown, T.A. (2007). *Genomes*. 3rd Edition. Wiley-Liss Publications.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	1	1	1	1	1	1	1	1
CO2	3	3	2	2	2	1	2	1	1	1	1	1
CO3	2	2	3	3	3	2	3	2	1	1	1	1
CO4	2	3	3	3	3	2	3	2	2	2	2	1
CO5	2	3	2	3	3	2	3	3	2	2	3	2
Average	2.4	2.6	2.4	2.6	2.4	1.6	2.4	1.8	1.4	1.4	1.6	1.2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC308	Project Work on Biochemistry	L	T	P	C
Version	**2.0**	**0**	**0**	**4**	**4**
Pre-requisites/Exposure	Knowledge of Biochemistry and allied subjects at UG level				
Co-requisites					

Course Objectives

1. Enable students to independently plan, design, and execute a research project in biochemistry.
2. Train students in laboratory techniques, experimental design, data collection, and data analysis.
3. Develop competency in scientific literature survey, critical evaluation of published work, and identification of research gaps.
4. Enhance skills in scientific writing through preparation of a dissertation report meeting academic standards.
5. Strengthen oral communication skills through presentation and defence of research findings.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** fundamental and advanced biochemistry concepts relevant to their research topic.

CO2 : **Understand** research methodologies, experimental workflows, and scientific literature in the chosen research area.

CO3 : **Apply** biochemical techniques, analytical tools, and statistical methods to generate and interpret research data.

CO4 : **Analyse** experimental results, troubleshoot protocols, and derive meaningful scientific interpretations.

CO5 : **Evaluate** the significance, limitations, and future directions of their research based on evidence and scientific rigor.

Catalogue Description

This course provides final-year undergraduate students with hands-on research experience in Biochemistry through a project. Students work on a problem of current relevance in physiology, genetics, biotechnology, immunology, environmental biochemistry, bioinformatics, or any allied domain. The course integrates laboratory experimentation (wet lab and/or dry lab), literature review, data analysis, and scientific writing. Students are required to prepare a comprehensive dissertation report and present their findings through an oral defense. The course aims to develop research aptitude, analytical thinking, technical competence, and scientific communication skills essential for careers in research and industry.

Modes of Evaluation

Components	Thesis	End Term
Weightage (%)	50	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	1	3	3	3	3	3	-	-	3
CO2	3	3	3	1	3	3	3	3	3	-	-	3
CO3	3	3	3	1	3	3	3	3	3	-	-	3
CO4	3	3	3	1	3	3	3	3	3	-	-	3
CO5	3	3	3	1	3	3	3	3	3	-	-	3
Average	3	3	3	1	3	3	3	3	3	-	-	3

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

PDC302	Professional Development Course IV	L	T	P	C
Version	**1.0**	**0**	**0**	**1**	**1**
Pre-requisites/Exposure	Completion of Professional Development Course III				
Co-requisites					

Course Objectives

1. To prepare students with essential skills for effective resume, cover letter writing, and professional communication.
2. To develop aptitude, technical, and interview skills required for campus and competitive placements.
3. To enhance teamwork, group discussion, and personal branding for professional success.
4. To provide industry insights, career guidance, and mock assessments for confident job readiness.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts and principles of professional development.
CO2 : **Understand** the importance of lifelong learning and continuous improvement in a professional context.
CO3 : **Apply** effective communication strategies in professional interactions.
CO4 : **Analyse** personal strengths and weaknesses to create a targeted development plan.
CO5 : **Evaluate** case studies of successful professional development initiatives.

Catalogue Description

This pre-placement training module equips students with essential career skills, including resume and cover letter writing, interview preparation, aptitude and technical practice, and group discussion. It emphasises professional skills, personal branding, industry awareness, and job search strategies, concluding with mock assessments to build confidence for successful career placement.

Course Content

1. Introduction to Pre-Placement Training
2. Resume Building & Cover Letter Writing
3. Interview Skills
4. Aptitude and Technical Skills
5. Group Discussion and Communication Skills
6. Personal Branding and Online Presence
7. Professional Skills
8. Industry Insights and Company Presentations
9. Career Guidance for Competitive Entrance Exams and Job Search Strategies
10. Mock Tests and Assessments

Modes of Evaluation

Components	Regular Evaluation	End Term
Weightage (%)	50	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	1	2	2	1	1	2	2	1	2	2
CO2	2	3	1	2	3	2	1	2	2	2	1	3
CO3	1	2	2	1	2	2	1	3	2	2	2	2
CO4	2	2	1	2	2	1	2	2	2	1	2	2
CO5	1	2	1	1	3	2	1	2	2	2	1	3
Average	1.60	2.20	1.20	1.60	2.40	1.60	1.20	2.20	2.00	1.60	1.60	2.40

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC401	Plant Biochemistry	L	T	P	C
Version	**2.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Knowledge of fundamental Biochemistry and Physiology				
Co-requisites	Knowledge of Plant Biology				

Course Objectives

1. To provide a comprehensive understanding of the structure, organisation, and biochemical functions of plant cells and biomolecules.
2. To explain the metabolic pathways of primary metabolites and their roles in plant growth and development.
3. To explore the biosynthesis and functional significance of secondary metabolites in plants.
4. To examine the biochemical and physiological responses of plants to abiotic stresses.
5. To develop practical skills in experimental techniques for studying plant biochemistry and metabolism.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** fundamental concepts of plant biochemistry, including biomolecules, organelles, and enzymes.
CO2 : **Understand** primary and secondary metabolic pathways in plants.
CO3 : **Apply** knowledge of biochemical processes to experimental investigations in plant systems.
CO4 : **Analyse** the biochemical basis of plant responses to environmental stresses.
CO5 : **Evaluate** the applications of plant biochemistry in agriculture, biotechnology, and industry.

Catalogue Description

This course provides an in-depth exploration of plant biochemistry, focusing on the molecular and biochemical processes underlying plant growth, development, and adaptation. Topics include plant cell structure, biomolecules, enzymology, and the metabolism of primary and secondary compounds. The course highlights the role of photosynthesis, respiration, nitrogen metabolism, and biosynthesis of metabolites in maintaining plant life. It also examines plant stress physiology, covering biochemical responses to abiotic stresses such as drought, salinity, and temperature. Laboratory sessions provide hands-on experience in quantifying photosynthesis, analysing metabolites, enzyme assays, and studying stress-induced biochemical changes, bridging theoretical knowledge with experimental practice.

Course Content

Unit 1 Introduction to Plant Biochemistry 9 hours

Plant Cells and Organelles: Overview of plant cell structure, organelles, and their functions; Plant Biomolecules: Carbohydrates, lipids, proteins, nucleic acids, and their roles in plant metabolism; Water and Minerals in Plants: Importance of water, mineral uptake, and transport in plants; Enzyme Activity in Plants: Enzyme function, types, and regulation in plant systems.

Unit 2 Primary Metabolites in Plants 12 hours

Photosynthesis: The light and dark reactions of photosynthesis, the Calvin cycle, and the role of chloroplasts; Respiration in Plants: Glycolysis, citric acid cycle, oxidative phosphorylation, and fermentation in plants; Nitrogen Metabolism: Nitrogen fixation, assimilation of nitrogen, and the role of legumes in nitrogen cycling; Synthesis of Primary Metabolites: Pathways for the synthesis of amino acids, nucleotides, and fatty acids in plants.

Unit 3 Secondary Metabolism in Plants 12 hours

Introduction to Secondary Metabolites: Definition and classification of secondary metabolites (alkaloids, terpenoids, flavonoids, phenolics, etc.); Biosynthesis of Secondary Metabolites: Pathways involved in the biosynthesis of major plant secondary metabolites; Roles of Secondary Metabolites: Functions in plant defense, signaling, and interactions with the environment; Applications of Secondary Metabolites: Use in agriculture, pharmaceuticals, and biotechnology (*e.g.,* alkaloids in medicine, essential oils in flavouring).

Unit 4 Plant Stress Physiology and Biochemistry 12 hours

Abiotic Stress Factors: Effects of drought, salinity, high temperature, and oxidative stress on plant metabolism; Biochemical Responses to Stress: Antioxidant defense systems, osmotic adjustment, and the role of stress hormones (ABA, ethylene); Stress-Related Pathways: Signaling pathways involved in plant stress response, including ROS (reactive oxygen species) and MAPK (mitogen-activated protein kinase) signaling; Plant Stress Tolerance Mechanisms: Mechanisms of acclimation and adaptation to environmental stress.

Unit 5 Practical Applications of Plant Biochemistry 30 hours

Photosynthesis Measurement – Quantifying the rate of photosynthesis using leaf discs or chlorophyll fluorescence

Enzyme Assays – Measuring enzyme activity (e.g., peroxidase, catalase) in plant tissues and the effect of environmental conditions on enzyme activity.

Analysis of Plant Secondary Metabolites – Extraction and qualitative analysis of secondary metabolites (e.g., alkaloids, flavonoids) from plant tissues.

Stress-Induced Biochemical Changes – Studying changes in plant antioxidant levels under abiotic stress conditions (e.g., salt stress, temperature).

Quantification of Plant Pigments – Extract and quantify chlorophyll and carotenoids from plant tissues using spectrophotometry.

Experiential Learning

1. Case Study: Drought Stress and Osmoprotectants in Crops
2. Case Study: Genetic Modification of Golden Rice for Vitamin A Deficiency

Textbooks

1. Taiz, L., and Zeiger, E. (2010). *Plant Physiology and Development* (5th ed.). Sunderland, MA: Sinauer Associates.
2. Buchanan, B. B., Gruissem, W., & Jones, R. L. (2015). *Biochemistry & Molecular Biology of Plants* (2nd ed.). Wiley-Blackwell.

Reference Books

1. Heldt, H. W., & Piechulla, B. (2011). *Plant Biochemistry* (4th ed.). Academic Press.
2. Jain, M., & Rani, S. (2019). *Plant Biochemistry and Biotechnology* (2nd ed.). Springer.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	2	2	2	3	-	-	2	-	2
CO2	2	3	2	3	3	3	2	1	2	2	1	2
CO3	2	3	3	3	3	3	2	1	2	2	1	-
CO4	3	3	3	2	2	3	3	2	-	2	2	3
CO5	3	2	3	2	2	3	2	2	3	3	3	3
Average	2.6	2.8	2.6	2.1	2.1	2.8	2.1	1.2	1.4	2.1	1.2	2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC402	Developmental Biology	L	T	P	C
Version	**2.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Knowledge of Biology at Plus Two level				
Co-requisites	Knowledge of Cell and Molecular Biology				

Course Objectives

1. To explain fundamental concepts of developmental biology in multicellular organisms.
2. To describe the major developmental events in plants and animals.
3. To analyse the mechanisms of morphogenesis and organogenesis in animals, focusing on pattern formation, gene regulation, and developmental signalling pathways.
4. To understand plant developmental processes including meristem organisation, leaf and floral development, and the genetic control of flowering.
5. To evaluate the roles of programmed cell death, ageing, and senescence in animal and plant development, highlighting underlying biochemical and physiological pathways.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** the fundamental terms and concepts of developmental biology
CO2 : **Understand** developmental processes in plants and animals.
CO3 : **Apply** developmental principles to study human development.
CO4 : **Analyse** developmental mechanisms and mutant phenotypes to infer regulatory pathways and developmental outcomes.
CO5 : **Evaluate** developmental strategies in diverse organisms.

Catalogue Description

This course explores the fundamental principles of developmental biology, focusing on how a single cell develops into a complex multicellular organism. It emphasises the interplay between cell biology, molecular biology, genomics, physiology, and fundamental biochemistry. Key topics include cell fate determination, morphogenesis, organogenesis, fertilisation, cleavage, gastrulation, and stem cell biology in plants and animals. Developmental processes are examined as being driven by tightly regulated biochemical pathways and molecular networks. This integrated perspective deepens understanding of gene regulation, signal transduction, and metabolic control within the broader context of organismal development.

Course Content

Unit 1 Foundations of Developmental Biology 3 hours

Introduction to Embryology and Developmental biology; Concepts of potency, commitment, specification, determination, differentiation; induction, competence, morphogenetic gradients; cell fate, lineage tracing; stem cells, genomic equivalence, imprinting.

Unit 2 Gametogenesis, Fertilisation and Early Development 7 hours

Egg cytoplasmic determinants and polarity, maternal factors, sperm - egg interaction; events in fertilisation, blocks to polyspermy; cleavage patterns, blastula, embryonic fields; gastrulation, germ-layer formation; gametogenesis and fertilisation in plants.

Unit 3 Animal Developmental Biology 15 hours

Axis specification in Drosophila: maternal effect, gap, pair-rule, segment polarity, Hox; early development of amphibians, chick, rabbit; organiser, BMP – chordin – noggin axis, nodal left–right patterning; interactions in development: induction, reciprocal signalling, morphogens; neural development; sex-determination mechanisms.

Unit 4 Human Embryology 12 hours

Human embryonic and foetal stages (Carnegie stages); major developmental milestones: heart tube, limb bud, neural tube closure, organ primordia; ultrasound imaging of development and developmental anomalies; prenatal and neonatal diagnostics: USG, chorionic villus sampling, amniocentesis.

Unit 5 Plant Developmental Biology 8 hours

Organisation of shoot and root apical meristems; development of shoot and root systems; leaf development, phyllotaxy, meristem fate; transition to flowering, photoperiodism, vernalisation; floral meristem identity genes: LFY, AP1; floral organ specification: ABC model in Arabidopsis, Antirrhinum; mutants affecting floral development.

Unit 6 Experiments in Developmental Biology 30 hours

1. Study of developmental stages of frog and chick embryo
2. Study of *Drosophila* development and epithelial morphogenesis mutants
3. Study of human developmental stages and defects in development
4. Study of common flowers and mapping to ABC model of development

Experiential Learning

1. Modelling gene expression timeline based on mRNA-Protein dynamics for axis-specification genes
2. Correlating enzyme kinetics with developmental processes and/or cell fate.

Textbooks

1. Gilbert, S.F. (2013). *Developmental Biology*. 9th Edition. Sinauer Associates.
2. Wolpert, L. and Tickle, C. (2022). *Principles of Development*. 6th Edition. Oxford University Press.
3. Verma, P. S., & Agarwal, V. K. (2010). *Chordate Embryology*. S. Chand Publishing.
4. Sadler, T.W. (2012). *Langman's Medical Embryology*. 12th Edition. Lippincott Williams & Wilkins.

Reference Books

1. Balinsky, B.I. (1994). *An Introduction to Embryology*. 5th Edition. Saunders College Publishing.
2. Reece, J.B., Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky, P.V. and Jackson, R.B. (2011). *Campbell Biology*. 9th Edition. Pearson Benjamin Cummings.
3. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. (2014). *Molecular Biology of the Cell*. 6th Edition. Garland Science.
4. Taiz, L. and Zeiger, E. (2010). *Plant Physiology and Development*. 6th Edition. Sinauer Associates.

Modes of Evaluation

Components	**Class Assessment (including lab)**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	1	1	1	1	–	–	–	1	–	1
CO2	3	3	2	2	1	1	–	–	–	1	–	1
CO3	2	3	3	3	2	2	1	–	–	2	1	2
CO4	2	3	3	3	2	2	1	1	–	2	1	2
CO5	2	3	3	3	2	2	1	1	–	3	2	3
Average	2.4	2.8	2.4	2.4	1.6	1.6	0.6	0.4	0	1.8	0.8	1.8

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC403	Genomics and Proteomics	L	T	P	C
Version	**V1.2**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Biology and Chemistry at Plus Two Level				
Co-requisites	Fundamentals of Genetics and Protein Biochemistry				

Course Objectives

1. To provide an introduction to genomics and proteomics.
2. To intricately describe various sequencing techniques
3. To introduce the outlines of state-of-the-art big data analysis approaches
4. To provide fundamental hands-on knowledge on structural modelling and visualization.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** the basic concepts and terminology related to genomics and proteomics, including genome sequencing, genome-wide screening, and genome editing.

CO2 : **Understand** the principles and techniques used in genome analysis tools like CHIP-SEQ, RNA-SEQ etc., and proteome analysis tools such as 2D-gel electrophoresis and mass spectrometry for proteomics research.

CO3 : **Apply** knowledge of genomics and proteomics to interpret and analyze data from genome sequencing and proteomics experiments (MS-data).

CO4 : **Analyze** and compare different methods of genome analysis and proteomics techniques for differential proteomics studies.

CO5 : **Evaluate** genome analysis tools and proteomics techniques to investigate biological processes and functions at the molecular level.

Catalogue Description

This course introduces the principles and applications of genomics and proteomics in understanding biological systems. Students will explore genome sequencing, gene expression analysis, and protein structure and function. Emphasis is placed on modern techniques and bioinformatics tools used in molecular biology research.

Course Content

Unit 1 Fundamentals of Genomics 9 hours
Structural organization of genome in Prokaryotes and Eukaryotes; Organelle DNA-mitochondrial, chloroplast; DNA sequencing-principles and translation to large scale projects; Recognition of coding and non-coding sequences and gene annotation; Tools for genome analysis-RFLP, DNA fingerprinting, RAPD, PCR, Linkage and Pedigree analysis-physical and genetic mapping.

Unit 2 Genome Sequencing 9 hours
Microbes, plants and animals; Accessing and retrieving genome project information from web; Comparative genomics, Identification and classification using molecular markers-16S rRNA typing/ sequencing, ESTs and SNPs.

Unit 3 Proteomics basics 9 hours
Protein analysis (includes measurement of concentration, amino-acid composition, N-terminal sequencing); 2-D electrophoresis of proteins; Microscale solution isoelectric focusing; Peptide fingerprinting

Unit 4 Quantitative proteomics 9 hours
LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF; SAGE and Differential display proteomics, Protein-protein interactions. Yeast two hybrid system.

Unit 5 Functional genomics and proteomics 9 hours
Analysis of microarray data; Epigenomics, CHIP-seq, Protein and peptide microarray-based technology; PCR-directed protein *in situ* arrays; Structural proteomics: structure prediction and visualization

Unit 6 Practical 30 hours
1. PCR amplification of 16SrDNA and analysis
2. Demonstration of sequence reads and analysis pipelines
3. SDS PAGE
4. Analysis of Mass-Spec data
5. Protein structural modelling and visualization

Experiential Learning

1. Case study: association study for SNP and genetic disorders
2. Consulting paper on differential and quantitative proteomics

Textbooks

1. Brown, T.A. (2023). *Genomes 5*. Garland Science.
2. Twyman, R.M. (2013). *Principles of Proteomics*. 2nd Edition. Garland Science.

Reference Books

1. Strachan, T. and Read, A. (2011). *Human Molecular Genetics*. 4th Edition. Garland Science/Taylor & Francis Group.
2. Campbell, A.M. and Heyer, L.J. (2007). *Discovering Genomics, Proteomics and Bioinformatics*. 2nd Edition. Benjamin Cummings.

Modes of Evaluation

Components	**Class Assessment (including lab)**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	1	2	1	1	1	1	–	–	–	–
CO2	2	3	3	3	2	2	2	1	1	–	–	–
CO3	2	3	3	3	3	3	3	1	1	–	–	–
CO4	2	3	2	3	3	2	3	1	1	–	–	–
CO5	2	3	2	3	3	3	3	2	1	1	1	1
Average	2.2	2.8	2.2	2.8	2.4	2.2	2.4	1.2	0.8	0.2	0.2	0.2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC411	Research Methodology	L	T	P	C
Version	1.0	**3**	**1**	**0**	**4**
Pre-requisites/Exposure	Basic understanding of biological techniques, statistics, awareness of research and scientific writing.				
Co-requisites	Preliminary awareness of research patterns in industry and academia				

Course Objectives

1. To introduce the fundamental concepts, types, and components of scientific research relevant to biochemistry.
2. To develop skills in research design, data collection methods, sampling techniques, and ethical considerations, including AI ethics.
3. To familiarize students with international research standards such as GLP, GMP, GALP, GDP, and relevant ISO/QCI guidelines.
4. To equip students with knowledge of quality management systems and validation procedures in microbiological and biochemical research.
5. To enhance students' abilities in scientific writing, project planning, reporting, and critically evaluating research literature.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key research concepts, ethical guidelines, and international regulatory standards.

CO2 : **Understand** research methodologies, design strategies, and quality frameworks applicable to biosciences.

CO3 : **Apply** research planning, data analysis, and reporting techniques in microbiological and biochemical contexts.

CO4 : **Analyse** experimental results, literature, and quality systems for strengths, limitations, and compliance.

CO5 : **Evaluate** research proposals and outcomes critically, ensuring ethical conduct and quality assurance in scientific research.

Catalogue Description

This course introduces advanced undergraduate students to the principles and practices of research methodology in microbiology and biochemistry. It covers the fundamentals of scientific inquiry, research design, data collection, and ethical considerations, including AI ethics in life sciences research. The course emphasizes quality management systems, validation processes, and discipline-specific methodologies.

Course Content

Unit 1 Fundamentals of Research and Problem Identification 12 hours

Definition, characteristics, and types (basic, applied, clinical, translational, operational); key components—research question, objectives, hypothesis, methodology, analysis, and interpretation; problem identification through observation, literature gaps, and feasibility; literature review using databases (PubMed, Scopus, Web of Science), keyword search, and reference managers (Mendeley, Zotero); formulation of research questions and hypotheses.

Unit 2 Research Methodologies and Ethical Considerations 12 hours

Selection of study population (target *vs*. accessible), types of variables (independent, dependent, control, confounding), and sampling techniques (random, stratified, cluster, systematic, convenience). Basics of sample size estimation and power analysis. Methods of data collection (observational, experimental, surveys), planning for data analysis, and statistical processing. Ethical considerations include animal ethics, biosafety, data privacy, plagiarism, publication ethics, and ethical approvals. Introduction to AI in research—applications in literature review, data analysis, and modeling, along with ethical issues like bias, transparency, and human oversight.

Unit 3 Research Planning, Fieldwork, and Reporting 12 hours

Work plan design – objectives, timelines (Gantt charts), resource allocation; Fieldwork – experimental protocols, data recording formats, field logs, sample transport and storage; Scientific writing – structure of reports, thesis, manuscripts, and reviews; Introduction to WHO/TDR GLP guidelines; WHO current GMP guidelines; GAMP-5 framework for automated systems in labs; Global Harmonization Task Force (GHTF) guidance on medical devices and IVDs; Laboratory audits – objectives, documentation, inspection process; Relevant ISO and QCI standards.

Unit 4 Good Automated and Distribution Practices 12 hours

Good Automated Laboratory Practices (GALP) – principles, SOPs, compliance requirements; Software evaluation checklist for laboratory systems; ISO and QCI standards in automated research; Good Distribution Practices (GDP) – legal and regulatory framework, WHO and USP GDP guidelines; Stability testing – principles, protocols, and documentation; Supply chain integrity and documentation.

Unit 5 Design and Data Validation in Research 12 hours

Principles of TQM, QbD in assay design, and Six Sigma applications. Validation in microbiological and biochemical research including media, sterility, microbial limits, enzyme assays, and analytical methods. Equipment qualification (DQ, IQ, OQ, PQ) and Validation Master Plan (VMP). Management of OOS and control. Overview of relevant ISO (17025, 15189) and QCI guidelines for biological labs.

Experiential Learning

1. Applications for Patents and Ethical Practices
2. Plagiarism Checks
3. Preparation of Graphical Abstracts
4. Statistical Analyses

Textbooks

1. Kothari, C.R. & Garg, G. (2019). *Research Methodology: Methods and Techniques* (4th Edition). New Age International Publishers.
2. World Health Organization (WHO)(2009). *Good Laboratory Practice (GLP): Quality Practices for Regulated Non-clinical Research and Development*.
3. Sarma, A. & Narahari, M. (2021). *Quality Assurance and Validation in Microbiology and Biochemistry*. Universities Press.
4. NABL India – ISO/IEC 17025 & 15189 Related Documents

Online Resources

1. INFLIBNET e-PG Pathshala: Research Methodology
2. UNESCO – Recommendation on the Ethics of Artificial Intelligence
3. HarvardX – Principles, Statistical and Computational Tools for Reproducible Science
4. OER Commons – Scientific Research Methods

Modes of Evaluation

Components	Class Assessment		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	1	3	2	2	1	1	–	–	–
CO2	2	3	3	3	2	2	2	1	1	–	–	–
CO3	2	3	3	3	2	3	3	1	1	–	–	–
CO4	2	3	2	3	3	3	3	1	1	–	–	–
CO5	2	3	2	3	3	3	3	2	1	1	1	1
Average	2.2	2.8	2.2	2.6	2.6	2.6	2.6	1.2	1.0	0.2	0.2	0.2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

MIB405	Modern Techniques and Bioinstrumentation	L	T	P	C
Version	1.0	**3**	**1**	**0**	**4**
Pre-requisites/Exposure	Basic knowledge of cell biology, biochemistry, and microbiological laboratory practices.				
Co-requisites	None				

Course Objectives

1. To introduce the principles and working of modern analytical and bioanalytical instruments.
2. To enable students to operate and interpret results from key instruments in molecular biology and biochemistry.
3. To train students in quality control and calibration procedures of laboratory instruments.
4. To develop analytical thinking for instrument selection based on experimental needs.
5. To provide practical exposure to chromatography, spectroscopy, electrophoresis, and imaging systems.

Course Outcomes

On completion of the course, the students will be able to

CO1	:	**Recall** the principles of instrumentation used in modern microbiological and biochemical research.
CO2	:	**Understand** working mechanisms, calibration, and maintenance of core laboratory instruments.
CO3	:	**Apply** instrument-based techniques for qualitative and quantitative analysis.
CO4	:	**Analyze** experimental data obtained from spectrophotometric, chromatographic, and electrophoretic techniques.
CO5	:	**Evaluate** appropriate instrumentation for specific research problems in life sciences.

Catalogue Description

This course provides theoretical knowledge and hands-on training in modern laboratory instrumentation, covering optical, electrochemical, chromatographic, and electrophoretic methods, with applications in molecular biology, microbiology, and biochemistry.

Course Content

Unit 1 Introduction to Instrumentation and Safety Practices **6 hours**
Instrument classification, sensitivity, accuracy, precision; Laboratory safety; Calibration and standard operating procedures (SOPs).

Unit 2 Spectroscopic Techniques **14 hours**
Principle and application of UV-Vis, Fluorescence, IR, and Atomic Absorption Spectroscopy, NMR, Circular dichroism, Mass spectrometry; Spectrophotometric assays.

Unit 3 Chromatographic Techniques **12 hours**
Principles and applications of Paper, Thin Layer, Gas, Ion-Exchange, affinity, and High-Performance Liquid Chromatography (HPLC).

Unit 4 Electrophoretic and Blotting Techniques **12 hours**
Agarose and SDS-PAGE; 2D gel electrophoresis; Western blotting and detection systems; Capillary electrophoresis, immunoelectrophoresis.

Unit 5 Centrifugation and Microscopy **8 hours**
Types of centrifuges; Differential and density gradient centrifugation; Bright-field, Fluorescence, Phase contrast, Confocal microscopy.

Unit 6 Molecular and Thermal Techniques **8 hours**
PCR and Real-time PCR; Nanodrop, Gel documentation systems; Calorimetry (DSC/ITC); Biosensors and microfluidics (introductory).

Experiential Learning

1. Use of spectrophotometer for nucleic acid and protein quantification.
2. Chromatographic separation of amino acids or sugars by paper/TLC.
3. SDS-PAGE analysis of protein samples followed by staining and documentation.
4. HPLC or simulated chromatographic run with interpretation of chromatograms (Demonstration/ Research institute visit).

Textbooks

1. Sheehan, D. (2009). *Physical Biochemistry: Principles and Applications*. Wiley-Blackwell.
2. Cotterill, R. (2002). *Biophysics: An Introduction*. Wiley.
3. Pandey, P. (2023). *Text Book on Bioinstrumentation*. Walnut Publication.
4. Baig, S.A. and Sinha, S. (2024). *Bio Instrumentation: Tools and Techniques*. IIP Iterative International Publishers.

Reference Books

1. Lakowicz, J.R. (2006). *Principles of Fluorescence Spectroscopy*. Springer.
2. Chandra, S. and Kumar, G. (2020). *Bio-Instrumentation and Biological Techniques*. P.K. Publisher.
3. Leake, M.C. (2016). *Biophysics: Tools and Techniques*. CRC Press.
4. Karasek, B. (2017). *Biophysics: Tools and Techniques*. NY Research Press.

Modes of Evaluation

Components	**Class Assessment**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	2	3	-	-	-	-	-	-	-	-
CO2	3	3	2	3	2	-	-	-	-	-	-	-
CO3	2	3	3	3	2	2	-	2	1	-	-	-
CO4	2	3	3	3	3	2	2	2	1	-	-	-
CO5	2	3	2	3	3	3	2	2	1	-	-	-
Average	2.4	2.8	2.4	3	2	1.4	0.8	1.2	0.6	-	-	-

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

PDC401	Professional Development Course V	L	T	P	C
Version	**1.0**	**0**	**0**	**1**	**1**
Pre-requisites/Exposure	Completion of Professional Development Course IV				
Co-requisites					

Course Objectives

1. To prepare students with essential skills for effective resume, cover letter writing, and professional communication.
2. To develop aptitude, technical, and interview skills required for campus and competitive placements.
3. To enhance teamwork, group discussion, and personal branding for professional success.
4. To provide industry insights, career guidance, and mock assessments for confident job readiness.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts and principles of professional development.
CO2 : **Understand** the importance of lifelong learning and continuous improvement in a professional context.
CO3 : **Apply** effective communication strategies in professional interactions.
CO4 : **Analyse** personal strengths and weaknesses to create a targeted development plan.
CO5 : **Evaluate** case studies of successful professional development initiatives.

Catalogue Description

This pre-placement training module equips students with essential career skills, including resume and cover letter writing, interview preparation, aptitude and technical practice, and group discussion. It emphasises professional skills, personal branding, industry awareness, and job search strategies, concluding with mock assessments to build confidence for successful career placement.

Course Content

1. Introduction to Pre-Placement Training
2. Resume Building & Cover Letter Writing
3. Interview Skills
4. Aptitude and Technical Skills
5. Group Discussion and Communication Skills
6. Personal Branding and Online Presence
7. Professional Skills
8. Industry Insights and Company Presentations
9. Career Guidance for Competitive Entrance Exams and Job Search Strategies
10. Mock Tests and Assessments

Modes of Evaluation

Components	**Regular Evaluation**	**End Term**
Weightage (%)	**50**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	2	1	2	2	1	1	2	2	1	2	2
CO2	2	3	1	2	3	2	1	2	2	2	1	3
CO3	1	2	2	1	2	2	1	3	2	2	2	2
CO4	2	2	1	2	2	1	2	2	2	1	2	2
CO5	1	2	1	1	3	2	1	2	2	2	1	3
Average	1.60	2.20	1.20	1.60	2.40	1.60	1.20	2.20	2.00	1.60	1.60	2.40

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

MIB406	Biostatistics and Biomathematics	L	T	P	C
Version	**V1.2**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	UG level biology and Mathematics at Plus Two Level				
Co-requisites	Basics of computer application				

Course Objectives

1. To provide students the basic understanding of application of mathematics in Biology.
2. Understanding of matrix and set theory.
3. Providing basic concept of sampling and sampling error.
4. In depth concept of biostatistics.
5. Statistical analysis of experimental and clinical data.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** foundational understanding of calculus and vector algebra in biological context
CO2 : **Understand** mathematical principles in biological model building
CO3 : **Apply** statistical concept to analyze biological data.
CO4 : **Analyse** biological datasets integrating probabilistic models and regression analysis.
CO5 : **Evaluate** hypotheses and testing experimental data implementing such tests.

Catalogue Description

This course covers the fundamental mathematical and statistical methods used in biological research. Topics include probability, data analysis, hypothesis testing, and modeling of biological systems. Students will gain hands-on experience in applying quantitative techniques to real-world biological problems.

Course Content

Unit 1 Power law and calculus **9 hours**

Logarithm and power-law, Graph and functions; Functions and derivatives, differentiation; integration: application in biology and model building. Vector algebra.

Unit 2 Matrices and Set Theory **9 hours**

Matrix and determinant: application in biology; Set theory: application in biology. Simple mathematical modelling.

Unit 3 Sampling and Central tendency **9 hours**

Sampling and sampling errors, distribution, central tendency, deviations, probability. Case study

Unit 4 Probability Distribution **9 hours**

Variables, probability distribution, correlation and regression. Case study

Unit 5 Testing Hypothesis **9 hours**

Hypothesis testing, Chi-square, Student's t-test, ANOVA, test for homogeneity. Monte-Carlo simulation (concept). Case study

Unit 6 Experimentation **30 hours**

Computational Biomathematics and Biostatistics

Experiential Learning

1. Case study: building models for biological processes implementing ODE
2. GraphPad Prism: software
3. Statistical analysis based on R

Textbooks

1. Bluman, A.G. (2024). *Elementary Statistics*. McGraw-Hill.
2. Foster, R. (2003). *Easy Mathematics for Biologists*. Harwood Academic Publishers.

Reference Books

1. Herzog, F., Francis, C., and Clerk, F. (2019). *Understanding Statistics and Experimental Design*. Springer.
2. Yau, S.S.-T., Zhao, X., Tian, K., and Yu, H. (2023). *Mathematical Principles in Bioinformatics*. Springer.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	2	1	1	1	1	–	–	–	–
CO2	2	3	2	3	2	2	2	1	1	–	–	–
CO3	2	3	3	3	2	3	3	1	1	–	–	–
CO4	2	3	2	3	3	3	3	1	1	–	–	–
CO5	2	3	2	3	3	3	3	2	1	1	1	1
Average	2.2	2.8	2.0	2.8	2.2	2.4	2.4	1.2	0.8	0.2	0.2	0.2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC410	Plant and Animal Tissue Culture	L	T	P	C
Version	**1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Knowledge of Basic Plant and Animal Biology				
Co-requisites					

Course Objectives

1. To understand the principles and historical evolution of plant and animal tissue culture.
2. To gain familiarity with media preparation and culture techniques used in plant and animal systems.
3. To apply tissue culture methods in research, agriculture, and medical biotechnology.
4. To evaluate ethical, legal, and safety considerations in tissue culture-based research.
5. To analyze recent innovations, including AI integration and 3D culture systems.

Course Outcomes

On completion of the course, the students will be able to

CO1	:	**Recall** the key concepts of totipotency, plasticity, and the evolution of plant and animal tissue culture
CO2	:	**Understand** different plant and animal tissue culture techniques, media, and contamination control
CO3	:	**Apply** tissue culture techniques in laboratory settings for plant propagation and animal cell maintenance
CO4	:	**Analyse** the implications of tissue culture applications in agriculture, medicine, and biotechnology
CO5	:	**Evaluate** the ethical, regulatory, and technological aspects of advanced tissue culture research and AI integration

Catalogue Description

This course offers a comprehensive introduction to the theoretical foundations and practical techniques of plant and animal tissue culture. Students will explore key principles such as totipotency and plasticity, culture media composition, and methods including callus induction, micropropagation, sub-culturing, and viability assays. The curriculum emphasizes the role of tissue culture in biotechnology, agriculture, and medicine, integrating ethical, legal, and regulatory concerns. Additionally, the course introduces current innovations like organ-on-chip models and AI-based automation. A significant hands-on component ensures experiential learning of aseptic techniques and viability testing. The course prepares students for research and industrial applications in biosciences.

Course Content

Unit 1 Fundamentals of Tissue Culture **8 hours**

History and evolution of tissue culture techniques; Importance and applications in research, agriculture, and medicine; Principles: Totipotency and plasticity; Culture types: Organ, tissue, and single-cell cultures; Basic laboratory requirements: setup, glassware, and safety

Unit 2 Plant Tissue Culture Techniques **12 hours**

Plant culture media: MS, B5, and White's medium – components and preparation; Techniques: Callus culture, organogenesis, somatic embryogenesis; Micropropagation stages: initiation, multiplication, rooting, and acclimatization; Applications: Disease-free plants, conservation, and metabolite production

Unit 3 Animal Tissue Culture Techniques **10 hours**

Introduction to animal cell lines: primary vs. continuous; Media used: RPMI, DMEM, MEM – composition and uses; Techniques: sub-culturing, cryopreservation, cell viability; Contamination sources and control measures

Unit 4 Applications and Ethical Aspects **8 hours**

Tissue culture in genetic engineering: production of transgenic plants/animals; Applications in medicine: monoclonal antibodies, vaccines, stem cells; Tissue culture in toxicology and drug testing; Ethical, legal, and regulatory considerations in tissue culture and genetic manipulation

Unit 5 Integration and Innovation in Tissue Culture **7 hours**

Recent advances: bioreactors, 3D cultures, organ-on-chip models; Role in precision medicine and personalized therapies; Trends in automated tissue culture and AI integration

Unit 6 Experiments in Plant and Animal Tissue Culture **30 hours**

Preparation of MS medium: pH adjustment and autoclaving
Aseptic transfer and inoculation of explants
Callus induction from leaf/nodal explants
Initiation of micropropagation from shoot tips
Preparation of DMEM medium
Demonstration/simulation of animal cell culture under sterile conditions
Trypan blue exclusion assay for viability check
MTT assay to assess cell viability/metabolic activity

Experiential Learning

1. Case-based discussion on ethical issues in stem cell use and GMOs
2. Analysis of cell viability data through dose response curves

Textbooks

1. Plant Tissue Culture: Theory and Practice; *S.S. Bhojwani, M.K. Razdan*; Elsevier.
2. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications; *R. Ian Freshney*; Wiley-Blackwell.
3. Biotechnology: Expanding Horizons; *B.D. Singh*; Kalyani Publishers.

Reference Books

1. Tissue Culture Techniques; *Bernice M. Martin*; 1st Edition, Birkhäuser, 1994.
2. Principles and Practices of Plant Tissue Culture; *U. Satyanarayana*; 1st Edition, Scientific Publishers, 2007.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	2	1	1	1	1	–	–	–	–
CO2	2	3	3	3	2	2	2	1	1	–	–	–
CO3	2	3	3	3	2	3	3	1	1	–	–	–
CO4	2	3	2	3	3	3	3	1	1	1	1	1
CO5	2	3	2	3	3	3	3	2	1	1	1	1
Average	2.2	2.8	2.2	2.8	2.2	2.4	2.4	1.2	1.0	0.4	0.4	0.4

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

MIB408	Biomedical Nanotechnology	L	T	P	C
Version	**2.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Fundamental concepts of Biology and Chemistry				
Co-requisites					

Course Objectives

1. To introduce students to the fundamentals of nanotechnology and various types of nanomaterials.
2. To understand the synthesis and characterization techniques of nanomaterials.
3. To explore the application of nanotechnology in drug delivery and biomedical imaging.
4. To examine the role of nanomaterials in tissue engineering and regenerative medicine.
5. To develop awareness of biosafety, regulatory, and ethical issues in biomedical nanotechnology.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** the concepts, terminology, and types of nanomaterials used in biomedical research.
CO2 : **Understand** the principles behind synthesis, characterization, and functionalization of nanomaterials.
CO3 : **Apply** nanotechnological approaches in drug delivery and imaging.
CO4 : **Analyze** the potential of nanomaterials in tissue engineering and regenerative medicine.
CO5 : **Evaluate** the ethical and safety aspects associated with nanomaterial use in biomedicine.

Catalogue Description

This course offers a comprehensive overview of biomedical nanotechnology, covering synthesis and applications of nanomaterials in drug delivery, tissue engineering, diagnostics, and their societal and ethical implications. Practical components include synthesis, characterization, and bio-nano interaction analysis.

Course Content

Unit 1 Introduction to Nanotechnology and Nanomaterials 9 hours
Definition and scale of nanotechnology, Historical overview and key milestones, Interdisciplinary nature and applications in biomedicine, Introduction to nanomaterials (metals, polymers, carbon-based, piezoelectric crystals, etc.)

Unit 2 Synthesis and Characterization of Nanomaterials 9 hours
Fabrication methods (top-down and bottom-up approaches), Characterization techniques (microscopy, spectroscopy, etc.)

Unit 3 Applications of nanotechnology in medicine 9 hours
Challenges in conventional drug delivery systems, Nanoparticles and nanocarriers for targeted drug delivery, Controlled release systems, Imaging techniques at the nanoscale (fluorescence, magnetic resonance, etc.)

Unit 4 Nanotechnology in Tissue Engineering and Regenerative Medicine 9 hours
Biomaterials for tissue engineering, Scaffold design and fabrication techniques, Application of nanotechnology in organ regeneration, Integration of nanomaterials and microfluidics

Unit 5 Safety and Ethical Considerations in Biomedical Nanotechnology 9 hours
Toxicity and risk assessment of nanomaterials, Regulatory frameworks and guidelines, Societal and ethical implications

Unit 6 List of practicals 30 hours
1. Synthesis of metallic nanoparticles (e.g., gold, silver) using chemical reduction methods or green synthesis approaches.
2. Characterization of nanoparticles using UV-Vis spectroscopy.
3. Investigation of nanoparticle-biomolecule interactions using fluorescence spectroscopy.
4. Case studies exploring real-world applications of nanobiotechnology and their implications for healthcare, environment, and society.

Experiential Learning

1. Organize a visit to a research laboratory to observe advanced instruments such as SEM, TEM, and DLS, and gain exposure to their working principles and applications in nanomaterial characterization.
2. Preparation of an SOP for Nanomaterial Handling.
3. Evaluate a published clinical trial or product using nanocarriers.

Textbooks

1. C.M. Niemeyer & C.A. Mirkin (2007). *Nanobiotechnology II: More Concepts and Applications*, Wiley-VCH.
2. Rajesh Singh Tomar, Anurag Jyoti, Shuchi Kaushik (2020). Nanobiotechnology: Concepts and Applications in Health, Agriculture and Environment, Apple Academic Press.
3. R.S. Khandpur (2004). *Biomedical Instrumentation: Technology and Applications*, McGraw Hill
4. Tuan Vo-Dinh (2019). *Nanotechnology in Biology and Medicine*, CRC Press.

Reference Books

1. Ajeet Kaushik, Sesha S. Srinivasan, Yogendra Kumar Mishra (2023). Analytical Techniques for Biomedical Nanotechnology, IOP.
2. Prasad, P.N (2012). *Introduction to Nanomedicine and Nanobioengineering*, Wiley.
3. Cassandra Callmann (2025). Biomedical Nanotechnology, Humana Pr Inc.
4. Sarah Hurst Petrosko, Emily S. Day (2017). Biomedical Nanotechnology: Methods and Protocols, Humana Press.

Modes of Evaluation

Components	**Class Assessment**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	1	2	1	1	1	1	–	–	–	–
CO2	2	3	3	3	2	2	2	1	1	–	–	–
CO3	2	3	3	3	2	3	3	1	1	–	–	–
CO4	2	3	2	3	3	3	3	1	1	1	1	1
CO5	2	3	2	3	3	3	3	2	1	1	1	1
Average	2.2	2.8	2.2	2.8	2.2	2.4	2.4	1.2	1.0	0.4	0.4	0.4

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC409	Dissertation on Biochemistry	L	T	P	C
Version	**2.0**	**0**	**0**	**12**	**12**
Pre-requisites/Exposure	Knowledge of Biochemistry and allied subjects at UG level				
Co-requisites					

Course Objectives

1. Enable students to independently plan, design, and execute a research project in biochemistry.
2. Train students in laboratory techniques, experimental design, data collection, and data analysis.
3. Develop competency in scientific literature survey, critical evaluation of published work, and identification of research gaps.
4. Enhance skills in scientific writing through preparation of a dissertation report meeting academic standards.
5. Strengthen oral communication skills through presentation and defence of research findings.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** fundamental and advanced biochemical concepts relevant to their research topic.
CO2 : **Understand** research methodologies, experimental workflows, and scientific literature in the chosen research area.
CO3 : **Apply** biochemical techniques, analytical tools, and statistical methods to generate and interpret research data.
CO4 : **Analyse** experimental results, troubleshoot protocols, and derive meaningful scientific interpretations.
CO5 : **Evaluate** the significance, limitations, and future directions of their research based on evidence and scientific rigor.

Catalogue Description

This course provides final-year undergraduate students with hands-on research experience in Biochemistry through a full-semester dissertation project. Students work on a problem of current relevance in physiology, genetics, biotechnology, immunology, environmental biochemistry, bioinformatics, or any allied domain. The course integrates laboratory experimentation (wet lab and/or dry lab), literature review, data analysis, and scientific writing. Students are required to prepare a comprehensive dissertation report and present their findings through an oral defense.

The course aims to develop research aptitude, analytical thinking, technical competence, and scientific communication skills essential for careers in research and industry.

Modes of Evaluation

Components	Thesis	End Term
Weightage (%)	50	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	1	3	3	3	3	3	-	-	3
CO2	3	3	3	1	3	3	3	3	3	-	-	3
CO3	3	3	3	1	3	3	3	3	3	-	-	3
CO4	3	3	3	1	3	3	3	3	3	-	-	3
CO5	3	3	3	1	3	3	3	3	3	-	-	3
Average	3	3	3	1	3	3	3	3	3	-	-	3

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

Syllabi of Multi-disciplinary Courses offered by the Department of Biological Sciences

Semester	Course Code	Course Title	Contact Hours per Week			Credit
			L	T	P	
I	MIB105	Sustainable Energy Solutions	2	0	1	3
II	BIC110	Chemical and Biocatalysis	2	0	1	3
III	MIB203	Biomaterial Sciences	2	0	1	3

MIB105	Sustainable Energy Solutions	L	T	P	C
Version	**1.0**	**2**	**0**	**1**	**3**
Pre-requisites/Exposure	Basic knowledge of Biology at Puls Two Level				
Co-requisites					

Course Objectives

1. To introduce students to the concepts, classification, and importance of renewable and sustainable energy resources in the context of global and national energy demand.
2. To explain the scientific principles, working mechanisms, advantages, and limitations of major renewable energy systems such as solar, wind, geothermal, and ocean energy.
3. To explore microbial and biochemical processes for bioenergy production, including biofuels, biogas, and waste-to-energy conversion technologies.
4. To familiarise students with emerging trends, policies, and global frameworks such as the Sustainable Development Goals (SDGs) for achieving carbon neutrality and sustainability.
5. To develop practical skills through laboratory experiments and projects for designing, evaluating, and prototyping renewable energy generation models.

Course Outcomes

On completion of the course, the students will be able to

CO1	:	**Recall** different types of renewable and sustainable energy resources
CO2	:	**Understand** the principles and working mechanisms of renewable energy systems
CO3	:	**Apply** sustainability, efficiency, and environmental impacts of different energy systems
CO4	:	**Analyse** microbial and biochemical approaches in biofuel and biogas production
CO5	:	**Evaluate** and design eco-friendly bio-based energy models through case studies or projects

Catalogue Description

This course provides a comprehensive overview of renewable and sustainable energy resources, highlighting their principles, technologies, and environmental significance. Topics include solar, wind, geothermal, and ocean energy systems, bioenergy production, and waste-to-energy technologies. Students will explore microbial and biochemical approaches for biofuel generation, government policies, and the role of emerging trends such as green hydrogen and AI in energy modeling. The course integrates the United Nations Sustainable Development Goals (SDGs) and concepts of the circular economy. Hands-on laboratory exercises and prototype development projects enable learners to design, evaluate, and apply eco-friendly energy solutions for a sustainable future.

Course Content

Unit 1 Introduction to Renewable Energy 5 hours

Energy demand *vs*. supply, conventional *vs*. non-conventional sources, principles of sustainability, India's renewable energy potential

Unit 2 Solar, Wind Energy and other renewable energy resources 8 hours

Solar radiation principles, photovoltaic systems, solar thermal systems, wind energy conversion systems, advantages and limitations; Introduction, advantages and disadvantages of geothermal energy over other energy forms; Sources of geothermal energy, characteristics of geothermal energy

Unit 3 Bioenergy and Biogas 5 hours

Biomass conversion, anaerobic digestion, microbial roles in biogas production, biodiesel from algal/lipid sources, bioethanol and biobutanol

Unit 4 Waste to Energy Technologies and Emerging Trends & Policies 7 hours

Conversion of agricultural, municipal and industrial wastes, microbial fuel cells, composting and vermicomposting techniques; Green hydrogen, geothermal, ocean thermal energy, government policies (MNRE, SDGs), carbon neutrality, role of AI in energy modeling

Unit 5 Sustainable Development Goals (SDG) 5 hours

Concept of Sustainable Development – Requirements for Sustainable Development – Concept of Linear and Circular Economy – Disadvantages of Linear Economy and hazards to the environment – Shifting from linear to circular economy – Circular economy (CE) leads to Sustainable Development - Sustainable Development Goals (SDG) by UN, 2015 – Bioconversion by microorganisms - Contribution of microbes to CE/SDG – Role of microorganisms in fulfilling goals 2, 3, 6, 7, 9, 12-15.

Unit 6 Experiments and Lab Exercises 30 hours

Estimation of total solids and volatile solids in organic waste
Ethanol production from biomass feedstock
Biogas production from microorganism by dark fermentation
Biodiesel production from algal biomass'
Isolation of lipid-producing algae or yeast from environmental samples
Prototype development and model presentation of any renewable energy generation

Experiential Learning

1. Visit to local Renewable Energy Park or Biogas Plant
2. Group project: Design a small-scale sustainable energy model
3. Policy-making on renewable energy implementation
4. Awareness campaign: "Green Energy for Clean Future"
5. Case study analysis: Bioenergy success stories (India/global) -Seminar/Workshop

Textbooks

1. Rai, G.D. (1988). *Non-Conventional Energy Resources*. Khanna Publishers.
2. Boyle, Godfrey (2012). *Renewable Energy: Power for a Sustainable Future*. Oxford University Press.
3. Khanal, Samir Kumar (2010). *Bioenergy and Biofuel from Biowastes and Biomass*. ASCE Library.

Supplementary Resources

1. Ministry of New and Renewable Energy (MNRE) Reports – https://mnre.gov.in
2. NPTEL Course - *Renewable Energy Engineering: Solar, Wind And Biomass Energy Systems*
3. UN SDG 7 documentation (https://sdgs.un.org/goals/goal7)

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	1	1	1	1	1	1	3	2	3
CO2	3	3	2	2	1	1	1	1	2	3	2	3
CO3	2	3	3	2	2	2	2	1	2	3	2	3
CO4	3	3	3	3	3	3	2	1	2	3	2	3
CO5	2	3	3	3	3	3	3	2	3	3	2	3
Average	2.6	2.8	2.6	2.2	2.0	2.0	1.8	1.2	2.0	3.0	2.0	3.0

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC110	Chemical and Biocatalysis	L	T	P	C
Version	**1.0**	**2**	**0**	**1**	**3**
Pre-requisites/Exposure	Biology at Plus Two Level				
Co-requisites	Amino acid structure and function				

Course Objectives

1. To comprehend the chemical and biocatalyst using the fundamentals of their catalysed reactions.
2. To understand the kinetics of enzyme activity.
3. To identify the patterns of enzyme inhibition
4. To comprehend the idea of the enzymes' active site structures, their modes of action, and their therapeutic uses.
5. To gain knowledge on the control of enzyme activity

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** classification of the enzymes according to the basis of their catalysed reactions.
CO2 : **Understand** the kinetic behaviour of enzymes.
CO3 : **Apply** the concept and determine different patterns of inhibitions of enzyme activity.
CO4 : **Analyse** the structures of active site of the enzymes, mechanisms of action and their clinical application.
CO5 : **Evaluate** the principles underlying regulation of enzyme activity.

Catalogue Description

This course provides a comprehensive understanding of enzyme biocatalysis, combining theoretical concepts with laboratory applications. Beginning with the fundamentals of chemical kinetics, catalysis, and enzyme structure–function relationships, it explores Michaelis–Menten kinetics, enzyme inhibition, and regulatory mechanisms such as allosteric control and covalent modifications. Detailed discussion of catalytic strategies, including acid–base and covalent catalysis, highlights the molecular basis of enzyme function. Modern experimental tools like spectroscopy and crystallography are introduced for mechanistic studies. Practical sessions reinforce concepts through enzyme assays, kinetic parameter estimation, and effects of pH and temperature. Applications span diagnostics, therapeutics, industry, biosensors, and protein engineering.

Course Content

Unit 1 Introduction to Chemical Kinetics and Catalysis 8 hours
Chemical kinetics, order and molecularity of reaction, collision theory and transition state theory, Definition of catalysis, biocatalyst, historical perspective, enzyme classification and nomenclature, structure and function of enzymes.

Unit 2 Kinetics of Enzyme Biocatalysis 10 hours
Chemical kinetics basics, Michaelis-Menten kinetics, derivation and assumptions, Lineweaver-Burk plot, types of enzyme assays.

Unit 3 Enzyme Inhibition 10 hours
Competitive, non-competitive, uncompetitive and mixed inhibition; irreversible inhibition; kinetics of inhibition.

Unit 4 Enzyme Regulation 10 hours
Allosteric regulation, covalent modifications, feedback inhibition, zymogens.

Unit 5 Mechanisms of Enzyme Catalysis and Applications of Enzymes 7 hours
Acid-base catalysis, covalent catalysis, metal ion catalysis, proximity and orientation effects, transition state stabilization. Use of X-ray crystallography, NMR, spectroscopy, isotope labelling to established reaction mechanism, Use of enzymes in diagnostics, therapy, industrial catalysis, biosensors, and protein engineering.

Unit 6 Lab Experiments on Biocatalysis 30 hours
Hydrogen peroxide decomposition using different catalysts
Enzyme activity assays of Alkaline phosphatase using pNPP
Determination of effect of pH on enzymatic activity
Determination of effect of temperature on enzymatic activity
Determination of K_M and V_{max} for Alkaline phosphatase

Experiential Learning

1. Industrial Case Study: Biocatalysis in Pharma
2. Biocatalysis in Green Chemistry: review writing
3. Project-Based Learning: Design a Biocatalytic Process
4. Enzyme Immobilization Workshop

Textbooks

1. **Lehninger, A.L., Nelson, D.L. & Cox, M.M. (2017).** *Lehninger Principles of Biochemistry*, W.H. Freeman and Company.
2. **Voet, D. & Voet, J.G. (2010).** *Biochemistry*, John Wiley & Sons.

3. Palmer, T. and Bonner, P. (2007). *Enzymes: Biochemistry, Biotechnology, Clinical Chemistry*. 2nd Edition. Horwood Publishing.

Reference Books

1. **Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. & Weil, P.A. (2018).** *Harper's Illustrated Biochemistry*, McGraw Hill Education.
2. **Satyanarayana, U. & Chakrapani, U. (2020).** *Biochemistry*, Elsevier India.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	1	1	-	-	-	-	-	-	-
CO2	2	3	2	2	1	-	-	-	-	-	-	-
CO3	1	2	3	2	2	1	-	-	1	-	-	-
CO4	1	2	2	3	2	2	1	-	-	1	-	-
CO5	1	2	2	3	2	2	1	-	-	1	-	-
Average	1.6	2.2	2.0	2.2	1.6	1.0	0.4	-	0.2	0.4	-	-

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

MIB203	Biomaterial Sciences	L	T	P	C
Version	**1.2**	**2**	**0**	**1**	**3**
Pre-requisites/Exposure	Knowledge of Biology and Chemistry at Plus Two Level				
Co-requisites					

Course Objectives

1. Introduce the fundamentals of biomaterials, their classification, and properties.
2. Explore the interaction between biomaterials and biological systems.
3. Discuss applications of biomaterials in microbiology, medicine, and biotechnology.
4. Promote interdisciplinary knowledge integrating materials science, microbiology, and engineering.
5. Enhance practical skills and problem-solving abilities related to biomedical materials.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** the definitions, classifications, and types of biomaterials.
CO2 : **Understand** the physicochemical and biological properties of biomaterials.
CO3 : **Apply** knowledge of microbiology to assess microbial interactions with biomaterials.
CO4 : **Analyze** the biocompatibility and degradation mechanisms of various biomaterials.
CO5 : **Evaluate** the design, function, and ethical issues in biomedical and microbial applications.

Catalogue Description

This course introduces the principles, properties, and applications of biomaterials, highlighting their multidisciplinary scope. Students will learn about the classification of natural and synthetic biomaterials, microbial interactions, sterilization, and strategies to control biofilm formation. The course explores biocompatibility, host responses, and biodegradation, with emphasis on regulatory considerations. Applications in drug delivery, tissue engineering, biosensors, and antimicrobial materials are critically discussed. Emerging trends such as smart biomaterials, nanotechnology, 3D bioprinting, and vaccine delivery are included. Practical sessions involve fabrication, characterization, and testing of biomaterials, culminating in a mini-project to design biodegradable, application-oriented products.

Course Content

Unit 1 Fundamentals of Biomaterials **6 hours**
Definition and scope of biomaterials, Historical development and multidisciplinary nature, Classification: natural vs synthetic; polymers, ceramics, metals, composites, Properties of biomaterials: mechanical, thermal, chemical

Unit 2 Microbial Interactions with Biomaterials **6 hours**
Microbial biofilms and material colonization, Antimicrobial surfaces and coatings, Sterilization techniques for biomaterials, Case studies: implants and microbial infections

Unit 3 Biocompatibility and Degradation **6 hours**
Biocompatibility: concepts and evaluation techniques, Host responses: inflammation, toxicity, immunogenicity, Biodegradation and resorption in polymers and natural materials, Regulatory considerations (ISO, FDA basics)

Unit 4 Applications of Biomaterials in Microbiology and Medicine **6 hours**
Drug delivery systems (e.g., nanoparticles, hydrogels), Tissue engineering scaffolds, Biosensors and diagnostic devices, Antimicrobial peptides, silver-based biomaterials

Unit 5 Emerging Trends and Ethical Considerations **6 hours**
Smart biomaterials, 3D bioprinting, nanomaterials, Biomaterials in vaccine delivery and microbiome modulation, Sustainability and green biomaterials, Ethics and societal impact of biomaterials in healthcare

Unit 6 **Experiments in Biomaterials Sciences** **15 hours**
Material fabrication - Hands-on: Preparation of agarose and gelatin-based biomaterials
Characterization of biomaterials: morphology, stability, solubility, degradability.
Demonstration: Biofilm formation on material surfaces
Mini project: Design a biodegradable material-based product

Experiential Learning

1. Field Visit and/or Lab Visits
2. Flip Classrooms and group presentation and Quiz
3. Case study analysis on implant infection

Textbooks

1. Park, J., & Lakes, R. S. (2007). *Biomaterials: An Introduction* (3rd ed.). Springer.
2. Ratner, B. D., Hoffman, A. S., Schoen, F. J., & Lemons, J. E. (2013). *Biomaterials Science: An Introduction to Materials in Medicine* (3rd ed.). Academic Press.
3. Rosenberg, E. (1992). *Microbiology and Biomaterials*. Academic Press.

Reference Books

1. Williams, D. F. (2019). *Biomaterials in Clinical Practice*. Springer.
2. Bronzino, J. D. (Ed.). (2000). *The Biomedical Engineering Handbook*. CRC Press.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	1	1	1	1	1	1	1	1	1
CO2	2	3	2	2	2	1	1	1	1	1	1	1
CO3	1	2	3	2	2	1	1	1	1	1	1	1
CO4	1	2	2	3	2	1	1	1	1	1	1	1
CO5	1	1	2	2	3	1	1	1	1	1	1	1
Average	1.6	2	2	2	2	1	1	1	1	1	1	1

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

Syllabi of Minor Courses offered by the Department of Biological Sciences

Semester	Course Code	Course Title	Contact Hours per Week			Credit
			L	T	P	
I	IKS101	Introduction to IKS	4	0	0	4
II	GEN104	Basic Cyber Security and Internet of Things	4	0	0	4
III	BIC253	Introduction to Biomolecules and Metabolism	2	1	1	4
IV	MIB254	Introduction to Cell and Molecular Biology	2	1	1	4
V	MIB353	Basics of Microbiology	2	1	1	4
VI	BIC352	Basics of Nutrition and Toxicology	2	1	1	4
VII	MIB453	Fundamentals of Recombinant DNA Technology	2	1	1	4
VIII	MIB452	Fundamentals of Nanobiotechnology	2	1	1	4
	BIC453	Drug Design and Development	2	1	1	4

Course Code	Basic Cyber Security and Internet of Things (IoT)	L	T	P	C
Pre-requisite	Basic Computer Applications and Internet	4	0	0	4
Co-requisite	None	Contact Hours: 60			

Course Objectives:

- To introduce students to the concepts of cyberspace, cyber security, and digital technologies used in everyday life.
- To develop awareness regarding cyber threats, cybercrime, and safe digital practices.
- To familiarize students with cyber ethics, privacy concerns, and basic cyber laws.
- To introduce the fundamentals, architecture, and applications of the Internet of Things (IoT).
- To understand security, privacy, and ethical concerns in smart connected environments.

Course Outcomes (COs):

On completion of this course, the student will be able to:

- **CO1**. Understand the concepts of cyberspace, digital assets, and cyber security fundamentals.
- **CO2**. Identify common cyber threats, cybercrimes, and appropriate preventive measures for safe digital usage.
- **CO3**. Demonstrate awareness regarding cyber ethics, responsible digital citizenship, privacy, and cyber laws.
- **CO4**. Explain the architecture, components, communication technologies, and working principles of IoT systems.

- **CO5**. Identify real-world applications of IoT across different sectors and smart environments.
- **CO6**. Understand security, privacy, and ethical concerns associated with IoT-enabled systems and emerging digital technologies.

Course Description:

The rapid expansion of digital technologies has transformed communication, education, healthcare, commerce, entertainment, and governance. Alongside these advancements, cyber threats and privacy concerns have emerged as critical challenges for individuals and organizations. Simultaneously, the Internet of Things (IoT) has enabled interconnected smart devices and intelligent systems that are reshaping modern lifestyles and industries.

This course introduces undergraduate students from all disciplines to the fundamentals of cyber security and IoT in a simple and learner-friendly manner. The course emphasizes cyber awareness, safe digital practices, responsible use of technology, ethical and legal aspects of cyberspace, and the principles and applications of IoT. Students will explore smart devices, sensors, communication technologies, and real-life applications of IoT in homes, healthcare, transportation, agriculture, and smart cities. The course is designed to develop informed, digitally aware, and responsible citizens capable of safely navigating an increasingly connected world..

Course Content:

Unit I: Digital World and Cyber Security Foundations	**12 Lecture Hours**
Digital Society and Emerging Technologies, Cyberspace, Digital Identity, Digital Footprints Data, Information, and Digital Assets, Fundamentals and Need for Cyber Security, CIA Principles (Confidentiality, Integrity, Availability), Common Cyber Threats and Cyber Risks, Cyber Awareness and Safe Digital Behaviour	
Unit II: Cyber Threats, Cybercrime and Safe Practices	**12 Lecture Hours**
Malware: Virus, Worm, Trojan, Spyware, Ransomware, Phishing, Smishing, Vishing, Online Fraud and Scams, Password Security and Multi-Factor Authentication (MFA), Social Engineering Attacks and Identity Theft, Social Media Security and Privacy Settings, Email, Mobile Device and Public Wi-Fi Safety, Safe Online Shopping and Digital Payment Security (UPI Safety), Cyber Hygiene and Best Practices	

Unit III: Cyber Ethics, Privacy and Cyber Laws	12 Lecture Hours
Cyber Ethics and Responsible Technology Use, Digital Citizenship and Online Behaviour, Privacy, Personal Data Protection and Digital Rights, Intellectual Property Rights (IPR), Copyright and Plagiarism, Information Technology Act, 2000 (Basic Overview), Cybercrime Reporting Mechanisms in India, Ethical Use of Artificial Intelligence Tools, Misinformation, Fake News and Deepfakes	
Unit IV: Fundamentals of Internet of Things (IoT)	**12 Lecture Hours**
Introduction and Evolution of IoT, Smart Devices, Sensors and Actuators, IoT Ecosystem and Architecture (Basic Concepts), Data Collection, Communication and Connectivity, IoT Communication Technologies: Wi-Fi, Bluetooth, RFID, NFC Cloud and Edge Computing in IoT (Basic Concepts), Benefits and Challenges of IoT	
Unit-V: IoT Applications, Security and Future Trends	**12 Lecture Hours**
Smart Homes and Smart Cities, Smart Healthcare and Wearables, Smart Agriculture and Transportation, Industrial IoT (Basic Concepts), Environmental Monitoring Systems IoT Security Risks and Privacy Issues, Safe Practices for Smart Devices, Artificial Intelligence and IoT (AIoT): Future Trends: Digital Twins, Industry 5.0, Sustainable Smart Technologies	
Suggested Practical/Activity (Optional for NEP Minor Course)	
1. Phishing email identification 2. Cybercrime case analysis 3. Social media privacy audit 4. Digital footprint assessment 5. IoT device survey at home/campus 6. Awareness poster/video creation 7. Group presentation on Smart City/Healthcare/Agriculture	

8.	Mini project/report on cyber safety or IoT impact

Textbooks:

1. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India.
2. Arshdeep Bahga & Vijay Madisetti, Internet of Things: A Hands-on Approach, Universities Press.
3. Charles J. Brooks et al., Cyber Security Essentials.

Reference Books:

1. Michael Miller, The Internet of Things.
2. Rajkumar Buyya and Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms.
3. William Stallings, Cryptography and Network Security, Pearson.
4. Pethuru Raj and Anupama Raman, The Internet of Things: Enabling Technologies, Platforms and Use Cases.

BIC 253	Introduction to Biomolecules and Metabolism	L	T	P	C
Version	**1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Basic knowledge of Biology and Chemistry at Higher Secondary level.				
Co-requisites	Fundamentals of Cell Biology and Biochemistry Laboratory.				

Course Objectives

1.	To introduce the structure, properties, and biological significance of biomolecules.
2.	To explain the organization and functions of carbohydrates, proteins, lipids, and nucleic acids.
3.	To provide fundamental knowledge of enzymology and metabolic pathways.
4.	To develop understanding of bioenergetics and regulation of metabolism.
5.	To impart basic laboratory skills related to qualitative analysis of biomolecules

Course Outcomes

On completion of the course, the students will be able to

CO1	:	Recall the structure, classification, and functions of biomolecules.
CO2	:	Understand the principles of enzymatic reactions and metabolic pathways.
CO3	:	Apply biochemical concepts in qualitative analysis of biomolecules.
CO4	:	Analyse metabolic interrelationships and energy production mechanisms.
CO5	:	Evaluate the significance of metabolism in normal physiological processes and diseases.

Catalogue Description

This course introduces the fundamental biomolecules of living systems including carbohydrates, proteins, lipids, nucleic acids, vitamins, and enzymes. It also covers the basics of metabolism, bioenergetics, and major metabolic pathways. Laboratory exercises provide practical exposure to qualitative analysis of biomolecules and enzyme activity.**Course Content**

Unit 1	Biomolecules and Carbohydrates	**10hours**
Introduction to biomolecules; chemical bonds and properties of water; classification and functions of carbohydrates; monosaccharides, disaccharides, polysaccharides; reducing and non-reducing sugars; biological significance of carbohydrates.		
Unit 2	Proteins and Amino Acids	**10hours**

Structure and classification of amino acids; peptide bond; levels of protein structure; fibrous and globular proteins; protein denaturation; biological functions of proteins; introduction to protein purification techniques.		
Unit 3	Lipids and Nucleic Acids	**10hours**
Classification and properties of lipids; fatty acids, triglycerides, phospholipids, steroids; biological membranes; structure and functions of DNA and RNA; nucleotides and nucleosides; central dogma of molecular biology.		
Unit 4	Enzymes and Bioenergetics	**10hours**
Introduction to enzymes; classification and nomenclature; mechanism of enzyme action; factors affecting enzyme activity; enzyme inhibition; coenzymes and cofactors; ATP and high-energy compounds; laws of thermodynamics and bioenergetics.		
Unit 5	Metabolism	**10hours**
Overview of metabolism; catabolism and anabolism; glycolysis; TCA cycle; electron transport chain; oxidative phosphorylation; glycogen metabolism; lipid metabolism; protein metabolism; metabolic regulation.		
Unit 6	**Lab Exercises**	**30 hours**
1. Identification tests for carbohydrates. 2. Identification tests for proteins and amino acids. 3. Identification tests for lipids. 4. Estimation of reducing sugars by Benedict's method. 5. Effect of pH and temperature on enzyme activity. 6. Preparation of standard solutions and buffers. 7. Separation of amino acids by paper chromatography. 8. Determination of saponification value of fats/oils. 9. Study of enzymatic hydrolysis of starch. **10.** Laboratory record submission and viva voce.		

Experiential Learning

1.	Hands-on laboratory experiments on biomolecule identification
2.	Preparation and analysis of metabolic pathway charts/models
3.	Group seminar on metabolic disorders and biochemical diseases
4.	Mini-project on nutritional biochemistry and metabolism.

Textbooks

1.	Lehninger Principles of Biochemistry by Nelson and Cox.
2.	Fundamentals of Biochemistry by Voet, Voet and Pratt.
3.	Biochemistry by U. Satyanarayana and U. Chakrapani.
4.	Harper's Illustrated Biochemistry by Rodwell et al

Reference Books

1.	Biochemistry by Lubert Stryer.
2.	Textbook of Biochemistry by D.M. Vasudevan
3.	Principles of Biochemistry by Jeffory Zubay.
4.	Outlines of Biochemistry by Conn and Stumpf.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	3	2	2	1	1	1	1	1	1	1	1
CO2	2	3	2	2	1	1	1	1	1	1	1	1
CO3	2	2	3	3	2	1	1	1	1	1	1	1
CO4	2	2	2	3	3	2	1	1	1	1	1	1
CO5	1	2	2	2	3	3	2	1	1	1	1	1
Average	2	2.2	2.2	2.2	2	1.6	1.2	1	1	1	1	1

1	:	Weakly mapped
2	:	Moderately mapped
3	:	Strongly mapped

Code MIB254	Introduction to Cell and Molecular Biology	L	T	P	C
Version	2.0	2	1	1	4
Pre-requisites/Exposure	Basic Knowledge in biology				
Co-requisites					

Course Objectives

1.	Explain cellular architecture, membrane transport, and the chemical basis of molecular recognition.
2.	Analyze energy metabolism, enzyme regulation, and the complete pathway of cellular respiration.
3.	Describe and compare DNA replication, transcription, translation, and predict the effects of mutations on protein structure.
4.	Compare prokaryotic (Lac operon) and eukaryotic (epigenetic/transcription factor) gene regulation mechanisms.
5.	Interpret basic molecular biology laboratory techniques.

Course Outcomes

On completion of the course, the students will be able to

CO1	:	Classify cellular architecture and membrane transport mechanisms in prokaryotes and eukaryotes.
CO2	:	Analyze enzyme kinetics, inhibition, and the complete pathway of cellular respiration.
CO3	:	Apply the knowledge of the central dogma and predict mutation effects on protein function
CO4	:	Differentiate and evaluate prokaryotic vs. eukaryotic gene regulation strategies.
CO5	:	Execute fundamental molecular biology lab techniques and interpret mutagenesis data.

Catalogue Description

The course is a fundamental course to develop knowledge about the genetic and cellular aspect of life forms. It discusses the aspects of cell structure, cell cycle and genetic make up of a cell.

Course Content

Unit 1: The Fundamental Unit of Life	**The Chemical Context of Life: Weak interactions (Hydrogen bonds, Van der Waals) and their role in molecular recognition. Properties of water. Carbon & Macromolecules: Monomers and Polymers: Carbohydrates, Lipids, Proteins, Nucleic Acids. Microscopy & Cell Theory: Resolution vs. Magnification (Light, Fluorescence, Electron, Cryo-EM). Prokaryotic vs. Eukaryotic architecture. Passive/Active transport, Endocytosis/Exocytosis.**	**10 hours**
Unit 2: Cellular Energy & Metabolism	**Thermodynamics in the Cell:Endergonic vs. Exergonic reactions; The role of ATP. Enzymes: Energy of activation, Active site, Induced fit model. Regulation: Inhibition (Competitive/Non-competitive) and Allostery.Cellular Respiration (Complete breakdown of Glucose):**	**10 hours**
Unit 3: The Central Dogma – DNA to Protein	**History & Structure of DNA: Griffith, Avery, Hershey-Chase, Chargaff, Franklin, Watson & Crick. DNA Replication: Semiconservative model (Meselson-Stahl). Machinery: Helicase, Polymerase, Primase, Ligase; Leading vs. Lagging strand. Transcription (DNA → RNA): RNA Polymerase, Promoters, Introns/Exons (Splicing). Translation, The Genetic Code & Mutations.**	**10hours**
Unit 4: Regulation & The Internal Environment	**Gene Regulation: Prokaryotic: The Lac Operon (Inducible system).** **Eukaryotic: Transcription factors, Enhancers, Epigenetics (Histone acetylation/DNA methylation).**	**10 hours**

Unit 5: Cell Cycle, Death & Cancer	**The Cell Cycle, Mitosis, Checkpoints (G1/S, G2/M, Spindle assembly). Cancer Biology: Oncogenes vs. Tumor Suppressor genes (Ras, p53). Hallmarks of Cancer, Cell Death: Apoptosis (Programmed, Caspase cascade) vs. Necrosis (Accidental).**	**5 hours**
Unit 6 Hands on	**Development of Replica and Master plate. Understanding the effect of mutagens (UV and HNO2) on bacterial cells. Observation of the survival curve of bacteria post UV exposure. Plasmid DNA isolation from *E.coli.* Plasmid DNA observation through Agarose Gel Electrophoresis. Study of Bacterial transformation, conjugation and transduction. AMES test.**	**15 hours**

Experiential Learning

1.	**Case-Based Learning (CBL) on UV-induced mutations and defective DNA repair (e.g., Xeroderma pigmentosum). Students propose genetic mechanisms and design rescue experiments.**
2.	**Assign students roles as researchers working in early microbial genetics (Griffith, Avery, Lederberg). Debate the nature of gene transfer mechanisms and argue from experimental data.**
3.	**Students write a mini research proposal on: Cyanide poisoning and the ETC.**
4.	**Case Study: CFTR gene and Cystic Fibrosis.**

Textbooks

1.	***Essential Cell Biology by Alberts et al.***
2.	***Cell and Molecular Biology: Concepts and Experiments by Gerald Karp.***

Reference Books

1.	***Genes XII (or Genes XI)*** **by Benjamin Lewin**
2.	**Brock Biology of Microorganisms by Madigan, Bender, Buckley, Sattley, and Stahl**

Modes of Evaluation

Components	**Class Assessment (including lab)**				**End Term**
	Experiential Learning	**Quiz, etc.**	**Regular Evaluation**	**Attendance**	
Weightage (%)	**10**	**5**	**30**	**5**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**3**	**-**	**-**	**1**	**3**
CO2	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**3**	**-**	**-**	**1**	**3**
CO3	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**3**	**-**	**-**	**1**	**3**
CO4	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**3**	**-**	**-**	**1**	**3**
CO5	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**3**	**-**	**-**	**1**	**3**
Average												

1	**:**	**Weakly mapped**
2	**:**	**Moderately mapped**
3	**:**	**Strongly mapped**

MIB353	Basics of Microbiology	L	T	P	C
Version	**1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Plus Two (12th) Level Biology				
Co-requisites	--				

Course Objectives

The course is designed to:

1. Introduce students to the fundamental concepts and scope of microbiology.
2. Develop understanding of microbial diversity, structure, growth, and metabolism.
3. Familiarize students with the role of microorganisms in health, environment, agriculture, and industry.
4. Provide hands-on laboratory exposure to basic microbiological techniques.
5. Enhance analytical, practical, and problem-solving skills relevant to microbiological applications.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** the history, scope, and significance of microbiology in various sectors.
CO2 : **Understand** the structure and classification of major groups of microorganisms.
CO3 : **Apply** basic microbiological techniques for isolation, cultivation, staining, and identification of microorganisms.
CO4 : **Analyze** microbial growth, nutrition, metabolism, and control methods.
CO5 : **Evaluate** the importance of microorganisms in industry, medicine, agriculture, and environmental sustainability.

Catalogue Description

Basics of Microbiology is a foundational course designed to introduce students to the principles and applications of microbiology. The course provides comprehensive knowledge of microbial diversity, cell structure, nutrition, growth, metabolism, and methods of microbial control. It also highlights the significance of microorganisms in healthcare, agriculture, food technology, environmental sustainability, and industrial biotechnology.

Course Content

Unit 1 Introduction and History of Microbiology **9 hours**

Definition, scope, and branches of microbiology; Historical development of microbiology; Contributions of scientists: Antonie van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Alexander Fleming; Germ theory of disease and Koch's postulates; Classification and nomenclature of microorganisms.

Unit 2 Microbial Diversity and Cell Structure **9 hours**

Diversity of microorganisms; General characteristics and importance of different microbial groups; Structure of bacterial cell; Gram-positive and Gram-negative bacteria; Structure and morphology of fungi and viruses.

Unit 3 Microbial Nutrition, Growth, and Metabolism **9 hours**

Nutritional requirements of microorganisms; Types of culture media and culture techniques; Physical factors affecting microbial growth: temperature, pH, oxygen, moisture, osmotic pressure; Phases of bacterial growth curve; Methods for measurement of microbial growth; Basic concepts of microbial metabolism.

Unit 4 Sterilization, Disinfection, and Control of Microorganisms **9 hours**

Concepts of sterilization, disinfection, antisepsis, sanitization; Physical methods of microbial control: heat, filtration, radiation, low temperature; Chemical methods of microbial control; Antibiotics and antimicrobial agents; Mechanism of action of antibiotics; Antibiotic resistance and its significance.

Unit 5 Applied Microbiology **9 hours**

Role of microorganisms in food and dairy industries; Microorganisms in agriculture: biofertilizers and biopesticides; Industrial applications: fermentation products, enzymes, antibiotics; Environmental microbiology: biodegradation, bioremediation, sewage treatment; Medical microbiology: normal microbiota and infectious diseases.

Unit 6 Lab Exercises **30 hours**

1. Introduction to microbiology laboratory and safety guidelines.
2. Preparation and sterilization of culture media.
3. Aseptic transfer techniques.
4. Isolation of microorganisms by streak plate, spread plate, and pour plate methods.
5. Enumeration of bacteria by serial dilution technique.
6. Observation of bacterial morphology using simple staining.
7. Gram staining of bacteria.
8. Observation of fungal cultures using lactophenol cotton blue staining.
9. Study of microbial growth curve.
10. Antibiotic sensitivity test by disc diffusion method.

Experiential Learning

1. Microbial Isolation from Environmental Samples
2. Industry/Diagnostic Laboratory Visit
3. Determination of effect of pH and temperature on microbial growth.

Textbooks

1. Michael T. Madigan et al., *Brock Biology of Microorganisms*, 16th edition, Pearson, 2021.
2. Prescott, Harley & Klein, *Microbiology*, 12th edition, Mc Graw Hill, 2025.
3. R. M. Atlas, *Principles of Microbiology*, 2nd edition, Wm. C. Brown Publishers, 2023.
4. Cappuccino & Sherman, *Microbiology: A Laboratory Manual*., 12th edition, Pearson, 2022.

Reference Books

1. R.Y. Stanier, *General Microbiology*, 5th edition, Palgrave Macmillan, 2000.
2. Tortora, Funke & Case, *Microbiology: An Introduction*, 14th edition, Pearson, 2024.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	1	1	2	1	2	1	2	1	2
CO2	3	3	1	2	2	1	1	1	1	1	1	2
CO3	3	3	2	2	2	2	1	1	1	1	1	2
CO4	2	2	3	3	3	2	1	2	2	2	1	2
CO5	3	2	2	2	2	3	3	2	2	2	1	3
Average	**2.8**	**2.4**	**1.8**	**2.0**	**2.0**	**2.0**	**1.4**	**1.6**	**1.4**	**1.6**	**1.0**	**2.2**

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC352	Basics of Nutrition and Toxicology	L	T	P	C
Version	**V1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Basic understanding of Human Physiology and Biochemistry				
Co-requisites	Metabolism, Environmental Biology				

Course Objectives

1. To provide students the basic understanding of nutrition, energy metabolism and toxicology.
2. To explain nutrient metabolism and their roles in maintaining health.
3. To explore the basic principles of toxicology and major classes of toxic agents.
4. To understand the biochemical and physiological impact of toxins.
5. To develop awareness of food safety, contaminants, and regulatory frameworks.

Course Outcomes

On completion of the course, the students will be able to

CO1	:	**Recall** the macro- and micronutrients along with their dietary sources and biological roles.
CO2	:	**Understand** nutrient metabolism and the physiological consequences of nutritional deficiencies.
CO3	:	**Apply** toxicological principles, including exposure routes and toxicokinetics.
CO4	:	**Analyse** natural and synthetic toxins and their effects on human health.
CO5	:	**Evaluate** food contaminants and adulterants, including their health impacts and regulatory controls.

Catalogue Description

This course explores the fundamentals of human nutrition and toxicology, focusing on the biochemical basis of nutrient functions, metabolism, and health impacts. Students will study the classification of nutrients, dietary requirements, and the physiological consequences of deficiencies, obesity, and lifestyle disorders. Core toxicology topics include dose–response, routes of exposure, ADME, and mechanisms of natural and synthetic toxins such as pesticides, heavy metals, and mycotoxins. Food toxicology addresses contaminants, adulterants, microbial toxins, and safety regulations (FSSAI, WHO, Codex). Laboratory work includes nutrient estimation, adulterant detection, haemoglobin assessment, bioassays, and nutrition surveys, integrating theory with practical applications in health and safety.

Course Content

Unit 1 Introduction to Nutrition and Energy Metabolism 8 hours

Defining Nutrition, role of nutrients. Unit of energy, Biological oxidation of foodstuff. Measurement of energy content of food, Physiological energy value of foods, SDA. Measurement of energy expenditure, estimating energy requirements, BMR factors Recommended Nutrient Intakes (RNI) and Recommended Dietary Allowances for different age groups.

Unit 2 Dietary Components and Health 9 hours

Review functions of carbohydrates, lipids, proteins and vitamins. Digestion, absorption. Their classification, sources, functions, digestion, absorption, utilization and storage. Deficiency diseases (Kwashiorkor, Scurvy, Rickets, Xeropthalmia etc.).Minerals (Ca, P, Fe etc.) absorption, importance and deficiency disease.

Unit 3 Assessment of Nutritional Status 9 hours

Anthropometric measurements; Z scores, BMI, skinfold, circumference ratios. Biochemical assessment; Basal metabolic panel, Comprehensive metabolic panel, CBC, Urine Analysis, Assessment of Anemia, ROS assessment, GTT and glycosylated Hb, Differential diagnosis of B_{12} and folate.

Unit 4 Food-Drug Interactions, Nutraceuticals and Toxicology 9 hours

Nutrient interactions affecting ADME of drugs, Alcohol and nutrient deficiency, Anti-depressants, psychoactive drugs and nutrient interactions, Appetite changes with drug intakes and malnutrition. Food as medicine.

Unit 5 Toxicology 10 hours

Classification of Food Toxicants. Food, Law and Safety. Principles of Toxicology I: Exposure, the Dose Response Curve. Absorption, Distribution and Elimination of Toxicants. Biotransformation Reactions (Phase I & Phase II).Carcinogenesis, Mutagenesis, Teratogenesis. Organ Toxicity. Natural Toxins in Foods of Plant Origin I. Risk Assessment. Pesticides in Foods. Marine, Toxins Poisonous Mushrooms , Mycotoxins ,Toxicants Resulting from Food Processing I , Food Additives I , Food Adulteration Pesticides .

Unit 6 Lab Exercises 30 hours

Estimation of Macronutrients in Food Samples
Detection of Common Food Adulterants
Determination of Hemoglobin and Iron Deficiency Indicators

Experiential Learning

1. Case study: Impact of iron and iodine deficiency in local communities.
2. Group presentation: Toxicological profile of a common household or environmental chemical.

Textbooks

1. Srilakshmi, B. (2021). *Nutrition Science*, New Age International Publishers.
2. Klaassen, C.D. (2018). *Casarett & Doull's Essentials of Toxicology*, McGraw-Hill.
3. Bamji, M.S., Rao, P.N., Reddy, V. (2019). *Textbook of Human Nutrition*, Oxford & IBH.

Reference Books

1. Shils, M.E. et al. (2017). *Modern Nutrition in Health and Disease*, Lippincott.
2. Hayes, A.W. (2020). *Principles and Methods of Toxicology*, CRC Press.
3. FSSAI Manual and WHO/FAO Guidelines on Food Safety and Toxicology (latest editions).

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	10	20	20	50

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	2	2	1	1	1	1	1	1	1
CO2	3	3	2	3	2	2	2	1	1	1	1	1
CO3	2	3	3	2	3	3	3	2	1	2	1	1
CO4	2	3	3	3	3	3	3	2	2	2	2	1
CO5	2	3	3	3	3	3	3	2	2	3	2	2
Average	2.4	2.8	2.6	2.6	2.6	2.4	2.4	1.6	1.4	1.8	1.4	1.2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

MIB353	Fundamentals of Recombinant DNA Technology	L	T	P	C
Version	**1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Knowledge of Microbiology and Molecular Biology				
Co-requisites					

Course Objectives

1. To introduce the foundational principles and tools used in recombinant DNA technology.
2. To familiarize students with classical and modern cloning vectors and strategies for gene isolation and manipulation.
3. To train students in techniques for analyzing nucleic acids and proteins.
4. To equip students with skills in designing, executing, and interpreting molecular cloning experiments.
5. To develop a critical understanding of transcriptional analysis, gene expression, and ethical issues related to genetic manipulation.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** key concepts, terminology, and methodologies in recombinant DNA technology.
CO2 : **Understand** the principles underlying cloning, gene expression, and molecular analysis techniques.
CO3 : **Apply** molecular techniques such as PCR, gel electrophoresis, and transformation in practical settings.
CO4 : **Analyse** experimental results, troubleshoot cloning workflows, and interpret gene expression data.
CO5 : **Evaluate** molecular biology protocols, design experimental approaches, and assess ethical implications in genetic research.

Catalogue Description

This course provides an in-depth understanding of the principles and methodologies of Recombinant DNA Technology. Students will explore DNA cloning, gene expression, library construction, transcriptomics, and modern analytical techniques. Emphasis is placed on both classical and advanced tools such as site-directed mutagenesis, protein overexpression strategies, and the use of various vectors. Ethical considerations and applications in biotechnology and medicine are also covered. The course prepares students for advanced research in molecular biology, genetic engineering, and allied life science disciplines.

Course Content

Unit 1 Basics of DNA Cloning **12 hours**
Introduction to cloning, cutting and joining DNA fragments; Types of plasmid vectors (cloning and expression) and their features; prokaryotic and eucaryotic vectors, shuttle vectors; Selection and screening of clones.

Unit 2 Methods of DNA and Protein Analysis **12 hours**
Agarose and polyacrylamide gel electrophoresis, Southern and Northern Blotting. Native PAGE, SDS-PAGE, and two-dimensional PAGE analysis of proteins; Western Blotting Analysis; Overview of Protein-Protein (GST-pull down) and DNA-Protein (ChIP) interaction analyses.

Unit 3 Polymerase Chain Reaction **6 hours**
Concept of PCR and various thermophilic enzymes used in PCR; Designing primers; Use of PCR for mutagenesis.

Unit 4 Construction of cDNA and genomic DNA libraries **9 hours**
Overview of DNA libraries; vectors used in the construction of cDNA *versus* genomic DNA libraries; Steps and enzymes involved in the construction of cDNA *versus* genomic DNA libraries.

Unit 5 Transcriptional Analysis of Gene Expression and Transcriptomics **6 hours**
Gene expression analysis by Northern Blotting, RT-PCR, Microarrays.

Unit 6 Lab Exercises in Genetic Engineering **30 hours**
Ligation Reaction
Preparation of Competent Cells and Transformation
Determination of Transformation Efficiency
Isolation of plasmid DNA
Qualitative and quantitative estimation of DNA

Experiential Learning

1. *In Silico* Primer and Cloning Design
2. Analysis of Cloning Strategies and Gene Expression Analyses from research articles

Textbooks

1. Brown, T.A. (2016). *Gene Cloning and DNA Analysis: An Introduction*. 7th Edition. Wiley-Blackwell.
2. Primrose, S.B. and Twyman, R.M. (2006). *Principles of Gene Manipulation and Genomics*. 7th Edition. Wiley-Blackwell.

Reference Books

1. Reece, R.J. (2003). *Analysis of Genes and Genomes*. Paperback Edition. Wiley-Blackwell.
2. Glick, B.R., Pasternak, J.J. and Patten, C.L. (2017). *Molecular Biotechnology: Principles and Applications of Recombinant DNA*. 5th Edition. ASM Press.

Modes of Evaluation

Components	**Class Assessment (including lab)**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	2	2	2	1	2	1	1	1	1	1
CO2	3	3	2	3	2	1	2	2	1	1	1	1
CO3	2	3	3	3	3	2	3	2	2	1	1	1
CO4	2	3	2	3	3	2	2	2	2	1	1	1
CO5	2	2	2	3	2	2	2	2	2	1	2	2
Average	2.4	2.6	2.2	2.8	2.4	1.6	2.2	1.8	1.6	1.0	1.2	1.2

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

MIB452	Fundamentals of Nanobiotechnology	L	T	P	C
Version	**2.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Fundamental concepts of Biology and Chemistry				
Co-requisites					

Course Objectives

1. To introduce students to the fundamentals of nanotechnology and various types of nanomaterials.
2. To understand the synthesis and characterization techniques of nanomaterials.
3. To explore the application of nanotechnology in drug delivery and biomedical imaging.
4. To examine the role of nanomaterials in tissue engineering and regenerative medicine.
5. To develop awareness of biosafety, regulatory, and ethical issues in biomedical nanotechnology.

Course Outcomes

On completion of the course, the students will be able to

CO1 : **Recall** the concepts, terminology, and types of nanomaterials used in biomedical research.
CO2 : **Understand** the principles behind synthesis, characterization, and functionalization of nanomaterials.
CO3 : **Apply** nanotechnological approaches in drug delivery and imaging.
CO4 : **Analyze** the potential of nanomaterials in tissue engineering and regenerative medicine.
CO5 : **Evaluate** the ethical and safety aspects associated with nanomaterial use in biomedicine.

Catalogue Description

This course offers a comprehensive overview of biomedical nanotechnology, covering synthesis and applications of nanomaterials in drug delivery, tissue engineering, diagnostics, and their societal and ethical implications. Practical components include synthesis, characterization, and bio-nano interaction analysis.

Course Content

Unit 1 Introduction to Nanobiotechnology 9 hours
Overview of nanotechnology and biotechnology; Introduction to nanomaterials and their properties; Applications of nanobiotechnology in healthcare, agriculture, and environmental remediation

Unit 2 Synthesis and Characterization of Nanomaterials 9 hours
Methods for the synthesis of nanoparticles (e.g., chemical reduction, sol-gel, template-assisted); Characterization techniques: TEM, SEM, AFM, XRD, DLS, and FTIR.

Unit 3 Interaction of Nanomaterials with Biological Systems 9 hours
Cellular uptake mechanisms of nanoparticles; Nanoparticle-biomolecule interactions; Toxicity and biocompatibility considerations

Unit 4 Applications of Nanobiotechnology 9 hours
Drug delivery systems: Nanocarriers, targeted delivery, and controlled release; Biosensors and diagnostic assays: Nanoparticle-based detection platforms; Tissue engineering and regenerative medicine: Scaffold design and functionalization.

Unit 5 Emerging Trends and Future Directions 9 hours
Nanobiotechnology in personalized medicine and precision agriculture; Challenges and opportunities in commercializing nanobiotechnology products; Ethical, social, and environmental implications

Unit 6 List of practicals 30 hours
1. Synthesis of metallic nanoparticles (e.g., gold, silver) using chemical reduction methods or green synthesis approaches.
2. Characterization of nanoparticles using UV-Vis spectroscopy.
3. Investigation of nanoparticle-biomolecule interactions using fluorescence spectroscopy.
4. Case studies exploring real-world applications of nanobiotechnology and their implications for healthcare, environment, and society.

Experiential Learning

1. Organize a visit to a research laboratory to observe advanced instruments such as SEM, TEM, and DLS, and gain exposure to their working principles and applications in nanomaterial characterization.
2. Preparation of an SOP for Nanomaterial Handling.
3. Evaluate a published clinical trial or product using nanocarriers.

Textbooks

1. C.M. Niemeyer & C.A. Mirkin (2007). *Nanobiotechnology II: More Concepts and Applications*, Wiley-VCH.
2. Rajesh Singh Tomar, Anurag Jyoti, Shuchi Kaushik (2020). Nanobiotechnology: Concepts and Applications in Health, Agriculture and Environment, Apple Academic Press.
3. R.S. Khandpur (2004). *Biomedical Instrumentation: Technology and Applications*, McGraw Hill
4. Tuan Vo-Dinh (2019). *Nanotechnology in Biology and Medicine*, CRC Press.

Reference Books

1. Ajeet Kaushik, Sesha S. Srinivasan, Yogendra Kumar Mishra (2023). Analytical Techniques for Biomedical Nanotechnology, IOP.
2. Prasad, P.N (2012). *Introduction to Nanomedicine and Nanobioengineering*, Wiley.
3. Cassandra Callmann (2025). Biomedical Nanotechnology, Humana Pr Inc.
4. Sarah Hurst Petrosko, Emily S. Day (2017). Biomedical Nanotechnology: Methods and Protocols, Humana Press.

Modes of Evaluation

Components	**Class Assessment**		**Mid Term**	**End Term**
	Experiential Learning	**Regular Evaluation**		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	1	2	1	1	1	1	–	–	–	–
CO2	2	3	3	3	2	2	2	1	1	–	–	–
CO3	2	3	3	3	2	3	3	1	1	–	–	–
CO4	2	3	2	3	3	3	3	1	1	1	1	1
CO5	2	3	2	3	3	3	3	2	1	1	1	1
Average	2.2	2.8	2.2	2.8	2.2	2.4	2.4	1.2	1.0	0.4	0.4	0.4

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

BIC453	Drug Design and Development	L	T	P	C
Version	**1.0**	**2**	**1**	**1**	**4**
Pre-requisites/Exposure	Knowledge of Microbiology and Biochemistry				
Co-requisites					

Course Objectives

1. To develop a conceptual understanding of protein folding, modeling, and drug-receptor interactions.
2. To understand the stages and principles of drug design and development.
3. To gain knowledge of computational tools and techniques used in drug discovery.
4. To learn to evaluate drug candidates for efficacy, safety, and optimization.
5. To understand regulatory, ethical, and intellectual property considerations in drug development.

Course Outcomes

On completion of the course, the students will be able to

CO1	:	**Recall** the stages of the drug development process and key concepts in drug design.
CO2	:	**Understand** the principles and methodologies used in drug design, development, and computational modeling.
CO3	:	**Apply** computational tools and software to design and analyze potential drug candidates.
CO4	:	**Analyse** experimental results, molecular interactions, and strategies to optimize drug efficacy and safety.
CO5	:	**Evaluate** drug design strategies and develop comprehensive plans for specific drug targets considering ethical and regulatory standards.

Catalogue Description

This course introduces students to the principles and practices of drug design and development. Topics include protein folding, drug-receptor interactions, structure-based drug design, SAR and QSAR analysis, enzyme inhibitors, molecular modeling, computational approaches, high-throughput screening, and intellectual property in pharmaceuticals. Students gain practical skills in evaluating drug candidates for efficacy and safety and develop an understanding of ethical, regulatory, and patent considerations. The course combines theoretical knowledge with hands-on application, preparing students for research and careers in medicinal chemistry, biotechnology, and pharmaceutical industries.

Course Content

Unit 1 Drug Design and Pro-drugs **9 hours**

Introduction to drug design; lead compounds and prodrug concepts; development of new drugs: procedure followed in drug design; prodrugs and soft drugs: formation of compounds containing various chemical groups, multiple prodrug formation; design principles of soft drugs.

Unit 2 SAR and QSAR **9 hours**

SAR: factors affecting bioactivity – resonance, inductive effect, isosterism, bioisosterism, spatial considerations, biological properties of functional groups; theories of drug activity: occupancy theory, rate theory, induced-fit theory; QSAR: history and development, drug-receptor interactions, additivity of group contributions.

Unit 3 QSAR Approaches and Molecular Modelling **9 hours**

Hansch analysis: advantages and drawbacks; Free Wilson analysis: advantages and drawbacks; introduction to molecular modeling using computers and docking; uses of molecular modeling: manual approaches, computer programming.

Unit 4 Enzyme Inhibitors: Design **9 hours**

Structure-based drug design: process and steps; deactivation of drugs for T-cell function; determination of the active site, special reference to chymotrypsin; design of enzyme inhibitors: 9-alkylpurines, 9-mercaptopurines, allopurines; active site-directed irreversible enzyme inhibition, suicide enzyme inactivators.

Unit 5 Drug Development and Patents **9 hours**

High-throughput screening in drug discovery; drug design software and applications; industrial designs, geographical indications, trademarks, trade secrets; patentable inventions and drugs: role of patents in pharmaceutical industry; patent writing for drug design; examples of newly developed drugs.

Unit 6 Lab exercises **30 hours**

Quantitative structure-activity relationship study
Designing of enzyme inhibitors as drug
High throughput screening for drug
Patent writing for drug designed

Experiential Learning

1. Identifying Drug targets in diseases and designing enzyme inhibitors
2. Drafting Patent for the designed drug

Textbooks

1. Pandeya, S.S. and Dimmock, J.R. (2007). *An Introduction to Drug Design*. New Age International (P) Ltd. Publishers.
2. Burge, E.W. (1997). *Medicinal Chemistry and Drug Discovery*, Vols. 1, 9, 14. John Wiley and Sons, New York.

Reference Books

1. Alen-Gringauz, A. (1996). *Introduction to Medicinal Chemistry*. 1st Edition. Wiley-VCH.
2. Lednicer, D. and Mitscher, L.A. (2005). *The Organic Chemistry of Drug Synthesis*, Vols. I–V. John Wiley.

Modes of Evaluation

Components	Class Assessment (including lab)		Mid Term	End Term
	Experiential Learning	Regular Evaluation		
Weightage (%)	**10**	**20**	**20**	**50**

Relationship between Course Outcomes (CO) and Program Outcomes (PO)

CO Number	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	2	1	1	1	1	–	–	–	–
CO2	2	3	3	3	2	2	2	1	1	–	–	–
CO3	2	3	3	3	2	3	3	1	1	–	–	–
CO4	2	3	2	3	3	3	3	1	1	1	1	1
CO5	2	3	2	3	3	3	3	2	1	1	1	1
Average	2.2	2.8	2.2	2.8	2.2	2.4	2.4	1.2	1.0	0.4	0.4	0.4

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

Paper Name: Introduction to IKS **Paper Code:** (XXX)
Credit: 4
LTP: 4–0–0

Course Objectives:

1. To introduce the fundamental concepts and sources of Indian Knowledge Systems.
2. To explore scientific and technological developments in ancient India.
3. To examine architectural, engineering, and ecological knowledge systems.
4. To analyze philosophical traditions contributing to scientific thought.
5. To relate traditional knowledge systems with modern scientific advancements.

Course Description:

This course provides a comprehensive overview of Indian Knowledge Systems with emphasis on scientific, technological, and intellectual developments of ancient India. It includes foundational texts, mathematical and astronomical advancements, metallurgical excellence, architectural achievements, and traditional medical knowledge. The course also highlights ecological sustainability and philosophical reasoning while establishing connections with modern science and innovation.

Course Outcomes:

CO1 Explain the historical development, fundamental concepts, educational traditions, and philosophical foundations of Indian Knowledge Systems, including major schools of Indian thought.

CO2 Describe the contributions of ancient India in polity, economy, mathematics, astronomy, Ayurveda, and other scientific disciplines, with reference to classical texts and scholars.

CO3 Interpret the principles of traditional Indian engineering, metallurgy, materials science, architecture, urban planning, and technological innovations developed in ancient India.

CO4 Analyze indigenous ecological knowledge, environmental ethics, water management systems, and sustainable agricultural practices in the context of present-day sustainability challenges.

CO5 Evaluate the significance and contemporary relevance of Indian Knowledge Systems in modern education, scientific research, innovation, technology development, and societal well-being.

Course Content:

Module I Foundations of Indian Knowledge Systems: Philosophy and Scientific Thoughts [14 lecture hours]

a. Introduction to Indian Knowledge Systems with historical evolution. Ancient Indian Literature and Scriptures (*Vedas, Vedanga, Puranas*, the maha-kavya— Ramayana and Mahabharata).
b. Oral traditions in Ancient Indian Education- Preservation of culture, tradition and Dharma through education*: Guru-Shishya Parampara*, Gurukulas, Six philosophical Schools-*Samkhya, Yoga, Nyaya, Vaisheshika, Purva-Mimamsa, Advaita (Uttara-Mimamsa)*
c. Indian philosophy: Concept of Pancha-bhuta. Conscious Awakening through Mindfulness, Breath Control, Meditation, Philosophical debates-Buddhism and Jainism- The role of ancient Indian Universities- *Nalanda* and *Takshashila.*

Module II Ancient Indian polity and economy [6 lecture hours]

a. Introduction to Ancient Indian Political and Economic System. The notion of Bharartavarsha as a Chakravarti-Kshetra and important attributes of Chakravartin.
b. Concept of Kingship: Duties and Responsibilities of a king in ancient India.
c. Ancient Indian economy- taxation, Savings and Expenditure

Module III Mathematics, Astronomy, Ayurveda and Life Sciences in Ancient India [12 lecture hours]

a. The development of mathematical and astronomical knowledge in ancient India, evolution of the number system, decimal representation, and the concept of zero and infinity. Contributions of Aryabhata, Brahmagupta, and Bhaskara II..
b. Early astronomical concepts and Astronomical Instruments (*Yantras*)
Application of Physics and Chemistry
c. The fundamental concepts of Ayurveda as a holistic system of medicine. Ayurvedic view of cause of deceases.
d. References to classical texts such as Surya Siddhanta, *Charaka Samhita*
and *Sushruta Samhita.*

Module IV Metallurgy, Materials, architecture and Civil Engineering [14 lecture hours]

a. The advancements in metallurgy and materials science in ancient India, traditional metallurgical practices and early innovations in materials : the Iron Pillar of Delhi- example of advanced materials engineering.
b. Nanomaterials and nanotechnology in ancient India.

c. The architecture and civil engineering in ancient India-Temple architecture- *Nagara* and *Dravida* styles
d. Urban planning concepts- the cities of Harappa and Mohenjo-Daro, drainage systems and spatial organization. Ancient cities of Indus -Saraswati region. Cave and monolithic architecture.

Module V Environmental Ecology and Agricultural Sustainability [8 lecture hours]

a. Traditional ecological knowledge and sustainable practices, biodiversity preservation. Ancient Indian water harvesting techniques. The concept of Pancha-bhuta and its relation to environmental balance.
b. Sustainable agricultural practices and their relevance in the context of present-day environmental challenges.

Module VI Modern Relevance of IKS [6 lecture hours]

a. Relevance of IKS in contemporary contexts. Ancient, traditional practices such as textile weaving, pottery, and shipbuilding as examples of applied knowledge systems.
b. The role of Indian Knowledge Systems in modern research, innovation, contemporary education and scientific development.

References-

1.Acarya P.K, *Indian Architecture*, Munshiram Manoharlal Publishers, New Delhi (1996)

2.Bag, A K, *Mathematics in Ancient and Medieval India*, Chaukhamba Orientalia, New Delhi, 1979

3.Banerjee, P*, Public Administration in Ancient India,* Macmillan, London, 1916

4.Chatterjee, Satishchandra, *An Introduction to Indian Philosophy*, Rupa & Co. Calcutta

5. Kapoor, kapil, Singh, Avadesh, *Indian Knowledge Systems* Vol. 1-2, D.K print World Ltd, New Delhi 2021

6. Debiprasad Chattopadhyaya, Science in Ancient India

7. Dharampal, Indian Science and Technology in the Eighteenth Century

8. A.L. Basham, The Wonder That Was India

INTEGRATED UNDER-GRADUATE SYLLABUS

OF COUMMUNICATIVE ENGLISH, SOFT SKILL AND APTITUDE

OF YEAR 2026 ONWARDS

ACKNOWLEDGEMENT

The successful development and implementation of the university-wide framework and syllabus for **Communicative English, Soft Skills and Aptitude at Adamas University** has been a result of collective vision, academic excellence, institutional support, and unwavering commitment from numerous leaders, academicians, and professionals. This endeavor reflects the University's dedication to preparing students for academic success, professional competence, and lifelong learning.

At the outset, I express my deepest gratitude to the **Hon'ble Chancellor of Adamas University** for providing visionary leadership and fostering an academic environment that encourages innovation, excellence, and industry relevance. His commitment to holistic education has been a guiding force behind initiatives aimed at enhancing student employability and professional growth.

I extend my sincere thanks to the **Vice Chancellor** for his constant encouragement and steadfast support throughout the conceptualization and development of this framework. His emphasis on academic rigor, interdisciplinary collaboration, and outcome-based education greatly influenced the direction and structure of the syllabus.

I am equally grateful to the **Pro Vice Chancellor** for offering valuable guidance and insightful suggestions during various stages of the curriculum development process. His proactive involvement and commitment to academic quality helped ensure that the framework remains contemporary, practical, and aligned with emerging educational and industry requirements.

My heartfelt appreciation goes to the **Dean of Academics**, whose academic expertise and constructive feedback played a pivotal role in refining the curriculum structure. The Dean's continuous support helped maintain the highest standards of curriculum design while ensuring alignment with institutional learning outcomes.

I would also like to acknowledge the invaluable contributions of the **Deans of all Schools of Adamas University**. Their diverse perspectives, academic insights, and recommendations enabled the development of a curriculum that caters to the varied needs of students across disciplines. Their active participation ensured that the framework remained relevant, inclusive, and responsive to the expectations of different academic domains.

Special thanks are extended to the **Heads of Departments of all Schools**, whose practical suggestions and discipline-specific inputs significantly enriched the syllabus. Their understanding of student needs, industry expectations, and subject-specific competencies helped create a robust and application-oriented framework that can effectively support learners from diverse academic backgrounds.

I express my profound gratitude to **Professor Abhijit Giri, Senior Vice President of the Career Development Cell (CDC)**, and all the members of CDC for their invaluable guidance and unwavering support. Their extensive experience in student development, employability enhancement, and placement readiness provided critical insights that helped shape the aptitude and professional skill development components of the curriculum. Prof. Giri's vision and commitment to preparing students for successful careers have been instrumental in strengthening the framework.

I would like to convey my sincere appreciation to Mr. Siladitya Basuray, the **Honorary Advisor of the Centre for Lifelong Learning (CLL)** for his strategic guidance and expert advice throughout the development process. His deep understanding of industry expectations and emerging workforce requirements helped ensure that the curriculum remains professionally relevant and future focused.

A special note of gratitude is due to the Co-ordinator of CLL, **Ms. Arpita Biswas,** for her relentless efforts, dedication, and meticulous attention to detail throughout the project. Her tireless coordination, consistent follow-ups, and commitment to excellence significantly contributed to the successful completion of this initiative. Her perseverance and hard work were instrumental in transforming ideas and discussions into a structured and comprehensive curriculum framework.

I also extend my heartfelt thanks to the **faculty members of the Centre for Lifelong Learning (CLL)** for their enthusiastic participation, collaborative spirit, and valuable contributions. Their collective expertise, thoughtful suggestions, and continuous engagement in curriculum planning, content development, and academic discussions enriched every stage of the process. Their dedication to student learning and professional development played a crucial role in shaping meaningful and impactful syllabus.

Finally, I acknowledge all academic leaders, faculty members, industry experts, and stakeholders whose encouragement, feedback, and support contributed to the successful development of this framework. Their collective wisdom and commitment have enabled the creation of a comprehensive curriculum that integrates communication competence, professional skills, aptitude development, and industry readiness.

This syllabus stands as a testament to what can be achieved when visionary leadership, academic expertise, institutional collaboration, and shared commitment come together with a common objective—to empower students of Adamas University with the knowledge, skills, and confidence required to excel in their academic, professional, and personal journeys.

Saswati Ghosh Bose

(Academic Head of CLL)

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COURSE SUMMARY

Programme Category	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Semester VII	Semester VIII
BBA Programmes (NON – NEP)	Communicative English I (ENG11053) + Soft Skills & Aptitude I (CLL11101)	Communicative English I (ENG11053) +Soft Skills & Aptitude II (CLL11102)	Soft Skills & Aptitude III (CLL11103)	Soft Skills & Aptitude IV (CLL11104)	Soft Skills & Aptitude V (CLL11105)	Soft Skills & Aptitude VI (CLL11106)	Soft Skills & Aptitude VII (CLL11107)	Soft Skills & Aptitude VIII (CLL11108)
B. Tech Programmes (NON - NEP)	Communicative English (ENG11053)	Soft Skills & Aptitude II (CLL11102)	Soft Skills & Aptitude III (CLL11103)	Soft Skills & Aptitude IV (CLL11104)	Soft Skills & Aptitude V (CLL11105)	Soft Skills & Aptitude VI (CLL11106)	Soft Skills & Aptitude VII (CLL11107)	—
UG Programmes (NEP)	Communicative English I (AEC101) + Soft Skills & Aptitude I (CLL151)	Communicative English II (AEC102) + Soft Skills & Aptitude II (CLL152)	Soft Skills & Aptitude III (CLL251)	Soft Skills & Aptitude IV (CLL252)	Soft Skills & Aptitude V (CLL351)	Soft Skills & Aptitude VI (CLL451)	—	—
UG Law Programmes	—	—	Professional English I (LWJ11201)	Professional English II (LWJ11202)	Professional English III (LWJ11203)	Professional English IV (LWJ11204)	Professional English V (LWJ11205)	Professional English VI (LWJ11206)
B. Pharm Programme	Healthcare Psychology & Communication Skills (BP103T) + Selected Professional Activities (BP108T)	Communication Skills & Mental Well-Being (BP212P SEC1)	Ethics, Universal Human Values & Internship Preparedness (BP303T)	Leadership, Professional Behaviour & Industry Communication (BP411T)	Career Awareness & Internship Preparation (BP511T)	Scientific Writing, Placement Readiness & Professional Skills (BP612T)	Industry Readiness & Strategic Professional Development (BP711T)	—

COMMUNICATIVE ENGLISH SYLLABUS FOR ALL NEP PROGRAMS

SEMESTER 1 – COMMUNICATIVE ENGLISH I **COURSE CODE – AEC101**
CONTACT HOURS – 30 HOURS

Module 1: Functional English & Language Basic **(10 Hours)**

1. Introduction to functional English usage in academic environments
2. Sentence formation and common sentence errors
3. Subject–Verb Agreement and practical grammar usage
4. Prepositions and Prepositional Phrases in communication
5. Vocabulary building through contextual speaking and usage

Module 2: Spoken Communication & Confidence Building **(10 Hours)**

1. Fundamentals of verbal and non-verbal communication
2. Breaking communication anxiety and stage fear
3. Pronunciation, articulation, and fluency improvement
4. Listening comprehension and interpretation skills
5. Introduction to storytelling and structured speaking

Module 3: Applied Grammar & Written Communication **(10 Hours)**

1. Active and Passive voice transformation
2. Basic Narration and Sentence transformation techniques
3. Idioms, Phrases, and practical expression building
4. Professional email drafting and paragraph writing
5. Digital etiquette and responsible communication practices

Course Outcomes –

CO1: Develop foundational English communication skills with improved grammatical accuracy and confidence.
CO2: Demonstrate effective verbal interaction, listening ability, and structured speaking techniques.
CO3: Apply functional written communication, digital etiquette, and practical language usage in academic contexts.

SEMESTER 2 – COMMUNICATIVE ENGLISH II **COURSE CODE – AEC102**

CONTACT HOURS – 30 HOURS

Module 1: Advanced Grammar & Professional Language Usage **(10 Hours)**

1. Advanced Subject–Verb Agreement and sentence refinement
2. Complex sentence structuring and coherence development
3. Advanced Voice change and Narration techniques
4. Idiomatic expressions and professional vocabulary enhancement
5. Functional business and workplace English usage

Module 2: Analytical Speaking & Interactive Communication **(10 Hours)**

1. Group discussion strategies and participation techniques
2. Persuasive speaking and opinion expression
3. Analytical listening and interpretation skills
4. Public speaking with logical sequencing of ideas
5. Presentation structuring and audience engagement

Module 3: Workplace Writing & Professional Communication **(10 Hours)**

1. Professional correspondence and formal drafting
2. Report writing and structured documentation basics
3. Workplace communication etiquette and standards
4. Meeting communication and professional interaction
5. Digital professionalism and communication ethics

Course Outcomes -

CO1: Apply advanced grammar, structured expression, and professional vocabulary effectively in communication.

CO2: Demonstrate analytical speaking, presentation, and interactive communication competencies confidently.

CO3: Develop workplace-ready writing, professional correspondence, and formal communication skills.

SOFT SKILLS AND APTITUDE SYLLABUS FOR ALL NEP COURSES

SEMESTER 1 – SOFT SKILLS AND APTITUDE I COURSE CODE – CLL151

CONTACT HOURS – 30 HOURS

SOFT SKILL

Module 1: Self Awareness & Personal Growth (5 Hours)

1. Understanding personality traits and behavioral styles
2. Identifying strengths, interests, and growth areas
3. Growth mindset and self-motivation techniques
4. Goal setting and personal accountability
5. Positive attitude and adaptability development

Module 2: Professional Discipline & Learning Behavior (5 Hours)

1. Professional discipline in higher education
2. Time management and productivity habits
3. Responsibility and accountability in team environments
4. Professional ethics and behavioral expectations
5. Building confidence and learning consistency

Module 3: Team Interaction & Creative Thinking (5 Hours)

1. Collaborative participation and peer interaction
2. Introduction to creative thinking approaches
3. Interpersonal understanding and cooperation
4. Problem-solving mindset development
5. Social confidence in group environments

Course Outcome (COs):

CO1: Demonstrate self-awareness, personal accountability, and a growth-oriented mindset to enhance personal effectiveness and continuous learning.

CO2: Apply professional discipline, ethical behaviour, time management, and responsible work practices in academic and collaborative environments.

CO3: Develop teamwork, interpersonal interaction, creative thinking, and problem-solving abilities to contribute effectively to group and professional settings.

APTITUDE

Module 1: Numerical Foundations & Arithmetic Skills **(5 Hours)**

1. Basic numerical operations and arithmetic reasoning
2. Percentage, ratio, proportion, and simplification techniques
3. Quantitative comparison and analytical calculation methods
4. Foundational financial arithmetic applications
5. Structured numerical problem-solving approaches

Module 2: Foundational Logical Reasoning **(5 Hours)**

1. Analogy and classification techniques
2. Coding-decoding and logical sequencing
3. Direction sense and pattern recognition
4. Basic logical interpretation techniques
5. Analytical observation and reasoning accuracy

Module 3: Business Problem-Solving Foundations **(5 Hours)**

1. Foundational decision-making techniques
2. Basic business-case interpretation
3. Structured reasoning during operational scenarios
4. Analytical thinking and quantitative interpretation
5. Reasoning speed and accuracy enhancement

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

Semester 2 – Soft Skills and Aptitude II **Course code – CLL152**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Workplace Professionalism & Biotechnology Interaction **(5 hours)**
1. Professional communication in laboratory and biotechnology environments
2. Professional identity development for biotechnology careers
3. Laboratory discipline and workplace accountability
4. Professional etiquette and executive presence
5. Team collaboration in scientific environments
6. Stakeholder interaction and workplace adaptability

Module 2: Technical Documentation & Scientific Reporting **(5 hours)**
1. Scientific report writing and laboratory documentation
2. Research note preparation and structured communication
3. Technical reporting and analytical explanation
4. Professional presentation and scientific interaction
5. Communication during laboratory workflows
6. Professional ethics in biotechnology environments

Module 3: Internship Readiness & Scientific Collaboration **(5 hours)**
1. Internship professionalism and industrial adaptability
2. Resume development and biotechnology profile building
3. Professional networking and collaborative interaction
4. Scientific discussion and multidisciplinary communication
5. Confidence building in laboratory and research environments
6. Professional responsibility during technical operations

Course Outcomes (COs)

CO1: Demonstrate professional workplace behaviour and biotechnology interaction skills effectively.

CO2: Apply technical documentation and scientific reporting practices responsibly.

CO3: Develop internship readiness, scientific collaboration, and professional adaptability competencies.

APTITUDE

Module 1: Arithmetic Applications & Quantitative Interpretation **(5 hours)**

1. Profit-loss and discount applications

2. Simple and compound interest calculations

3. Averages, mixtures, and allegation concepts

4. Quantitative interpretation and comparison techniques

5. Analytical simplification approaches

Module 2: Logical & Critical Reasoning **(5 hours)**

1. Logical deduction and structured interpretation

2. Syllogism and Venn diagram applications

3. Seating arrangement and analytical reasoning

4. Critical reasoning and structured problem-solving

5. Decision-making during business situations

Module 3: Business Analytical Aptitude **(5 hours)**

1. Business data interpretation techniques

2. Operational reasoning and analytical comparison

3. Timework and productivity calculations

4. Analytical communication of quantitative findings

5. Strategic aptitude-solving approaches

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

Semester 3 – Soft Skills and Aptitude III **Course code – CLL251**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Scientific & Professional Communication **(5 Hours)**
1. Communication in laboratories, research environments, GIS and geospatial workspaces, analytical centers, and scientific institutions

2. Scientific observation, interpretation, and professional interaction basics

3. Technical explanation and presentation of scientific concepts

4. Professional communication in multidisciplinary scientific environments

5. Listening, analytical interpretation, and response management in scientific discussions

Module 2: Scientific Documentation & Academic Communication **(5 Hours)**
1. Scientific report writing and documentation fundamentals

2. Research note preparation and technical communication

3. Professional email and scientific reporting standards

4. Vocabulary enhancement for scientific and analytical disciplines

5. Reading comprehension and interpretation of scientific content

Module 3: Internship Interview & Professional Readiness **(5 Hours)**
1. Internship interview communication for scientific and analytical sectors

2. Professional introduction and scientific identity building

3. Professional body language and presentation etiquette

4. Resume basics and academic profile development

5. Workplace communication standards in laboratories and research organizations

Course Outcomes (COs)

CO1: Demonstrate professional communication skills required for laboratories, research environments, analytical centers, and scientific institutions.

CO2: Apply scientific documentation, report writing, and structured communication techniques effectively in academic and professional settings.

CO3: Prepare for internships through interview communication, profile building, professional interaction, and scientific presentation skills.

APTITUDE

Module 1: Data Interpretation & Analytical Evaluation **(5 Hours)**

1. Table-based and graphical data interpretation
2. Pie charts, bar graphs, and line graph analysis
3. Comparative analytical interpretation techniques
4. Data-driven analytical reasoning
5. Structured interpretation of operational datasets

Module 2: Analytical Reasoning & Data Sufficiency **(5 Hours)**

1. Data sufficiency interpretation methods
2. Logical evaluation and analytical deduction
3. Quantitative interpretation during analytical scenarios
4. Decision-making using structured analytical approaches
5. Problem-solving under operational conditions

Module 3: Domain-Based Problem Solving **(5 Hours)**

1. Analytical reasoning during discipline-oriented situations
2. Research-oriented interpretation methodologies
3. Structured operational problem-solving
4. Analytical adaptability during academic workflows
5. Strategic interpretation and effectiveness of aptitude

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

Semester 4 – Soft Skills and Aptitude IV **Course code – CLL252**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Professional Presentation & Technical Communication **(5 Hours)**
1. Public speaking and scientific presentation techniques
2. Presentation structuring for technical and analytical subjects
3. Explaining scientific and mathematical concepts to interdisciplinary audiences
4. Group discussion and collaborative scientific communication
5. Professional interaction in research and analytical environments

Module 2: Ethics, Leadership & Scientific Team Dynamics **(5 Hours)**
1. Ethical practices in scientific research and analytical environments
2. Leadership and accountability in scientific workflows
3. Team coordination and multidisciplinary collaboration
4. Conflict handling and professional decision-making
5. Analytical reasoning and responsibility in scientific projects

Module 3: Internship Orientation & Workplace Preparedness **(5 Hours)**
1. Understanding internship expectations in scientific and industrial sectors
2. Professional behavior during laboratory and research internships
3. Workplace adaptability and project accountability
4. Communication with supervisors, scientific teams, and technical stakeholders
5. Professional discipline and reporting hierarchy in scientific organizations

Course Outcomes (COs)

CO1: Demonstrate presentation, interpersonal interaction, and technical communication skills with professional confidence.

CO2: Apply ethical decision-making, leadership qualities, teamwork, and responsible behaviour in scientific and analytical environments.

CO3: Develop internship readiness through workplace professionalism, communication ethics, adaptability, and professional accountability.

APTITUDE

Module 1: Advanced Quantitative Aptitude **(5 Hours)**

1. Probability and advanced arithmetic applications
2. Geometry, mensuration, and quantitative interpretation
3. Advanced analytical calculation techniques
4. Operational reasoning methodologies
5. Time-bound aptitude-solving approaches

Module 2: Critical Reasoning & Decision-Making **(5 Hours)**

1. Critical reasoning and analytical deduction
2. Puzzle-solving and structured analytical frameworks
3. Decision-making during complex scenarios
4. Logical evaluation and reasoning coordination
5. Strategic interpretation techniques

Module 3: Applied Analytical Leadership **(5 Hours)**

1. Analytical leadership during academic operations
2. Strategic problem-solving and adaptability
3. Collaborative reasoning and structured interaction
4. Operational effectiveness during multidisciplinary environments
5. Professional analytical resilience

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

Semester 5 – Soft Skills and Aptitude V **Course code – CLL351**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Industry Readiness & Employability Skills **(5 Hours)**
1. Understanding scientific, environmental, geospatial, analytical, and research industry expectations
2. Workplace professionalism and adaptability in scientific sectors
3. Communication in multidisciplinary technical and research teams
4. Professional networking and stakeholder relationship management
5. Accountability and ownership in research and analytical projects
6. Career awareness in scientific and applied science industries

Module 2: Resume, SOP & Professional Branding **(5 Hours)**
1. Advanced resume and scientific portfolio development
2. SOP and academic profile writing
3. LinkedIn and professional profile optimization
4. Personal branding and professional communication image
5. Email etiquette for placements, internships, and research correspondence
6. Professional portfolio presentation and documentation

Module 3: Group Discussion & Workplace Communication **(5 Hours)**
1. Group discussion techniques for scientific and analytical industries
2. Meeting etiquette and professional interaction
3. Team communication effectiveness in research environments
4. Professional negotiation and stakeholder communication basics
5. Handling workplace pressure and project deadlines

Course Outcomes (COs)

CO1: Develop employability skills, workplace professionalism, and collaborative communication abilities aligned with scientific and analytical sectors.

CO2: Prepare professional resumes, SOPs, portfolios, and professional profiles for internships and placement opportunities.

CO3: Demonstrate group discussion, workplace communication, negotiation, and professional interaction skills effectively in organizational settings.

APTITUTE

Module 1: Placement Aptitude Preparation (5 Hours)

1. Placement-oriented aptitude-solving techniques
2. Analytical interpretation under assessment conditions
3. Structured reasoning during aptitude evaluations
4. Decision-making and workplace reasoning
5. Strategic aptitude performance enhancement

Module 2: Advanced Data & Analytical Interpretation (5 Hours)

1. Advanced data interpretation and analytical comparison
2. Statistical reasoning and operational evaluation
3. Analytical interpretation during professional scenarios
4. Structured quantitative communication techniques
5. Professional analytical effectiveness enhancement

Module 3: Professional Problem Solving & Operational Reasoning (5 Hours)

1. Operational problem-solving methodologies
2. Strategic adaptability and analytical resilience
3. Collaborative reasoning during institutional operations
4. Professional accountability in multidisciplinary environments
5. Analytical interaction and structured evaluation

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

Semester 6 – Soft Skills and Aptitude VI **Course code – CLL451**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Interview Skills & Placement Communication **(5 Hours)**

1. HR interview preparation for scientific and technical industries
2. Technical and non-technical interview communication
3. Confidence building and executive presence
4. Corporate communication standards in research and industrial organizations
5. Handling difficult interviews and technical interaction scenarios
6. Professional adaptability and career planning

Module 2: Advanced Workplace Communication **(5 Hours)**

1. Corporate communication etiquette in scientific and industrial environments
2. Professional presentations and analytical reporting
3. Workplace conflict management in technical teams
4. Strategic communication and collaborative coordination
5. Communication under research and workplace pressure
6. Professional decision-making in scientific workflows

Module 3: Career Transition & Professional Sustainability **(5 Hours)**

1. Transition from student to scientific professional
2. Workplace ethics and professional responsibilities
3. Professional resilience and adaptability in dynamic scientific environments
4. Long-term career planning in applied science sectors
5. Professional networking and relationship management

Course Outcomes (COs)

CO1: Demonstrate interview preparedness, professional confidence, executive presence, and corporate communication skills for placement opportunities.

CO2: Apply advanced workplace communication, presentation, conflict management, collaboration, and professional decision-making skills effectively.

CO3: Develop career adaptability, workplace resilience, ethical professionalism, and lifelong learning orientation for sustainable professional growth.

APTITUDE

Module 1: Executive Quantitative & Logical Aptitude **(5 Hours)**

1. Executive-level quantitative reasoning
2. Advanced logical interpretation techniques
3. Strategic operational reasoning approaches
4. Professional analytical evaluation under pressure situations
5. Advanced aptitude-solving methodologies

Module 2: Leadership Aptitude & Strategic Decision-Making **(5 Hours)**

1. Leadership-oriented analytical reasoning
2. Strategic decision-making and analytical coordination
3. Problem-solving during organizational operations
4. Operational adaptability and analytical effectiveness
5. Professional resilience during complex environments

Module 3: Advanced Professional Analytical Competencies **(5 Hours)**

1. Advanced reasoning during professional scenarios
2. Strategic aptitude communication techniques
3. Analytical coordination during multidisciplinary operations
4. Structured interpretation during executive evaluations
5. Professional readiness for placement-oriented assessments

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

Semester 7 – Soft Skills and Aptitude VII **Course code – CLL352**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Advanced Professional Communication & Placement Readiness **(5 Hours)**
1. Strategic communication for scientific recruitment processes
2. Advanced professional networking and stakeholder communication
3. Executive communication and workplace professionalism
4. Professional adaptability in evolving scientific industries
5. Personal branding and scientific professional identity

Module 2: Innovation, Analytical Thinking & Industry Case Evaluation **(5 Hours)**
1. Research-oriented problem-solving methodologies
2. Strategic thinking and innovation management
3. Industry case-study evaluation and analytical interpretation
4. Scientific decision-making and solution development
5. Professional reporting and technical presentation techniques

Module 3: Leadership Readiness & Career Sustainability **(5 Hours)**
1. Leadership communication in scientific organizations
2. Managing multidisciplinary technical collaborations
3. Professional accountability and ethical decision-making
4. Long-term career sustainability and professional development
5. Continuous learning and technical upskilling approaches

Course Outcomes (COs)

CO1: Demonstrate advanced professional communication and placement readiness skills for scientific and analytical industries.

CO2: Apply innovation, analytical thinking, and strategic decision-making techniques in professional contexts.

CO3: Develop leadership readiness, ethical professionalism, and long-term career sustainability competencies.

APTITUDE

Module 1: Industry-Oriented Analytical Aptitude **(5 Hours)**

1. Integrated aptitude-solving during placement simulations
2. Advanced analytical interpretation and structured evaluation
3. Strategic problem-solving during operational scenarios
4. Decision-making during multidisciplinary environments
5. Executive analytical effectiveness techniques

Module 2: Advanced Placement Readiness & Competitive Reasoning **(5 Hours)**

1. Mock aptitude assessments and analytical diagnostics
2. Professional reasoning under competitive conditions
3. Strategic aptitude coordination during assessments
4. Operational interpretation and workplace reasoning
5. Advanced analytical adaptability and resilience

Module 3: Career Sustainability & Executive Analytical Leadership **(5 Hours)**

1. Long-term professional analytical growth
2. Strategic reasoning during organizational transformation
3. Professional adaptability in evolving industry ecosystems
4. Executive-level aptitude and leadership readiness
5. Industry-oriented analytical sustainability approaches

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

COMMUNICATIVE ENGLISH SYLLABUS FOR BBA

SEMESTER 1 – COMMUNICATIVE ENGLISH I   COURSE CODE – ENG11053

CONTACT HOURS – 30 HOURS

Module 1: Functional English & Language Basics

(10 Hours)

1. Introduction to functional English usage in academic environments
2. Sentence formation and common sentence errors
3. Subject–Verb Agreement and practical grammar usage
4. Prepositions and Prepositional Phrases in communication
5. Vocabulary building through contextual speaking and usage

Module 2: Spoken Communication & Confidence Building

(10 Hours)

1. Fundamentals of verbal and non-verbal communication
2. Breaking communication anxiety and stage fear
3. Pronunciation, articulation, and fluency improvement
4. Listening comprehension and interpretation skills
5. Introduction to storytelling and structured speaking

Module 3: Applied Grammar & Written Communication

(10 Hours)

1. Active and Passive voice transformation
2. Basic Narration and Sentence transformation techniques
3. Idioms, Phrases, and practical expression building
4. Professional email drafting and paragraph writing
5. Digital etiquette and responsible communication practices

Course Outcomes –

CO1: Develop foundational English communication skills with improved grammatical accuracy and confidence.

CO2: Demonstrate effective verbal interaction, listening ability, and structured speaking techniques.

CO3: Apply functional written communication, digital etiquette, and practical language usage in academic contexts.

SEMESTER 2 – COMMUNICATIVE ENGLISH II   COURSE CODE – ENG11053

CONTACT HOURS – 30 HOURS

Module 1: Advanced Grammar & Professional Language Usage (10 Hours)

1. Advanced Subject–Verb Agreement and sentence refinement
2. Complex sentence structuring and coherence development
3. Advanced Voice change and Narration techniques
4. Idiomatic expressions and professional vocabulary enhancement
5. Functional business and workplace English usage

Module 2: Analytical Speaking & Interactive Communication (10 Hours)

1. Group discussion strategies and participation techniques
2. Persuasive speaking and opinion expression
3. Analytical listening and interpretation skills
4. Public speaking with logical sequencing of ideas
5. Presentation structuring and audience engagement

Module 3: Workplace Writing & Professional Communication (10 Hours)

1. Professional correspondence and formal drafting
2. Report writing and structured documentation basics
3. Workplace communication etiquette and standards
4. Meeting communication and professional interaction
5. Digital professionalism and communication ethics

Course Outcomes -

CO1: Apply advanced grammar, structured expression, and professional vocabulary effectively in communication.

CO2: Demonstrate analytical speaking, presentation, and interactive communication competencies confidently.

CO3: Develop workplace-ready writing, professional correspondence, and formal communication skills.

SOFT SKILLS AND APTITUDE SYLLABUS FOR BBA

SEMESTER 1 – SOFT SKILLS AND APTITUDE I COURSE CODE – CLL11101

CONTACT HOURS – 30 HOURS

SOFT SKILL

Module 1: Self Awareness & Personal Growth (5 Hours)

1. Understanding personality traits and behavioral styles
2. Identifying strengths, interests, and growth areas
3. Growth mindset and self-motivation techniques
4. Goal setting and personal accountability
5. Positive attitude and adaptability development

Module 2: Professional Discipline & Learning Behavior (5 Hours)

1. Professional discipline in higher education
2. Time management and productivity habits
3. Responsibility and accountability in team environments
4. Professional ethics and behavioral expectations
5. Building confidence and learning consistency

Module 3: Team Interaction & Creative Thinking (5 Hours)

1. Collaborative participation and peer interaction
2. Introduction to creative thinking approaches
3. Interpersonal understanding and cooperation
4. Problem-solving mindset development
5. Social confidence in group environments

Course Outcome (COs):

CO1: Demonstrate self-awareness, personal accountability, and a growth-oriented mindset to enhance personal effectiveness and continuous learning.

CO2: Apply professional discipline, ethical behaviour, time management, and responsible work practices in academic and collaborative environments.

CO3: Develop teamwork, interpersonal interaction, creative thinking, and problem-solving abilities to contribute effectively to group and professional settings.

APTITUDE

Module 1: Numerical Foundations & Arithmetic Skills **(5 Hours)**

1. Basic numerical operations and arithmetic reasoning
2. Percentage, ratio, proportion, and simplification techniques
3. Quantitative comparison and analytical calculation methods
4. Foundational financial arithmetic applications
5. Structured numerical problem-solving approaches

Module 2: Foundational Logical Reasoning **(5 Hours)**

1. Analogy and classification techniques
2. Coding-decoding and logical sequencing
3. Direction sense and pattern recognition
4. Basic logical interpretation techniques
5. Analytical observation and reasoning accuracy

Module 3: Business Problem-Solving Foundations **(5 Hours)**

1. Foundational decision-making techniques
2. Basic business-case interpretation
3. Structured reasoning during operational scenarios
4. Analytical thinking and quantitative interpretation
5. Reasoning speed and accuracy enhancement

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

Semester 2 – Soft Skills and Aptitude II **Course code – CLL11102**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Workplace Professionalism & Biotechnology Interaction **(5 hours)**

1. Professional communication in laboratory and biotechnology environments
2. Professional identity development for biotechnology careers
3. Laboratory discipline and workplace accountability
4. Professional etiquette and executive presence
5. Team collaboration in scientific environments
6. Stakeholder interaction and workplace adaptability

Module 2: Technical Documentation & Scientific Reporting **(5 hours)**

1. Scientific report writing and laboratory documentation
2. Research note preparation and structured communication
3. Technical reporting and analytical explanation
4. Professional presentation and scientific interaction
5. Communication during laboratory workflows
6. Professional ethics in biotechnology environments

Module 3: Internship Readiness & Scientific Collaboration **(5 hours)**

1. Internship professionalism and industrial adaptability
2. Resume development and biotechnology profile building
3. Professional networking and collaborative interaction
4. Scientific discussion and multidisciplinary communication
5. Confidence building in laboratory and research environments
6. Professional responsibility during technical operations

Course Outcomes (COs)

CO1: Demonstrate professional workplace behaviour and biotechnology interaction skills effectively.

CO2: Apply technical documentation and scientific reporting practices responsibly.

CO3: Develop internship readiness, scientific collaboration, and professional adaptability competencies.

APTITUDE

Module 1: Arithmetic Applications & Quantitative Interpretation **(5 hours)**

1. Profit-loss and discount applications
2. Simple and compound interest calculations
3. Averages, mixtures, and allegation concepts
4. Quantitative interpretation and comparison techniques
5. Analytical simplification approaches

Module 2: Logical & Critical Reasoning **(5 hours)**

1. Logical deduction and structured interpretation
2. Syllogism and Venn diagram applications
3. Seating arrangement and analytical reasoning
4. Critical reasoning and structured problem-solving
5. Decision-making during business situations

Module 3: Business Analytical Aptitude **(5 hours)**

1. Business data interpretation techniques
2. Operational reasoning and analytical comparison
3. Timework and productivity calculations
4. Analytical communication of quantitative findings
5. Strategic aptitude-solving approaches

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

SOFT SKILLS AND APTITUDE SYLLABUS FOR NON-NEP PROGRAMS

Semester 3 – Soft Skills and Aptitude III **Course code – CLL11103**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Corporate Communication & Workplace Interaction **(5 hours)**

1. Professional communication in corporate and commercial environments
2. Client handling and stakeholder communication techniques
3. Business meeting etiquette and workplace professionalism
4. Professional interaction in retail, sales, and service sectors
5. Communication in multidisciplinary business environments
6. Corporate communication ethics and organizational conduct

Module 2: Business Documentation & Commercial Communication **(5 hours)**

1. Business report writing and commercial documentation practices
2. Professional email drafting and corporate correspondence
3. Communication clarity in financial and commercial transactions
4. Vocabulary enhancement for business, commerce, and e-commerce sectors
5. Reading comprehension and interpretation of business case studies
6. Structured communication in corporate environments

Module 3: Internship Readiness & Professional Branding **(5 hours)**

1. Professional identity development and executive presence
2. Resume building and business profile preparation
3. Internship readiness and workplace adaptability
4. Professional grooming and presentation etiquette
5. Communication standards in corporate organizations
6. Confidence building and professional interaction

Course Outcomes (COs)

CO1: Demonstrate professional communication and workplace interaction skills required for business and commercial environments.

CO2: Apply business documentation, corporate correspondence, and structured communication techniques effectively.

CO3: Develop internship readiness, professional branding, and executive communication competencies.

APTITUDE

Module 1: Data Interpretation Techniques **(5 hours)**

1. Table-based and graphical data interpretation
2. Pie charts, line graphs, and bar graph analysis
3. Business data evaluation techniques
4. Comparative analytical interpretation
5. Data-driven decision-making approaches

Module 2: Analytical Reasoning & Data Sufficiency **(5 hours)**

1. Data sufficiency and analytical interpretation
2. Logical evaluation and business reasoning
3. Quantitative interpretation under time constraints
4. Business operational problem-solving
5. Analytical accuracy enhancement

Module 3: Statistical & Business Aptitude **(5 hours)**

1. Statistical interpretation fundamentals
2. Averages, variance, and analytical reasoning
3. Business analytical comparison techniques
4. Structured interpretation of operational datasets
5. Professional analytical effectiveness

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

Semester 4 – Soft Skills and Aptitude IV **Course code – CLL11104**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Sales & Marketing Communication **(5 hours)**

1. Customer interaction and relationship management
2. Sales communication and persuasive interaction techniques
3. Professional negotiation and business pitching strategies
4. Brand communication and customer engagement practices
5. Communication in retail, marketing, and business operations
6. Professional interaction during promotional and marketing activities

Module 2: Leadership & Organizational Behaviour **(5 hours)**

1. Leadership communication in corporate environments
2. Team coordination and collaborative management practices
3. Decision-making and accountability in business workflows
4. Conflict management and workplace diplomacy
5. Professional collaboration in organizational environments
6. Strategic communication and managerial interaction

Module 3: Digital Business & E-Commerce Communication **(5 hours)**

1. Communication practices in e-commerce and digital business platforms
2. Professional interaction in online business environments
3. Digital customer support and client relationship communication
4. Communication for online branding and digital engagement
5. Professional conduct in virtual business environments
6. Workplace adaptability in digital commerce ecosystems

Course Outcomes (COs)

CO1: Demonstrate sales, marketing, and customer interaction skills effectively in corporate environments.

CO2: Apply leadership communication, organizational coordination, and managerial interaction strategies professionally.

CO3: Develop digital business communication and e-commerce workplace competencies.

APTITUDE

Module 1: Advanced Quantitative Aptitude **(5 hours)**

1. Probability and advanced arithmetic reasoning
2. Geometry, mensuration, and quantitative interpretation
3. Advanced comparison and analytical solving methods
4. Operational calculation strategies
5. Time-bound aptitude-solving approaches

Module 2: Corporate Logical Reasoning **(5 hours)**

1. Critical reasoning and analytical deduction
2. Advanced puzzle-solving techniques
3. Business-case interpretation and reasoning
4. Decision-making during corporate scenarios
5. Strategic logical evaluation methods

Module 3: Business Decision-Making Aptitude **(5 hours)**

1. Operational reasoning and strategic analysis
2. Analytical interpretation during management situations
3. Professional aptitude-solving environments under pressure
4. Structured business problem-solving methodologies
5. Corporate analytical effectiveness techniques

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

Semester 5 – Soft Skills and Aptitude V **Course code – CLL11105**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Corporate Operations & Business Coordination **(5 hours)**

1. Corporate communication in business operations and commercial sectors
2. Stakeholder interaction and business coordination techniques
3. Cross-functional collaboration in organizational environments
4. Professional communication during operational workflows
5. Communication under workplace pressure and business deadlines
6. Professional accountability in corporate practices

Module 2: Financial & Commercial Workplace Communication **(5 hours)**

1. Communication in financial and accounting environments
2. Professional interaction in banking, finance, and commerce sectors
3. Business presentation and financial reporting communication
4. Strategic communication in commercial operations
5. Professional ethics in finance and corporate environments
6. Commercial negotiation and client communication

Module 3: Professional Development & Career Communication **(5 hours)**

1. Professional networking and relationship management
2. SOP writing and career communication strategies
3. Professional portfolio and LinkedIn profile development
4. Email etiquette for placements and business interaction
5. Career awareness in corporate and entrepreneurial sectors
6. Professional branding and workplace image management

Course Outcomes (COs)

CO1: Demonstrate professional coordination, operational communication, and workplace accountability skills effectively.

CO2: Apply financial, commercial, and corporate communication techniques in business environments.

CO3: Develop career communication, networking, and professional branding competencies.

APTITUDE

Module 1: Company-Specific Aptitude Preparation **(5 hours)**

1. TCS, Deloitte, EY, KPMG, Capgemini, and Infosys aptitude patterns
2. Adaptive aptitude-solving techniques
3. Sectional aptitude preparation strategies
4. Time-bound aptitude-solving methods
5. Corporate assessment reasoning approaches

Module 2: Business Analytical Assessments **(5 hours)**

1. Full-length mock aptitude assessments
2. Performance analytics and diagnostic evaluation
3. Weak-area identification and analytical improvement
4. Decision-making and workplace reasoning
5. Corporate analytical interpretation under assessment conditions

Module 3: Strategic Corporate Aptitude **(5 hours)**

1. Business-case analytical evaluation
2. Operational problem-solving techniques
3. Analytical communication during placement processes
4. Professional reasoning under competitive conditions
5. Strategic aptitude performance enhancement

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

Semester 6 – Soft Skills and Aptitude VI **Course code – CLL11106**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Placement Communication & Executive Presence **(5 hours)**

1. HR interview preparation and placement communication
2. Executive communication and professional confidence
3. Group discussion and corporate interaction strategies
4. Professional body language and executive presence
5. Communication during client-facing business scenarios
6. Professional adaptability and workplace readiness

Module 2: Corporate Leadership & Strategic Interaction **(5 hours)**

1. Leadership communication in business organizations
2. Strategic decision-making and workplace coordination
3. Negotiation and persuasive communication in corporate settings
4. Professional diplomacy and stakeholder management
5. Conflict handling in workplace environments
6. Managerial communication and operational leadership

Module 3: E-Commerce Operations & Business Innovation **(5 hours)**

1. Communication in e-commerce operations and digital marketplaces
2. Business innovation and entrepreneurial communication
3. Strategic communication for startup ecosystems
4. Professional interaction during online business operations
5. Customer engagement and digital branding communication
6. Business growth communication and innovation management

Course Outcomes (COs)

CO1: Demonstrate placement readiness, executive communication, and professional interaction skills effectively.

CO2: Apply leadership communication, negotiation, and stakeholder management techniques professionally.

CO3: Develop e-commerce operational communication and business innovation competencies.

APTITUDE

Module 1: Executive Analytical Reasoning **(5 hours)**

1. Executive-level numerical reasoning
2. Strategic analytical interpretation techniques
3. Advanced decision-making methodologies
4. Operational reasoning during corporate simulations
5. Analytical adaptability during business challenges

Module 2: Leadership Aptitude & Strategic Evaluation **(5 hours)**

1. Leadership-oriented analytical thinking
2. Strategic stakeholder evaluation methods
3. Analytical coordination during operational management
4. Corporate reasoning and structured interpretation
5. Professional analytical resilience

Module 3: Corporate Problem-Solving & Aptitude **(5 hours)**

1. Advanced business-case solving methodologies
2. Professional aptitude during management situations
3. Analytical reasoning during operational decision-making
4. Structured evaluation during organizational scenarios
5. Corporate analytical effectiveness enhancement

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

Semester 7 – Soft Skills and Aptitude VII **Course code – CLL11107**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Entrepreneurship & Startup Communication **(5 hours)**

1. Entrepreneurial communication and startup interaction strategies
2. Investor pitching and business proposal communication
3. Client acquisition and business networking techniques
4. Professional communication in startup ecosystems
5. Business storytelling and entrepreneurial branding
6. Strategic communication for business growth

Module 2: Business Sustainability & Corporate Ethics **(5 hours)**

1. Corporate sustainability communication practices
2. Ethical professionalism in business environments
3. Responsible business communication and organizational accountability
4. Workplace adaptability and resilience in dynamic industries
5. Professional discipline and long-term career sustainability
6. Strategic leadership communication in business environments

Module 3: Advanced Business Problem Solving **(5 hours)**

1. Analytical thinking and business problem-solving approaches
2. Case-study evaluation and strategic interpretation
3. Decision-making communication in business operations
4. Professional reporting and analytical presentation techniques
5. Innovation-driven communication in business environments
6. Collaborative problem-solving in corporate settings

Course Outcomes (COs)

CO1: Demonstrate entrepreneurial communication and startup interaction skills effectively.

CO2: Apply sustainability communication, ethical professionalism, and strategic leadership techniques professionally.

CO3: Develop analytical thinking, business problem-solving, and decision-making communication competencies.

APTITUDE

Module 1: Strategic Business Reasoning **(5 hours)**

1. Strategic analytical interpretation in corporate environments

2. Advanced business analytics reasoning

3. Operational decision-making during organizational challenges

4. Integrated business-case evaluation techniques

5. Strategic quantitative interpretation methodologies

Module 2: Placement Analytics & Professional Assessment **(5 hours)**

1. Integrated placement aptitude assessments

2. Analytical reasoning during executive evaluations

3. Mock corporate aptitude and reasoning tests

4. Professional analytical performance enhancement

5. Strategic reasoning during placement readiness

Module 3: Industry Readiness & Executive Analytical Leadership **(5 hours)**

1. Executive-level aptitude and operational reasoning

2. Professional adaptability during evolving corporate environments

3. Strategic analytical leadership techniques

4. Business sustainability reasoning approaches

5. Long-term professional analytical effectiveness

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

Semester 8 – Soft Skills and Aptitude VIII **Course code – CLL11108**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Executive Leadership & Corporate Professionalism **(5 hours)**
1. Executive leadership communication and workplace influence
2. Strategic stakeholder engagement and managerial coordination
3. Corporate diplomacy and professional negotiation
4. Leadership readiness in business organizations
5. Executive professionalism and workplace accountability
6. Strategic workplace communication and organizational management

Module 2: Career Sustainability & Global Workplace Interaction **(5 hours)**
1. Career sustainability and long-term professional planning
2. Professional networking and corporate relationship management
3. Global workplace communication and cross-cultural interaction
4. Continuous learning and professional upskilling approaches
5. Workplace resilience and adaptability in dynamic industries
6. Professional growth and leadership sustainability

Module 3: Corporate Innovation & Business Transformation **(5 hours)**
1. Strategic communication in business environments
2. Digital transformation and business adaptability
3. Professional communication during organizational change
4. Business transformation and leadership communication
5. Corporate innovation management and stakeholder interaction
6. Professional readiness for evolving business ecosystems

Course Outcomes (COs)

CO1: Demonstrate executive leadership, workplace professionalism, and strategic communication competencies.

CO2: Apply global workplace interaction, professional networking, and career sustainability strategies effectively.

CO3: Develop innovation-driven communication and organizational transformation competencies.

APTITUDE

Module 1: Executive Corporate Analytical Leadership
(5 hours)

1. Executive strategic reasoning and operational evaluation
2. Advanced business-case interpretation techniques
3. Analytical leadership during organizational coordination
4. Professional reasoning during executive operations
5. Strategic management aptitude methodologies

Module 2: Advanced Industry-Oriented Aptitude
(5 hours)

1. Advanced placement-oriented aptitude assessments
2. Corporate analytical evaluation techniques
3. Professional reasoning under high-pressure situations
4. Strategic operational interpretation methods
5. Executive-level analytical adaptability

Module 3: Career Sustainability & Strategic Aptitude
(5 hours)

1. Long-term analytical leadership development
2. Strategic professional reasoning and adaptability
3. Executive decision-making during organizational transformation
4. Professional sustainability and analytical resilience
5. Industry-oriented strategic aptitude effectiveness

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

SOFT SKILLS & APTITUDE SYLLABUS FOR NON-NEP PROGRAM

Semester 1 – Healthcare Psychology and Communication Skills

Contact Hours – 30 hours

Theory – Professional Communication in Healthcare Settings Course Code - BP103T

(hours)

1. Communication with patients, caregivers, and interdisciplinary teams
2. Delivering difficult news and handling emotionally charged situations
3. Legal and ethical issues in health communication including confidentiality and consent
4. Writing patient records, reports, and discharge summaries
5. Use of technology and digital communication tools in healthcare services

Practical – Selected Professional Activities Course Code - BP108T

(hours)

1. Counselling a patient with chronic illness
2. Breaking bad news in a clinical setting
3. Empathetic listening in crisis response
4. Reflective listening and paraphrasing
5. Effective team communication and decision-making
6. Designing IEC materials for public health awareness
7. Conducting mock health education sessions
8. Weekly reflection on emotional responses during care simulations
9. Growth in communication skill development over the semester
10. Mental health cases in primary care
11. Impact of miscommunication in healthcare errors
12. Patient communication role-play exercises

Course Outcomes (COs)

1. CO1: Demonstrate effective professional communication in healthcare and pharmaceutical settings.
2. CO2: Apply empathy, interpersonal interaction, and patient-sensitive communication skills effectively.
3. CO3: Develop reflective communication and healthcare interaction abilities.

Semester 2 – Communication Skills & Mental Well-Being   Course Code - BP212P SEC1
Contact Hours – 30 hours
Communication Skills -   (hours)

1. Introduction to communication in pharmacy
2. Listening and observation skills workshop
3. Communicating with a patient for dispensing a prescription
4. Handling difficult conversations professionally
5. Professional email writing and documentation
6. Preparing patient information leaflets and drug labels
7. Non-verbal communication skills
8. Presentation skills and healthcare awareness presentations
9. Patient counseling practice
10. Communicating with healthcare professionals
11. Digital communication skills for pharmacists
12. Ethics and professionalism in communication

Mental Well-Being & Stress Management -   (hours)

1. Self-assessment of stress levels
2. Mindfulness breathing and reflection exercises
3. Guided meditation and emotional balance
4. Time management using Eisenhower Matrix
5. Conflict resolution role-play
6. SWOT analysis of personal behaviour and coping mechanisms
7. Cognitive restructuring for negative thoughts
8. Visualization techniques to reduce anxiety
9. Progressive muscle relaxation practice
10. Team activities for trust building and communication
11. Case study analysis in healthcare or pharma setup
12. Reflection report and gratitude practice

Course Outcomes (COs)

1. CO1: Apply professional pharmacy communication and interpersonal interaction skills effectively.
2. CO2: Demonstrate emotional resilience, stress management, and conflict handling abilities.
3. CO3: Develop patient counseling, professional ethics, and healthcare communication skills.

Semester 3 – Ethics, Universal Human Values & Internship Preparedness
Course Code - BP303T

Contact Hours – 30 hours

Module 1: Ethics and Universal Human Values
(hours)

1. Concept, definition, and need for value education
2. Application of human values in professional and personal life
3. Development of positive attitude and self-confidence
4. Harmony between self, society, and professional responsibilities
5. Professional ethics in pharmaceutical and healthcare industries

Module 2: Internship Preparedness Program
(hours)

1. Understanding internship expectations in pharmaceutical industries
2. Professional workplace behaviour and discipline
3. Communication etiquette during internships
4. Professional documentation and internship reporting
5. Introduction to resume basics and professional profiles
6. Presentation of internship learning and reflective reporting
7. Professional interaction with mentors and supervisors

Module 3: Professional Communication & Presentation
(hours)

1. Presentation structuring techniques
2. Communication clarity and confidence enhancement
3. Professional interaction and teamwork
4. Case-based communication exercises
5. Healthcare and pharmaceutical workplace communication

Course Outcomes (COs)

1. CO1: Demonstrate ethical awareness and professional responsibility in healthcare environments.
2. CO2: Develop internship preparedness and professional workplace communication skills.
3. CO3: Apply presentation, teamwork, and professional interaction abilities effectively.

Semester 4 – Leadership, Professional Behaviour & Industry Communication
Course Code - BP411T

Contact Hours – 30 hours

Module 1: Leadership & Team Dynamics
(5 hours)

1. Leadership communication and collaboration
2. Team coordination and accountability
3. Confidence building and executive presence
4. Problem-solving and workplace adaptability
5. Professional discipline in pharmaceutical environments

Module 2: Industry Communication & Workplace Readiness
(5 hours)

1. Professional communication in pharmaceutical industries
2. Formal communication and documentation
3. Corporate interaction and workplace etiquette
4. Healthcare product communication basics
5. Professional networking and collaboration

Module 3: Professional Presentation & Communication Skills
(5 hours)

1. Presentation and public speaking techniques
2. Communication clarity and audience engagement
3. Healthcare and pharmaceutical case discussions
4. Professional interaction and confidence management
5. Group communication and collaborative tasks

Course Outcomes (COs)

1. CO1: Demonstrate leadership, collaboration, and workplace professionalism effectively.
2. CO2: Apply industry communication and professional interaction skills in pharmaceutical settings.
3. CO3: Develop presentation, public speaking, and communication confidence abilities.

APTITUDE

Module 1: Advanced Quantitative Aptitude
(5 hours)

1. Probability and advanced arithmetic applications
2. Geometry, mensuration, and quantitative interpretation
3. Advanced analytical calculation techniques
4. Operational reasoning methodologies
5. Time-bound aptitude-solving approaches

Module 2: Critical Reasoning & Decision-Making
(5 hours)

1. Critical reasoning and analytical deduction
2. Puzzle-solving and structured analytical frameworks
3. Decision-making during complex scenarios
4. Logical evaluation and reasoning coordination
5. Strategic interpretation techniques

Module 3: Applied Analytical Leadership
(5 hours)

1. Analytical leadership during academic operations
2. Strategic problem-solving and adaptability
3. Collaborative reasoning and structured interaction
4. Operational effectiveness during multidisciplinary environments
5. Professional analytical resilience

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

Semester 5 – Career Awareness & Internship Preparation Course Code – BP511T

Contact Hours – 30 hours

Module 1: Career Readiness & Industry Exposure (5 hours)

1. Understanding pharmaceutical industry expectations
2. Employability skills and workplace preparedness
3. Professional networking and communication etiquette
4. Career awareness in healthcare and pharmaceutical sectors
5. Workplace adaptability and accountability

Module 2: Advanced Internship Preparedness (5 hours)

1. Resume and CV preparation for internships
2. Group discussion techniques and communication strategies
3. Professional email communication and documentation
4. Interview preparation for internships
5. Professional presentation and self-branding

Module 3: Professional Development & Workplace Interaction (5 hours)

1. Workplace communication standards
2. Professional body language and confidence
3. Collaborative communication and teamwork
4. Problem-solving and workplace coordination
5. Professional ethics and responsible behaviour

Course Outcomes (COs)

1. CO1: Develop career awareness and industry preparedness aligned with pharmaceutical sectors.
2. CO2: Demonstrate internship readiness through resume, GD, and interview communication skills.
3. CO3: Apply workplace professionalism, teamwork, and communication skills effectively.

APTITUDE

Module 1: Placement Aptitude Preparation
(5 hours)

1. Placement-oriented aptitude-solving techniques
2. Analytical interpretation under assessment conditions
3. Structured reasoning during aptitude evaluations
4. Decision-making and workplace reasoning
5. Strategic aptitude performance enhancement

Module 2: Advanced Data & Analytical Interpretation
(5 hours)

1. Advanced data interpretation and analytical comparison
2. Statistical reasoning and operational evaluation
3. Analytical interpretation during professional scenarios
4. Structured quantitative communication techniques
5. Professional analytical effectiveness enhancement

Module 3: Professional Problem Solving & Operational Reasoning
(5 hours)

1. Operational problem-solving methodologies
2. Strategic adaptability and analytical resilience
3. Collaborative reasoning during institutional operations
4. Professional accountability in multidisciplinary environments
5. Analytical interaction and structured evaluation

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

Semester 6 – Scientific Writing, Placement Readiness & Professional Skills
Course Code - BP612T

Contact Hours – 30 hours

Scientific Writing & Research Communication
(hours)

1. Principles of scientific writing
2. Scientific research documentation
3. Literature review and research reporting
4. Scientific citation and referencing
5. Ethics in scientific writing and publication

Placement Readiness & Professional Communication

1. Resume and CV writing for placements
2. Group discussion and mock interview preparation
3. Professional email writing and executive communication
4. LinkedIn profile development and professional branding
5. Workplace scenario simulations and communication under pressure

Professional Skills Development
(hours)

1. Public speaking and presentation skills
2. Conflict resolution and workplace coordination
3. Listening and analytical communication exercises
4. Goal setting and career mapping
5. Professional adaptability and workplace behaviour

Course Outcomes (COs)

1. CO1: Develop scientific writing, documentation, and research communication abilities.
2. CO2: Demonstrate placement readiness through GD, mock interview, and professional branding skills.
3. CO3: Apply professional communication, presentation, and workplace interaction skills effectively.

Semester 7 – Industry Readiness & Strategic Professional Development Course Code – BP711T

Module 1: Industry Readiness
(5 hours)

1. Understanding pharmaceutical corporate culture
2. Advanced workplace professionalism
3. Strategic communication and professional networking
4. Career adaptability in pharmaceutical industries
5. Corporate expectations and leadership readiness

Module 2: Placement Communication & Professional Skills
(5 hours)

1. Advanced GD and interview communication
2. Professional presentation and executive interaction
3. Corporate communication and workplace etiquette
4. Mock interviews and placement simulations
5. Professional confidence and executive presence

Module 3: Strategic Problem Solving & Career Development
(5 hours)

1. Industry case study discussions
2. Analytical thinking and workplace decision-making
3. Collaborative problem-solving techniques
4. Professional accountability and leadership
5. Career progression planning and workplace sustainability

Course Outcomes (COs)

1. CO1: Demonstrate industry readiness and workplace professionalism in pharmaceutical sectors.
2. CO2: Apply placement communication, GD, and interview skills effectively.
3. CO3: Develop strategic thinking, leadership, and professional adaptability abilities.

APTITUDE

Module 1: Industry-Oriented Analytical Aptitude
(5 hours)

1. Integrated aptitude-solving during placement simulations
2. Advanced analytical interpretation and structured evaluation
3. Strategic problem-solving during operational scenarios
4. Decision-making during multidisciplinary environments
5. Executive analytical effectiveness techniques

Module 2: Advanced Placement Readiness & Competitive Reasoning
(5 hours)

1. Mock aptitude assessments and analytical diagnostics
2. Professional reasoning under competitive conditions
3. Strategic aptitude coordination during assessments
4. Operational interpretation and workplace reasoning
5. Advanced analytical adaptability and resilience

Module 3: Career Sustainability & Executive Analytical Leadership
(5 hours)

1. Long-term professional analytical growth
2. Strategic reasoning during organizational transformation
3. Professional adaptability in evolving industry ecosystems
4. Executive-level aptitude and leadership readiness
5. Industry-oriented analytical sustainability approaches

Course Outcomes (COs)
CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

COMMUNICATIVE ENGLISH SYLLABUS FOR NON-NEP PROGRAMS

SEMESTER 1 – COMMUNICATIVE ENGLISH I **COURSE CODE – AEC101**

CONTACT HOURS – 30 HOURS

Module 1: Functional English & Language Basics

(10 Hours)

1. Introduction to functional English usage in academic environments
2. Sentence formation and common sentence errors
3. Subject–Verb Agreement and practical grammar usage
4. Prepositions and Prepositional Phrases in communication
5. Vocabulary building through contextual speaking and usage

Module 2: Spoken Communication & Confidence Building

(10 Hours)

1. Fundamentals of verbal and non-verbal communication
2. Breaking communication anxiety and stage fear
3. Pronunciation, articulation, and fluency improvement
4. Listening comprehension and interpretation skills
5. Introduction to storytelling and structured speaking

Module 3: Applied Grammar & Written Communication

(10 Hours)

1. Active and Passive voice transformation
2. Basic Narration and Sentence transformation techniques
3. Idioms, Phrases, and practical expression building
4. Professional email drafting and paragraph writing
5. Digital etiquette and responsible communication practices

Course Outcomes –

CO1: Develop foundational English communication skills with improved grammatical accuracy and confidence.

CO2: Demonstrate effective verbal interaction, listening ability, and structured speaking techniques.

CO3: Apply functional written communication, digital etiquette, and practical language usage in academic contexts.

SEMESTER 2 – COMMUNICATIVE ENGLISH II COURSE CODE – AEC102

CONTACT HOURS – 30 HOURS

Module 1: Advanced Grammar & Professional Language Usage (10 Hours)

1. Advanced Subject–Verb Agreement and sentence refinement
2. Complex sentence structuring and coherence development
3. Advanced Voice change and Narration techniques
4. Idiomatic expressions and professional vocabulary enhancement
5. Functional business and workplace English usage

Module 2: Analytical Speaking & Interactive Communication (10 Hours)

1. Group discussion strategies and participation techniques
2. Persuasive speaking and opinion expression
3. Analytical listening and interpretation skills
4. Public speaking with logical sequencing of ideas
5. Presentation structuring and audience engagement

Module 3: Workplace Writing & Professional Communication (10 Hours)

1. Professional correspondence and formal drafting
2. Report writing and structured documentation basics
3. Workplace communication etiquette and standards
4. Meeting communication and professional interaction
5. Digital professionalism and communication ethics

Course Outcomes -

CO1: Apply advanced grammar, structured expression, and professional vocabulary effectively in communication.

CO2: Demonstrate analytical speaking, presentation, and interactive communication competencies confidently.

CO3: Develop workplace-ready writing, professional correspondence, and formal communication skills.

SOFT SKILLS AND APTITUDE SYLLABUS FOR NON- NEP PROGRAMS

SEMESTER 1 – SOFT SKILLS AND APTITUDE I COURSE CODE – CLL151

CONTACT HOURS – 30 HOURS

SOFT SKILL

Module 1: Self Awareness & Personal Growth

(5 Hours)

1. Understanding personality traits and behavioral styles
2. Identifying strengths, interests, and growth areas
3. Growth mindset and self-motivation techniques
4. Goal setting and personal accountability
5. Positive attitude and adaptability development

Module 2: Professional Discipline & Learning Behavior

(5 Hours)

1. Professional discipline in higher education
2. Time management and productivity habits
3. Responsibility and accountability in team environments
4. Professional ethics and behavioral expectations
5. Building confidence and learning consistency

Module 3: Team Interaction & Creative Thinking

(5 Hours)

1. Collaborative participation and peer interaction
2. Introduction to creative thinking approaches
3. Interpersonal understanding and cooperation
4. Problem-solving mindset development
5. Social confidence in group environments

Course Outcome (COs):

CO1: Demonstrate self-awareness, personal accountability, and a growth-oriented mindset to enhance personal effectiveness and continuous learning.

CO2: Apply professional discipline, ethical behaviour, time management, and responsible work practices in academic and collaborative environments.

CO3: Develop teamwork, interpersonal interaction, creative thinking, and problem-solving abilities to contribute effectively to group and professional settings.

APTITUDE

Module 1: Numerical Foundations & Arithmetic Skills **(5 Hours)**

1. Basic numerical operations and arithmetic reasoning
2. Percentage, ratio, proportion, and simplification techniques
3. Quantitative comparison and analytical calculation methods
4. Foundational financial arithmetic applications
5. Structured numerical problem-solving approaches

Module 2: Foundational Logical Reasoning **(5 Hours)**

1. Analogy and classification techniques
2. Coding-decoding and logical sequencing
3. Direction sense and pattern recognition
4. Basic logical interpretation techniques
5. Analytical observation and reasoning accuracy

Module 3: Business Problem-Solving Foundations **(5 Hours)**

1. Foundational decision-making techniques
2. Basic business-case interpretation
3. Structured reasoning during operational scenarios
4. Analytical thinking and quantitative interpretation
5. Reasoning speed and accuracy enhancement

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

Semester 2 – Soft Skills and Aptitude II **Course code – CLL152**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Workplace Professionalism & Biotechnology Interaction **(5 hours)**

1. Professional communication in laboratory and biotechnology environments
2. Professional identity development for biotechnology careers
3. Laboratory discipline and workplace accountability
4. Professional etiquette and executive presence
5. Team collaboration in scientific environments
6. Stakeholder interaction and workplace adaptability

Module 2: Technical Documentation & Scientific Reporting **(5 hours)**

1. Scientific report writing and laboratory documentation
2. Research note preparation and structured communication
3. Technical reporting and analytical explanation
4. Professional presentation and scientific interaction
5. Communication during laboratory workflows
6. Professional ethics in biotechnology environments

Module 3: Internship Readiness & Scientific Collaboration **(5 hours)**

1. Internship professionalism and industrial adaptability
2. Resume development and biotechnology profile building
3. Professional networking and collaborative interaction
4. Scientific discussion and multidisciplinary communication
5. Confidence building in laboratory and research environments
6. Professional responsibility during technical operations

Course Outcomes (COs)

CO1: Demonstrate professional workplace behaviour and biotechnology interaction skills effectively.

CO2: Apply technical documentation and scientific reporting practices responsibly.

CO3: Develop internship readiness, scientific collaboration, and professional adaptability competencies.

APTITUDE

Module 1: Arithmetic Applications & Quantitative Interpretation (5 hours)

1. Profit-loss and discount applications

2. Simple and compound interest calculations

3. Averages, mixtures, and allegation concepts

4. Quantitative interpretation and comparison techniques

5. Analytical simplification approaches

Module 2: Logical & Critical Reasoning (5 hours)

1. Logical deduction and structured interpretation

2. Syllogism and Venn diagram applications

3. Seating arrangement and analytical reasoning

4. Critical reasoning and structured problem-solving

5. Decision-making during business situations

Module 3: Business Analytical Aptitude (5 hours)

1. Business data interpretation techniques

2. Operational reasoning and analytical comparison

3. Timework and productivity calculations

4. Analytical communication of quantitative findings

5. Strategic aptitude-solving approaches

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and business problem-solving competencies effectively.

CO2: Apply structured logical reasoning, data interpretation, and strategic decision-making techniques professionally.

CO3: Develop placement-oriented corporate aptitude, analytical leadership, and executive reasoning competencies.

Semester 3 – Soft Skills and Aptitude III **Course code – CLL251**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Scientific & Professional Communication **(5 Hours)**
1. Communication in laboratories, research environments, GIS and geospatial workspaces, analytical centers, and scientific institutions

2. Scientific observation, interpretation, and professional interaction basics

3. Technical explanation and presentation of scientific concepts

4. Professional communication in multidisciplinary scientific environments

5. Listening, analytical interpretation, and response management in scientific discussions

Module 2: Scientific Documentation & Academic Communication **(5 Hours)**
1. Scientific report writing and documentation fundamentals

2. Research note preparation and technical communication

3. Professional email and scientific reporting standards

4. Vocabulary enhancement for scientific and analytical disciplines

5. Reading comprehension and interpretation of scientific content

Module 3: Internship Interview & Professional Readiness **(5 Hours)**
1. Internship interview communication for scientific and analytical sectors

2. Professional introduction and scientific identity building

3. Professional body language and presentation etiquette

4. Resume basics and academic profile development

5. Workplace communication standards in laboratories and research organizations

Course Outcomes (COs)

CO1: Demonstrate professional communication skills required for laboratories, research environments, analytical centers, and scientific institutions.

CO2: Apply scientific documentation, report writing, and structured communication techniques effectively in academic and professional settings.

CO3: Prepare for internships through interview communication, profile building, professional interaction, and scientific presentation skills.

APTITUDE

Module 1: Data Interpretation & Analytical Evaluation (5 Hours)

1. Table-based and graphical data interpretation
2. Pie charts, bar graphs, and line graph analysis
3. Comparative analytical interpretation techniques
4. Data-driven analytical reasoning
5. Structured interpretation of operational datasets

Module 2: Analytical Reasoning & Data Sufficiency (5 Hours)

1. Data sufficiency interpretation methods
2. Logical evaluation and analytical deduction
3. Quantitative interpretation during analytical scenarios
4. Decision-making using structured analytical approaches
5. Problem-solving under operational conditions

Module 3: Domain-Based Problem Solving (5 Hours)

1. Analytical reasoning during discipline-oriented situations
2. Research-oriented interpretation methodologies
3. Structured operational problem-solving
4. Analytical adaptability during academic workflows
5. Strategic interpretation and effectiveness of aptitude

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

Semester 4 – Soft Skills and Aptitude IV **Course code – CLL252**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Professional Presentation & Technical Communication **(5 Hours)**
1. Public speaking and scientific presentation techniques
2. Presentation structuring for technical and analytical subjects
3. Explaining scientific and mathematical concepts to interdisciplinary audiences
4. Group discussion and collaborative scientific communication
5. Professional interaction in research and analytical environments

Module 2: Ethics, Leadership & Scientific Team Dynamics **(5 Hours)**
1. Ethical practices in scientific research and analytical environments
2. Leadership and accountability in scientific workflows
3. Team coordination and multidisciplinary collaboration
4. Conflict handling and professional decision-making
5. Analytical reasoning and responsibility in scientific projects

Module 3: Internship Orientation & Workplace Preparedness **(5 Hours)**
1. Understanding internship expectations in scientific and industrial sectors
2. Professional behavior during laboratory and research internships
3. Workplace adaptability and project accountability
4. Communication with supervisors, scientific teams, and technical stakeholders
5. Professional discipline and reporting hierarchy in scientific organizations

Course Outcomes (COs)

CO1: Demonstrate presentation, interpersonal interaction, and technical communication skills with professional confidence.

CO2: Apply ethical decision-making, leadership qualities, teamwork, and responsible behaviour in scientific and analytical environments.

CO3: Develop internship readiness through workplace professionalism, communication ethics, adaptability, and professional accountability.

APTITUDE

Module 1: Advanced Quantitative Aptitude **(5 Hours)**

1. Probability and advanced arithmetic applications
2. Geometry, mensuration, and quantitative interpretation
3. Advanced analytical calculation techniques
4. Operational reasoning methodologies
5. Time-bound aptitude-solving approaches

Module 2: Critical Reasoning & Decision-Making **(5 Hours)**

1. Critical reasoning and analytical deduction
2. Puzzle-solving and structured analytical frameworks
3. Decision-making during complex scenarios
4. Logical evaluation and reasoning coordination
5. Strategic interpretation techniques

Module 3: Applied Analytical Leadership **(5 Hours)**

1. Analytical leadership during academic operations
2. Strategic problem-solving and adaptability
3. Collaborative reasoning and structured interaction
4. Operational effectiveness during multidisciplinary environments
5. Professional analytical resilience

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

Semester 5 – Soft Skills and Aptitude V **Course code – CLL351**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Industry Readiness & Employability Skills **(5 Hours)**
1. Understanding scientific, environmental, geospatial, analytical, and research industry expectations

2. Workplace professionalism and adaptability in scientific sectors

3. Communication in multidisciplinary technical and research teams

4. Professional networking and stakeholder relationship management

5. Accountability and ownership in research and analytical projects

6. Career awareness in scientific and applied science industries

Module 2: Resume, SOP & Professional Branding **(5 Hours)**
1. Advanced resume and scientific portfolio development

2. SOP and academic profile writing

3. LinkedIn and professional profile optimization

4. Personal branding and professional communication image

5. Email etiquette for placements, internships, and research correspondence

6. Professional portfolio presentation and documentation

Module 3: Group Discussion & Workplace Communication **(5 Hours)**
1. Group discussion techniques for scientific and analytical industries

2. Meeting etiquette and professional interaction

3. Team communication effectiveness in research environments

4. Professional negotiation and stakeholder communication basics

5. Handling workplace pressure and project deadlines

Course Outcomes (COs)

CO1: Develop employability skills, workplace professionalism, and collaborative communication abilities aligned with scientific and analytical sectors.

CO2: Prepare professional resumes, SOPs, portfolios, and professional profiles for internships and placement opportunities.

CO3: Demonstrate group discussion, workplace communication, negotiation, and professional interaction skills effectively in organizational settings.

APTITUTE

Module 1: Placement Aptitude Preparation **(5 Hours)**

1. Placement-oriented aptitude-solving techniques
2. Analytical interpretation under assessment conditions
3. Structured reasoning during aptitude evaluations
4. Decision-making and workplace reasoning
5. Strategic aptitude performance enhancement

Module 2: Advanced Data & Analytical Interpretation **(5 Hours)**

1. Advanced data interpretation and analytical comparison
2. Statistical reasoning and operational evaluation
3. Analytical interpretation during professional scenarios
4. Structured quantitative communication techniques
5. Professional analytical effectiveness enhancement

Module 3: Professional Problem Solving & Operational Reasoning **(5 Hours)**

1. Operational problem-solving methodologies
2. Strategic adaptability and analytical resilience
3. Collaborative reasoning during institutional operations
4. Professional accountability in multidisciplinary environments
5. Analytical interaction and structured evaluation

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

Semester 6 – Soft Skills and Aptitude VI **Course code – CLL451**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Interview Skills & Placement Communication **(5 Hours)**
1. HR interview preparation for scientific and technical industries
2. Technical and non-technical interview communication
3. Confidence building and executive presence
4. Corporate communication standards in research and industrial organizations
5. Handling difficult interviews and technical interaction scenarios
6. Professional adaptability and career planning

Module 2: Advanced Workplace Communication **(5 Hours)**
1. Corporate communication etiquette in scientific and industrial environments
2. Professional presentations and analytical reporting
3. Workplace conflict management in technical teams
4. Strategic communication and collaborative coordination
5. Communication under research and workplace pressure
6. Professional decision-making in scientific workflows

Module 3: Career Transition & Professional Sustainability **(5 Hours)**
1. Transition from student to scientific professional
2. Workplace ethics and professional responsibilities
3. Professional resilience and adaptability in dynamic scientific environments
4. Long-term career planning in applied science sectors
5. Professional networking and relationship management

Course Outcomes (COs)

CO1: Demonstrate interview preparedness, professional confidence, executive presence, and corporate communication skills for placement opportunities.

CO2: Apply advanced workplace communication, presentation, conflict management, collaboration, and professional decision-making skills effectively.

CO3: Develop career adaptability, workplace resilience, ethical professionalism, and lifelong learning orientation for sustainable professional growth.

APTITUDE

Module 1: Executive Quantitative & Logical Aptitude **(5 Hours)**

1. Executive-level quantitative reasoning
2. Advanced logical interpretation techniques
3. Strategic operational reasoning approaches
4. Professional analytical evaluation under pressure situations
5. Advanced aptitude-solving methodologies

Module 2: Leadership Aptitude & Strategic Decision-Making **(5 Hours)**

1. Leadership-oriented analytical reasoning
2. Strategic decision-making and analytical coordination
3. Problem-solving during organizational operations
4. Operational adaptability and analytical effectiveness
5. Professional resilience during complex environments

Module 3: Advanced Professional Analytical Competencies **(5 Hours)**

1. Advanced reasoning during professional scenarios
2. Strategic aptitude communication techniques
3. Analytical coordination during multidisciplinary operations
4. Structured interpretation during executive evaluations
5. Professional readiness for placement-oriented assessments

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and structured interpretation competencies effectively.

CO2: Apply logical reasoning, strategic problem-solving, and operational analytical techniques professionally.

CO3: Develop placement-oriented aptitude, executive analytical readiness, and industry-oriented reasoning competencies.

PROFESSIONAL ENGLISH SYLLABUS FOR NON-NEP PROGRAMS

Semester 3 - Professional English – I **Course Code: LWJ11201**
Contact Hours - 30

Module 1: Foundational Legal Communication
10 hours
1. Fundamentals of professional verbal and non-verbal communication
2. Grammar enhancement and sentence structuring
3. Professional vocabulary development for legal communication
4. Listening, narration, and interpretation skills
5. Reading comprehension of legal and policy-based content

Module 2: Academic & Professional Writing
10 hours
1. Professional email drafting and legal correspondence basics
2. Paragraph and summary writing techniques
3. Formal and professional communication styles
4. Structured articulation and communication clarity
5. Communication ethics in academic and institutional environments

Module 3: Professional Expression & Confidence Development
10 hours
1. Professional self-introduction and articulation
2. Stage confidence and public speaking fundamentals
3. Presentation structuring techniques
4. Basic legal storytelling and explanation skills
5. Collaborative communication practices

Course Outcomes (COs)

CO1: Demonstrate competencies aligned with professional english - i requirements.

CO2: Apply advanced professional communication and analytical articulation techniques effectively.

CO3: Develop industry-oriented legal professionalism and executive communication competencies.

Semester 3 – Professional Aptitude and Skills I Course Code – LWJ11221
Contact Hours – 15 hours

Module 1: Numerical & Quantitative Foundations
5 hours
1. Basic numerical operations and arithmetic reasoning
2. Percentage, ratio, proportion, and legal-data interpretation basics
3. Quantitative comparison techniques
4. Structured analytical calculation approaches
5. Interpretation of numerical legal and policy-oriented data

Module 2: Foundational Legal Reasoning
5 hours
1. Analogy and classification in legal reasoning
2. Basic coding-decoding and pattern recognition
3. Direction sense and analytical interpretation
4. Blood relation and logical association techniques
5. Foundational critical reasoning for legal environments

Module 3: Logical Interpretation & Problem Solving
5 hours
1. Structured logical interpretation techniques
2. Analytical observation and reasoning fundamentals
3. Problem-solving approaches in legal environments
4. Basic decision-making and analytical thinking
5. Logical accuracy and reasoning speed development

Course Outcomes (COs)
CO1: Demonstrate quantitative aptitude, analytical reasoning, and legal interpretation competencies effectively.

CO2: Apply structured legal reasoning, problem-solving, and analytical decision-making techniques professionally.

CO3: Develop placement-oriented legal aptitude, strategic reasoning, and professional analytical competencies.

Semester 4 - Professional English – II **Course Code: LWJ11202**
Contact Hours - 30

Module 1: Legal Communication & Interpretation
10 hours
1. Professional articulation in legal and institutional environments
2. Interpretation of legal documents and case materials
3. Advanced vocabulary enhancement for legal environments
4. Analytical reading and comprehension techniques
5. Professional communication during academic discussions

Module 2: Presentation & Persuasive Communication
10 hours
1. Presentation communication and audience engagement
2. Persuasive speaking and professional articulation
3. Structured legal explanation techniques
4. Communication clarity during legal interaction
5. Professional presentation ethics and discipline

Module 3: Legal Writing & Documentation
10 hours
1. Structured legal writing and reporting practices
2. Professional drafting techniques
3. Analytical explanation and written articulation
4. Professional correspondence in legal environments
5. Documentation clarity and communication precision

Course Outcomes (COs)

CO1: Demonstrate competencies aligned with professional english - ii requirements.

CO2: Apply advanced professional communication and analytical articulation techniques effectively.

CO3: Develop industry-oriented legal professionalism and executive communication competencies.

Semester 4 – Professional Aptitude and Skills II Course Code – LWJ11222
Contact Hours – 15 hours

Module 1: Analytical Quantitative Applications
5 hours

1. Arithmetic applications in legal and administrative contexts
2. Time-work and operational interpretation
3. Averages, mixtures, and structured quantitative reasoning
4. Analytical simplification and comparative evaluation
5. Quantitative interpretation under professional conditions

Module 2: Intermediate Logical & Legal Reasoning
5 hours

1. Syllogism and logical deduction techniques
2. Seating arrangement and structured legal interpretation
3. Venn diagrams and analytical comparison
4. Critical reasoning in legal scenarios
5. Decision-making and reasoning accuracy

Module 3: Legal Problem Solving & Interpretation
5 hours

1. Structured interpretation of legal situations
2. Analytical approaches to legal case reasoning
3. Problem-solving under legal and institutional contexts
4. Logical communication and analytical response management
5. Strategic aptitude-solving approaches

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and legal interpretation competencies effectively.

CO2: Apply structured legal reasoning, problem-solving, and analytical decision-making techniques professionally.

CO3: Develop placement-oriented legal aptitude, strategic reasoning, and professional analytical competencies.

Semester 5: Professional English – III **Course Code: LWJ11203**
Contact Hours – 30 hours

Module 1: Courtroom & Advocacy Communication
10 hours
1. Professional courtroom communication practices
2. Advocacy-oriented articulation techniques
3. Public speaking and persuasive legal communication
4. Professional confidence during legal interaction
5. Communication during legal argument presentation

Module 2: Corporate Legal Communication
10 hours
1. Corporate communication in legal environments
2. Professional interaction during client consultation
3. Communication during arbitration and mediation discussions
4. Stakeholder-oriented communication techniques
5. Professional etiquette in corporate legal settings

Module 3: Legal Presentation & Professional Expression
10 hours
1. Case presentation and structured articulation
2. Visual and verbal communication techniques
3. Professional explanation of legal scenarios
4. Communication during legal presentations and reviews
5. Professional networking communication practices

Course Outcomes (COs)

CO1: Demonstrate competencies aligned with professional english - iii requirements.

CO2: Apply advanced professional communication and analytical articulation techniques effectively.

CO3: Develop industry-oriented legal professionalism and executive communication competencies.

Semester 5 – Professional Aptitude and Skills II **Course Code – LWJ11223**
Contact Hours – 15 hours

Module 1: Legal Data Interpretation Techniques
5 hours

1. Table-based and graphical legal data interpretation
2. Comparative legal and policy data analysis
3. Pie charts, bar graphs, and analytical evaluation
4. Analytical reasoning using structured information
5. Decision-making through legal-data interpretation

Module 2: Critical Legal Analysis & Reasoning
5 hours

1. Critical reasoning in litigation and legal interpretation
2. Logical deduction and structured argument analysis
3. Analytical comparison and legal evaluation techniques
4. Interpretation of legal facts and reasoning frameworks
5. Professional analytical accuracy under time constraints

Module 3: Strategic Legal Aptitude
5 hours

1. Analytical interpretation in corporate legal environments
2. Professional aptitude-solving during legal operations
3. Logical evaluation in administrative and institutional environments
4. Structured decision-making and operational reasoning
5. Professional accountability in analytical interpretation

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and legal interpretation competencies effectively.

CO2: Apply structured legal reasoning, problem-solving, and analytical decision-making techniques professionally.

CO3: Develop placement-oriented legal aptitude, strategic reasoning, and professional analytical competencies.

Semester 6: Professional English – IV **Course Code: LWJ11204**
Contact Hours – 30 Hours

Module 1: Strategic Legal Communication
10 hours
1. Strategic communication during complex legal situations
2. Analytical articulation and legal interpretation
3. Professional interaction during legal negotiations
4. Communication during institutional coordination
5. Professional diplomacy in legal environments

Module 2: Research & Analytical Writing
10 hours
1. Research-oriented legal writing techniques
2. Analytical reporting and structured explanation
3. Professional interpretation of legal and policy frameworks
4. Communication during academic and legal research
5. Professional drafting for institutional environments

Module 3: Executive Presentation & Interaction
10 hours
1. Executive communication and professional articulation
2. Professional body language and executive presence
3. Communication during professional reviews and evaluations
4. Advanced presentation structuring techniques
5. Communication confidence in legal environments

Course Outcomes (COs)

CO1: Demonstrate competencies aligned with professional english - iv requirements.

CO2: Apply advanced professional communication and analytical articulation techniques effectively.

CO3: Develop industry-oriented legal professionalism and executive communication competencies.

Semester 6 – Professional Aptitude and Skills III **Course Code – LWJ11224**
Contact Hours – 15 hours

Module 1: Advanced Quantitative & Analytical Reasoning
5 hours
1. Advanced arithmetic and operational reasoning
2. Probability and structured legal data analysis
3. Complex numerical interpretation techniques
4. Analytical comparison under pressure situations
5. Advanced aptitude-solving methodologies

Module 2: Critical Legal Reasoning & Decision-Making
5 hours
1. Advanced legal reasoning and analytical deduction
2. Critical interpretation of institutional scenarios
3. Complex puzzle-solving and analytical frameworks
4. Strategic decision-making in legal environments
5. Professional reasoning during legal operations

Module 3: Advanced Verbal & Logical Interpretation
5 hours
1. Advanced reading comprehension for legal environments
2. Para-jumbles and structured legal articulation
3. Analytical verbal interpretation techniques
4. Professional reasoning communication accuracy
5. Legal analytical interpretation under time constraints

Course Outcomes (COs)
CO1: Demonstrate quantitative aptitude, analytical reasoning, and legal interpretation competencies effectively.

CO2: Apply structured legal reasoning, problem-solving, and analytical decision-making techniques professionally.

CO3: Develop placement-oriented legal aptitude, strategic reasoning, and professional analytical competencies.

Semester 7: Professional English – V **Course Code: LWJ11205**
Contact Hours – 30 Hours

Module 1: Professional Legal Networking & Communication
10 hours
1. Strategic professional communication in legal practice
2. Professional networking and stakeholder interaction
3. Client-facing communication techniques
4. Professional etiquette in legal firms and organizations
5. Communication during multidisciplinary collaboration

Module 2: Advanced Legal Documentation
10 hours
1. Advanced legal drafting and documentation practices
2. Professional written articulation in legal environments
3. Communication during documentation and workflow management
4. Analytical interpretation of legal case materials
5. Structured legal reporting techniques

Module 3: Leadership Communication in Legal Practice
10 hours
1. Leadership communication in legal environments
2. Professional articulation during legal coordination
3. Communication during team interaction and collaboration
4. Decision-making communication practices
5. Professional accountability and organizational interaction

Course Outcomes (COs)

CO1: Demonstrate competencies aligned with professional english - v requirements.

CO2: Apply advanced professional communication and analytical articulation techniques effectively.

CO3: Develop industry-oriented legal professionalism and executive communication competencies.

Semester 7 – Professional Aptitude and Skills IV Course Code – LWJ11225
Contact Hours – 15 hours

Module 1: Corporate Legal Analytical Skills
5 hours

1. Corporate legal aptitude and operational reasoning
2. Analytical interpretation during legal workflow management
3. Strategic legal-data evaluation techniques
4. Professional reasoning during client-oriented scenarios
5. Analytical coordination in multidisciplinary environments

Module 2: Placement-Oriented Legal Aptitude
5 hours

1. Placement-oriented aptitude-solving strategies
2. Analytical interpretation under assessment conditions
3. Professional aptitude communication and response management
4. Mock aptitude-solving and reasoning evaluation
5. Decision-making and legal workplace reasoning

Module 3: Institutional Problem Solving & Professional Effectiveness
5 hours

1. Professional problem-solving during institutional operations
2. Strategic adaptability and analytical resilience
3. Professional accountability in legal environments
4. Operational effectiveness and reasoning coordination
5. Collaborative analytical interaction techniques

Course Outcomes (COs)
CO1: Demonstrate quantitative aptitude, analytical reasoning, and legal interpretation competencies effectively.

CO2: Apply structured legal reasoning, problem-solving, and analytical decision-making techniques professionally.

CO3: Develop placement-oriented legal aptitude, strategic reasoning, and professional analytical competencies.

Semester 8: Professional English – VI **Course Code: LWJ11206**
Contact Hours – 30 hours

Module 1: Crisis & Conflict Communication
10 hours
1. Communication during high-pressure legal situations
2. Crisis-oriented articulation and professional response management
3. Conflict communication and professional negotiation
4. Communication during legal risk evaluation
5. Strategic interaction in complex legal environments

Module 2: Corporate Presentation & Legal Consulting Communication
10 hours
1. Corporate-style legal presentation techniques
2. Professional articulation during consulting interaction
3. Communication during legal case evaluation
4. Structured presentation for professional audiences
5. Professional communication during legal consulting practices

Module 3: Global Legal Communication & Professional Adaptability
10 hours
1. Global workplace communication practices
2. Cross-cultural interaction in legal environments
3. Professional adaptability in evolving legal ecosystems
4. Advanced professional etiquette and communication standards
5. Professional readiness for global legal environments

Course Outcomes (COs)

CO1: Demonstrate competencies aligned with professional english - vi requirements.

CO2: Apply advanced professional communication and analytical articulation techniques effectively.

CO3: Develop industry-oriented legal professionalism and executive communication competencies.

Semester 8 – Professional Aptitude and Skills VI Course Code – LWJ11226
Contact Hours – 15 hours

Module 1: Strategic Legal Analysis & High-Level Reasoning
5 hours

1. Advanced strategic reasoning and analytical interpretation
2. Legal risk analysis and structured evaluation techniques
3. Complex institutional problem-solving approaches
4. Operational decision-making in legal ecosystems
5. Professional analytical effectiveness during crisis situations

Module 2: Leadership Aptitude & Professional Coordination
5 hours

1. Leadership-oriented analytical thinking
2. Professional coordination during institutional operations
3. Strategic stakeholder management and analytical interaction
4. Operational adaptability and professional resilience
5. Collaborative leadership and organizational effectiveness

Module 3: Advanced Placement Readiness & Professional Sustainability
5 hours

1. Advanced aptitude-solving during professional evaluations
2. Analytical communication during high-pressure environments
3. Career sustainability and professional adaptability
4. Professional readiness for evolving legal ecosystems
5. Strategic professional growth and long-term effectiveness

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, analytical reasoning, and legal interpretation competencies effectively.

CO2: Apply structured legal reasoning, problem-solving, and analytical decision-making techniques professionally.

CO3: Develop placement-oriented legal aptitude, strategic reasoning, and professional analytical competencies.

Semester 9: Professional English – VII **Course Code: LWJ11207**
Contact Hours – 30 hours

Module 1: Executive Leadership Communication
10 hours

1. Leadership communication in legal profession
2. Executive articulation during strategic legal interaction
3. Professional diplomacy and organizational communication
4. Advanced stakeholder communication techniques
5. Executive professionalism and communication influence

Module 2: Advanced Advocacy & Institutional Communication
10 hours

1. Advanced advocacy communication techniques
2. Professional interaction during institutional coordination
3. Communication during large-scale legal operations
4. Strategic presentation and legal articulation
5. Professional interaction in corporate legal ecosystems

Module 3: Career Sustainability & Legal Professionalism
10 hours

1. Professional networking and long-term career communication
2. Communication during leadership and management practices
3. Continuous professional development communication
4. Professional readiness for evolving legal industries
5. Career sustainability and executive legal professionalism

Course Outcomes (COs)

CO1: Demonstrate competencies aligned with professional english - vii requirements.

CO2: Apply advanced professional communication and analytical articulation techniques effectively.

CO3: Develop industry-oriented legal professionalism and executive communication competencies.

COMMUNICATIVE ENGLISH SYLLABUS FOR (B. TECH BIOTECHNOLOGY)

SEMESTER 1 – Communicative English **Course Code – ENG11053**
Total Hours: 30

Module 1: Foundational Scientific Communication
(10 Hours)
1. Professional verbal and written communication fundamentals

2. Scientific vocabulary enhancement and biotechnology terminology usage

3. Grammar enhancement, sentence structuring, and technical articulation

4. Prepositions, subject–verb agreement, and professional sentence correction

5. Active voice, passive voice, narration, and transformation techniques

6. Listening comprehension and interpretation of scientific discussions

Module 2: Academic Writing & Technical English
(10 Hours)
1. Scientific paragraph writing and structured communication

2. Professional email drafting and scientific correspondence

3. Reading comprehension and interpretation of biotechnology content

4. Summary writing and analytical explanation techniques

5. Idioms, phrases, and prepositional expressions in professional communication

6. Presentation structuring and communication clarity

Module 3: Communication Confidence & Professional Interaction
(10 Hours)
1. Technical explanation of biotechnology concepts

2. Professional self-introduction and scientific interaction

3. Presentation communication and confidence development

4. Laboratory communication and academic interaction practices

5. Communication ethics and professional conduct

6. Collaborative communication in academic environments

Course Outcomes (COs)
CO1: Demonstrate effective communicative English skills in academic and scientific environments.
CO2: Apply technical writing, grammar, and professional communication techniques accurately.

CO3: Develop confidence, clarity, and structured interaction skills for biotechnology communication.

SOFT SKILLS AND APTITUDE SYLLABUS FOR NON-NEP PROGRAMS

Semester 2 – Soft Skills and Aptitude II **Course code – CLL11102**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Workplace Professionalism & Biotechnology Interaction **(5 hours)**

1. Professional communication in laboratory and biotechnology environments
2. Professional identity development for biotechnology careers
3. Laboratory discipline and workplace accountability
4. Professional etiquette and executive presence
5. Team collaboration in scientific environments
6. Stakeholder interaction and workplace adaptability

Module 2: Technical Documentation & Scientific Reporting **(5 hours)**

1. Scientific report writing and laboratory documentation
2. Research note preparation and structured communication
3. Technical reporting and analytical explanation
4. Professional presentation and scientific interaction
5. Communication during laboratory workflows
6. Professional ethics in biotechnology environments

Module 3: Internship Readiness & Scientific Collaboration **(5 hours)**

1. Internship professionalism and industrial adaptability
2. Resume development and biotechnology profile building
3. Professional networking and collaborative interaction
4. Scientific discussion and multidisciplinary communication
5. Confidence building in laboratory and research environments
6. Professional responsibility during technical operations

Course Outcomes (COs)

CO1: Demonstrate professional workplace behaviour and biotechnology interaction skills effectively.

CO2: Apply technical documentation and scientific reporting practices responsibly.

CO3: Develop internship readiness, scientific collaboration, and professional adaptability competencies.

APTITUDE

Module 1: Foundational Quantitative & Technical Reasoning **(5 hours)**

1. Basic numerical operations and engineering arithmetic applications
2. Percentage, ratio, proportion, and technical-data interpretation
3. Quantitative comparison and analytical calculations
4. Structured technical problem-solving methodologies
5. Foundational operational reasoning approaches

Module 2: Foundational Logical & Engineering Analytical Skills **(5 hours)**

1. Logical deduction and analytical sequencing techniques
2. Pattern recognition and structured interpretation methodologies
3. Critical observation and analytical reasoning fundamentals
4. Reasoning accuracy and structured technical evaluation
5. Foundational computational and operational reasoning

Module 3: Engineering & Research Aptitude Foundations **(5 hours)**

1. Analytical interpretation during technical and laboratory environments
2. Research-oriented critical thinking methodologies
3. Operational reasoning during multidisciplinary engineering scenarios
4. Professional analytical discipline and accountability
5. Problem-solving adaptability during engineering workflows

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

Semester 3 – Soft Skills and Aptitude III **Course code – CLL11103**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Research Communication & Scientific Interaction **(5 hours)**

1. Research communication in biotechnology and life science environments
2. Technical explanation of experimental findings
3. Data interpretation and analytical communication
4. Professional interaction in multidisciplinary research teams
5. Communication during laboratory operations and project execution
6. Structured scientific discussion and collaboration

Module 2: Laboratory Ethics & Biotechnology Practices **(5 hours)**

1. Professional ethics in biotechnology and laboratory environments
2. Biosafety communication and responsible laboratory practices
3. GLP and GMP awareness in biotechnology industries
4. Professional accountability during laboratory workflows
5. Time management in research environments
6. Professional discipline in industrial biotechnology settings

Module 3: Technical Presentation & Scientific Reporting **(5 hours)**

1. Technical presentation and biotechnology reporting techniques
2. Analytical presentation of biotechnology case studies
3. Research communication during technical reviews and evaluations
4. Structured reporting in biotechnology environments
5. Scientific documentation practices
6. Professional interaction during technical presentations

Course Outcomes (COs)

CO1: Demonstrate research communication and scientific interaction skills effectively.

CO2: Apply laboratory ethics, biosafety awareness, and biotechnology professional practices responsibly.

CO3: Develop technical presentation, biotechnology reporting, and analytical communication competencies.

APTITUDE

Module 1: Quantitative Analysis & Technical Interpretation **(5 hours)**

1. Arithmetic applications and engineering-data evaluation
2. Time-management and operational reasoning methodologies
3. Analytical comparison and quantitative interpretation
4. Technical analytical calculation techniques
5. Structured engineering-data interpretation approaches

Module 2: Applied Logical & Computational Reasoning **(5 hours)**

1. Critical reasoning and analytical deduction techniques
2. Logical sequencing and computational interpretation
3. Decision-making during engineering operational scenarios
4. Structured evaluation and technical reasoning methodologies
5. Problem-solving during multidisciplinary technical environments

Module 3: Industry-Oriented Technical Aptitude **(5 hours)**

1. Operational reasoning during engineering and industrial workflows
2. Research-data interpretation and analytical adaptability
3. Structured technical evaluation methodologies
4. Professional accountability during operational environments
5. Industry-oriented analytical effectiveness approaches

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

Semester 4 – Soft Skills and Aptitude IV **Course code – CLL11104**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Industrial Biotechnology Communication **(5 hours)**

1. Professional communication in biopharmaceutical and biotechnology industries
2. Communication during production, quality control, and operational workflows
3. Professional interaction with technical and industrial teams
4. Communication in biotechnology supply chain operations
5. Industrial reporting and operational communication practices
6. Stakeholder interaction in biotechnology environments

Module 2: Leadership & Biotechnology Team Coordination **(5 hours)**

1. Leadership communication in biotechnology organizations
2. Collaborative coordination in research and industrial teams
3. Decision-making and accountability in biotechnology workflows
4. Conflict management and professional negotiation techniques
5. Strategic communication during technical operations
6. Operational coordination and workforce management

Module 3: Sustainable Biotechnology & Regulatory Awareness **(5 hours)**

1. Regulatory communication and compliance awareness
2. Environmental responsibility and ethical biotechnology practices
3. Communication during biotechnology audits and evaluations
4. Strategic communication for biotechnology innovation
5. Professional interaction in healthcare and biotech ecosystems
6. Sustainable biotechnology communication practices

Course Outcomes (COs)

CO1: Demonstrate industrial biotechnology communication and stakeholder interaction skills effectively.

CO2: Apply leadership communication and operational coordination strategies responsibly.

CO3: Develop regulatory awareness and biotechnology professionalism competencies.

APTITTUDE

Module 1: Engineering Data Interpretation & Analytics **(5 hours)**

1. Table-based and graphical engineering-data interpretation
2. Comparative analytical evaluation using technical datasets
3. Statistical reasoning and operational interpretation
4. Analytical reasoning using structured engineering information
5. Data-driven technical problem-solving methodologies

Module 2: Technical Reasoning & Operational Decision-Making **(5 hours)**

1. Analytical reasoning during engineering operations
2. Operational interpretation during manufacturing and technical workflows
3. Decision-making during industrial and computational scenarios
4. Critical reasoning under structured technical conditions
5. Problem-solving environments in engineering coordination environments

Module 3: Applied Technical Aptitude & Research Interpretation **(5 hours)**

1. Research-oriented analytical reasoning methodologies
2. Operational adaptability during technical projects
3. Structured technical problem-solving approaches
4. Professional analytical resilience during engineering environments
5. Strategic interpretation during multidisciplinary technical operations

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

Semester 5 – Soft Skills and Aptitude V **Course code – CLL11105**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Biotechnology Industry Exposure & Corporate Interaction **(5 hours)**

1. Understanding biotechnology industry expectations and operational standards
2. Corporate communication in biotechnology organizations
3. Professional interaction with industrial stakeholders and clients
4. Cross-functional communication in biotechnology operations
5. Professional communication during industrial collaborations
6. Corporate professionalism in biotechnology environments

Module 2: Professional Branding & Biotechnology Career Development **(5 hours)**

1. Professional resume and biotechnology portfolio development
2. SOP writing and biotechnology profile presentation
3. Professional networking and LinkedIn profile optimization
4. Email etiquette for industrial communication and placements
5. Personal branding and biotechnology career communication
6. Career awareness in biotechnology and allied industries

Module 3: Workplace Communication & Strategic Interaction **(5 hours)**

1. Group discussion techniques for biotechnology industries
2. Professional meeting etiquette and workplace interaction
3. Strategic communication during biotechnology projects
4. Communication under operational and research pressure
5. Professional decision-making communication
6. Collaborative communication in industrial biotechnology environments

Course Outcomes (COs)

CO1: Demonstrate biotechnology industry communication and corporate interaction skills effectively.

CO2: Prepare professional resumes, portfolios, SOPs, and biotechnology profiles for placements and higher studies.

CO3: Develop workplace communication and professional decision-making competencies.

APTITUDE

Module 1: Advanced Quantitative & Technical Aptitude (5 hours)

1. Advanced arithmetic and engineering analytical reasoning
2. Probability, statistics, and operational interpretation
3. Advanced quantitative comparison and evaluation techniques
4. Technical analytical calculations under complex conditions
5. Strategic aptitude-solving methodologies

Module 2: Advanced Computational & Technical Reasoning (5 hours)

1. Advanced analytical deduction and computational reasoning
2. Critical reasoning during technical and operational scenarios
3. Decision-making during industrial and engineering workflows
4. Technical problem-solving during multidisciplinary environments
5. Analytical resilience and operational adaptability

Module 3: Placement-Oriented Technical Aptitude (5 hours)

1. Placement-oriented aptitude-solving techniques
2. Technical analytical interpretation during assessments
3. Professional reasoning during competitive evaluations
4. Operational problem-solving during workplace simulations
5. Industry readiness for engineering and technology ecosystems

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

Semester 6 – Soft Skills and Aptitude V **Course code – CLL11106**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Interview Skills & Biotechnology Placement Communication **(5 hours)**

1. Technical and HR interview preparation for biotechnology industries
2. Executive communication and professional confidence
3. Placement process communication and recruitment readiness
4. Professional interaction during laboratory and industrial interviews
5. Corporate communication standards in biotechnology organizations
6. Professional adaptability and career planning

Module 2: Advanced Corporate Communication & Research Coordination **(5 hours)**

1. Strategic communication in biotechnology organizations
2. Research coordination and collaborative interaction
3. Conflict handling and stakeholder management
4. Professional communication during industrial operations
5. Leadership readiness and operational accountability
6. Technical communication for biotechnology innovation

Module 3: Emerging Biotechnology Trends & Innovation Communication **(5 hours)**

1. Communication for emerging biotechnology technologies and innovations
2. Professional interaction in genomics, bioinformatics, and biopharmaceutical environments
3. Innovation-driven communication in biotechnology ecosystems
4. Strategic pitching of biotechnology solutions
5. Professional communication during research transformation initiatives
6. Communication for technology adoption and operational advancement

Course Outcomes (COs)

CO1: Demonstrate placement readiness, executive communication, and professional interaction skills effectively.

CO2: Apply strategic communication, stakeholder coordination, and leadership competencies responsibly.

CO3: Develop innovation communication and emerging biotechnology interaction competencies.

APITITIDE

Module 1: Executive Technical Analytical Aptitude **(5 hours)**

1. Executive-level engineering analytical reasoning
2. Advanced quantitative interpretation methodologies
3. Strategic technical decision-making techniques
4. Operational reasoning during complex engineering situations
5. Executive aptitude-solving and analytical coordination

Module 2: Industry-Oriented Strategic Reasoning **(5 hours)**

1. Strategic problem-solving during engineering and research workflows
2. Analytical interpretation during technical coordination
3. Operational adaptability during multidisciplinary projects
4. Professional analytical leadership methodologies
5. Structured evaluation during industrial operations

Module 3: Advanced Research & Innovation Aptitude **(5 hours)**

1. Research-oriented analytical leadership techniques
2. Innovation-driven problem-solving methodologies
3. Analytical reasoning during R&D and project workflows
4. Strategic adaptability during emerging technology scenarios
5. Professional resilience during advanced technical environments

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

Semester 7 – Soft Skills and Aptitude V **Course code – CLL11107**
Contact hours – 30 hours

Module 1: Executive Leadership & Biotechnology Professionalism **(5 hours)**

1. Executive leadership communication in biotechnology organizations
2. Strategic workplace influence and managerial coordination
3. Professional diplomacy and operational negotiation
4. Leadership readiness in biotechnology and healthcare environments
5. Executive professionalism and organizational accountability
6. Strategic workplace communication in biotechnology management

Module 2: Career Sustainability & Global Biotechnology Practices **(5 hours)**

1. Career sustainability and long-term biotechnology professional growth
2. Global workplace communication and cross-cultural interaction
3. Continuous learning and biotechnology, upskilling approaches
4. Professional networking and stakeholder relationship management
5. Workplace resilience and adaptability in evolving biotechnology industries
6. Leadership sustainability and biotechnology professionalism

Module 3: Biotechnology Innovation & Organizational Transformation **(5 hours)**

1. Strategic innovation communication in biotechnology environments
2. Digital transformation and biotechnology adaptability
3. Professional communication during organizational change
4. Biotechnology transformation and operational leadership
5. Technology-driven biotechnology innovation management
6. Professional readiness for evolving biotechnology ecosystems

Course Outcomes (COs)

CO1: Demonstrate executive leadership, biotechnology professionalism, and strategic communication competencies.

CO2: Apply global workplace interaction, professional networking, and career sustainability strategies effectively.

CO3: Develop innovation-driven communication and organizational transformation competencies.

APTITUDE

Module 1: Advanced Placement-Oriented Engineering Aptitude (5 hours)

1. Integrated aptitude-solving during technical assessments
2. Advanced analytical interpretation and structured reasoning
3. Strategic technical problem-solving during operational scenarios
4. Decision-making during multidisciplinary engineering environments
5. Executive analytical effectiveness techniques

Module 2: Industry Simulation & Analytical Evaluation (5 hours)

1. Mock technical aptitude assessments and analytical diagnostics
2. Professional reasoning during competitive evaluations
3. Operational interpretation and workplace analytical reasoning
4. Advanced adaptability during engineering simulations
5. Strategic analytical coordination during technical operations

Module 3: Career Sustainability & Technical Leadership Aptitude (5 hours)

1. Long-term technical analytical growth strategies
2. Strategic reasoning during organizational transformation
3. Professional adaptability in evolving engineering ecosystems
4. Executive-level technical leadership readiness
5. Industry-oriented analytical sustainability methodologies

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

COMMUNICATIVE ENGLISH SYLLABUS FOR NON-NEP PROGRAMS

SEMESTER 1 – COMMUNICATIVE ENGLISH I   COURSE CODE – CLL5101

CONTACT HOURS – 30 HOURS

Module 1: Functional English & Language Basics

(10 Hours)

1. Introduction to functional English usage in academic environments
2. Sentence formation and common sentence errors
3. Subject–Verb Agreement and practical grammar usage
4. Prepositions and Prepositional Phrases in communication
5. Vocabulary building through contextual speaking and usage

Module 2: Spoken Communication & Confidence Building

(10 Hours)

1. Fundamentals of verbal and non-verbal communication
2. Breaking communication anxiety and stage fear
3. Pronunciation, articulation, and fluency improvement
4. Listening comprehension and interpretation skills
5. Introduction to storytelling and structured speaking

Module 3: Applied Grammar & Written Communication

(10 Hours)

1. Active and Passive voice transformation
2. Basic Narration and Sentence transformation techniques
3. Idioms, Phrases, and practical expression building
4. Professional email drafting and paragraph writing
5. Digital etiquette and responsible communication practices

Course Outcomes –

CO1: Develop foundational English communication skills with improved grammatical accuracy and confidence.

CO2: Demonstrate effective verbal interaction, listening ability, and structured speaking techniques.

CO3: Apply functional written communication, digital etiquette, and practical language usage in academic contexts.

SEMESTER 2 – COMMUNICATIVE ENGLISH II COURSE CODE – CLL5102
CONTACT HOURS – 30 HOURS

Module 1: Advanced Grammar & Professional Language Usage
(10 Hours)

1. Advanced Subject–Verb Agreement and sentence refinement
2. Complex sentence structuring and coherence development
3. Advanced Voice change and Narration techniques
4. Idiomatic expressions and professional vocabulary enhancement
5. Functional business and workplace English usage

Module 2: Analytical Speaking & Interactive Communication
(10 Hours)

1. Group discussion strategies and participation techniques
2. Persuasive speaking and opinion expression
3. Analytical listening and interpretation skills
4. Public speaking with logical sequencing of ideas
5. Presentation structuring and audience engagement

Module 3: Workplace Writing & Professional Communication
(10 Hours)

1. Professional correspondence and formal drafting
2. Report writing and structured documentation basics
3. Workplace communication etiquette and standards
4. Meeting communication and professional interaction
5. Digital professionalism and communication ethics

Course Outcomes -

CO1: Apply advanced grammar, structured expression, and professional vocabulary effectively in communication.

CO2: Demonstrate analytical speaking, presentation, and interactive communication competencies confidently.

CO3: Develop workplace-ready writing, professional correspondence, and formal communication skills.

SOFT SKILLS AND APTITUDE SYLLABUS FOR NON-NEP PROGRAMS

SEMESTER 1 – SOFT SKILLS AND APTITUDE I   COURSE CODE – CLL5001

CONTACT HOURS – 30 HOURS

SOFT SKILL

Module 1: Self Awareness & Personal Growth

(5 Hours)

1. Understanding personality traits and behavioral styles
2. Identifying strengths, interests, and growth areas
3. Growth mindset and self-motivation techniques
4. Goal setting and personal accountability
5. Positive attitude and adaptability development

Module 2: Professional Discipline & Learning Behavior

(5 Hours)

1. Professional discipline in higher education
2. Time management and productivity habits
3. Responsibility and accountability in team environments
4. Professional ethics and behavioral expectations
5. Building confidence and learning consistency

Module 3: Team Interaction & Creative Thinking

(5 Hours)

1. Collaborative participation and peer interaction
2. Introduction to creative thinking approaches
3. Interpersonal understanding and cooperation
4. Problem-solving mindset development
5. Social confidence in group environments

Course Outcome (COs):

CO1: Demonstrate self-awareness, personal accountability, and a growth-oriented mindset to enhance personal effectiveness and continuous learning.

CO2: Apply professional discipline, ethical behaviour, time management, and responsible work practices in academic and collaborative environments.

CO3: Develop teamwork, interpersonal interaction, creative thinking, and problem-solving abilities to contribute effectively to group and professional settings.

APTITUDE

Module 1: Foundational Quantitative & Scientific Reasoning (5 Hours)

1. Basic numerical operations and scientific calculations
2. Percentage, ratio, proportion, and quantitative interpretation
3. Measurement accuracy and analytical calculations
4. Structured scientific data interpretation
5. Foundational problem-solving methodologies

Module 2: Foundational Logical & Analytical Interpretation (5 Hours)

1. Logical reasoning and analytical sequencing techniques
2. Pattern recognition and structured interpretation
3. Critical observation and analytical deduction
4. Reasoning accuracy and structured evaluation approaches
5. Scientific analytical adaptability fundamentals

Module 3: Academic & Operational Aptitude Foundations (5 Hours)

1. Operational reasoning during laboratory and agricultural environments
2. Critical thinking during scientific scenarios
3. Foundational analytical decision-making techniques
4. Problem-solving in multidisciplinary healthcare and agricultural contexts
5. Professional analytical discipline and accountability

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, scientific reasoning, and structured analytical interpretation competencies effectively.

CO2: Apply operational reasoning, analytical problem-solving, and industry-oriented evaluation techniques professionally.

CO3: Develop placement-oriented aptitude, multidisciplinary analytical readiness, and professional strategic decision-making competencies.

SEMESTER 2 – SOFT SKILLS AND APTITUDE II COURSE CODE – CLL5002

CONTACT HOURS – 30 HOURS

SOFT SKILL

Module 1: Emotional Intelligence & Relationship Management (5 Hours)

1. Emotional awareness and self-regulation
2. Empathy and interpersonal sensitivity
3. Relationship management and trust building
4. Constructive feedback and professional interaction
5. Managing emotions in collaborative environments

Module 2: Critical Thinking & Decision Making (5 Hours)

1. Logical thinking and analytical reasoning
2. Observation and interpretation approaches
3. Structured problem-solving methods
4. Decision-making in practical situations
5. Creative solution development techniques

Module 3: Workplace Behaviour & Adaptability (5 Hours)

1. Workplace ethics and professional values
2. Adaptability in dynamic environments
3. Team collaboration and responsibility sharing
4. Professional maturity and workplace conduct
5. Readiness for organizational environments

Course Outcome (COs):

CO1: Apply emotional intelligence, empathy, and relationship management skills to build positive professional interactions and collaborative working relationships.

CO2: Demonstrate logical reasoning, critical thinking, decision-making, and structured problem-solving abilities to address academic and workplace challenges effectively.

CO3: Exhibit workplace professionalism, ethical behaviour, adaptability, teamwork, and organizational readiness in diverse professional environments.

APTITUDE

Module 1: Quantitative Interpretation & Operational Analysis
(5 Hours)

1. Arithmetic applications and quantitative reasoning
2. Data interpretation using scientific and operational datasets
3. Analytical comparison and structured evaluation
4. Time-management and operational reasoning techniques
5. Scientific interpretation under structured conditions

Module 2: Logical Deduction & Analytical Problem Solving
(5 Hours)

1. Critical reasoning and logical deduction methodologies
2. Analytical sequencing and structured interpretation
3. Decision-making during operational and clinical scenarios
4. Problem-solving during scientific and healthcare workflows
5. Analytical communication and interpretation techniques

Module 3: Industry-Oriented Scientific Aptitude
(5 Hours)

1. Research-oriented analytical interpretation
2. Operational reasoning during healthcare and agricultural workflows
3. Structured scientific evaluation methodologies
4. Analytical adaptability in multidisciplinary ecosystems
5. Professional accountability in operational environments

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, scientific reasoning, and structured analytical interpretation competencies effectively.

CO2: Apply operational reasoning, analytical problem-solving, and industry-oriented evaluation techniques professionally.

CO3: Develop placement-oriented aptitude, multidisciplinary analytical readiness, and professional strategic decision-making competencies.

SEMESTER 3 – SOFT SKILLS AND APTITUDE III COURSE CODE – CLL5003

CONTACT HOURS – 30 HOURS

SOFT SKILL

Module 1: Precision Agriculture & Agri-tech Communication **(5 Hours)**

1. Communication in precision farming and smart agriculture ecosystems
2. Interpretation of sensor-based farming and IoT-enabled agricultural practices
3. Technical communication for drone-assisted and data-driven agriculture
4. Professional reporting in crop monitoring and smart irrigation environments
5. Communication for climate-smart and sustainable farming practices
6. Agri tech coordination and operational communication

Module 2: Agricultural Extension & Rural Engagement **(5 Hours)**

1. Farmer advisory communication and field interaction techniques
2. Community outreach communication for agricultural awareness programmes
3. Technology adoption communication in rural farming environments
4. Field demonstration and crop advisory presentation techniques
5. Participatory communication in agricultural extension activities
6. Professional interaction during agricultural surveys and field projects

Module 3: Agricultural Field Professionalism **(5 Hours)**

1. Professional conduct during agricultural operations and field activities
2. Stakeholder communication in rural and agribusiness environments
3. Field coordination and agricultural workflow accountability
4. Communication in agri-input and agri-service industries
5. Adaptability in rural and field-based work environments
6. Professional ethics in agricultural operations

Course Outcomes (COs)

CO1: Demonstrate agritech communication and precision farming interaction skills effectively.

CO2: Apply agricultural extension and rural engagement communication strategies professionally.

CO3: Develop field professionalism, stakeholder interaction, and agricultural operational competencies.

APTITUDE

Module 1: Data Interpretation & Scientific Analytics **(5 Hours)**

1. Table-based and graphical scientific-data interpretation
2. Comparative evaluation using healthcare and agricultural datasets
3. Statistical reasoning and analytical interpretation
4. Data-driven analytical problem-solving techniques
5. Structured operational evaluation approaches

Module 2: Laboratory & Clinical Analytical Reasoning **(5 Hours)**

1. Analytical reasoning during laboratory and diagnostic operations
2. Scientific interpretation during clinical workflows
3. Operational decision-making during analytical scenarios
4. Problem-solving during healthcare and agricultural operations
5. Critical reasoning under professional conditions

Module 3: Applied Operational Aptitude **(5 Hours)**

1. Structured reasoning during field and healthcare operations
2. Research-oriented analytical problem-solving
3. Operational adaptability and analytical coordination
4. Professional analytical resilience during multidisciplinary operations
5. Strategic interpretation techniques

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, scientific reasoning, and structured analytical interpretation competencies effectively.

CO2: Apply operational reasoning, analytical problem-solving, and industry-oriented evaluation techniques professionally.

CO3: Develop placement-oriented aptitude, multidisciplinary analytical readiness, and professional strategic decision-making competencies.

SEMESTER 4 – SOFT SKILLS AND APTITUDE IV COURSE CODE – CLL5004

CONTACT HOURS – 30 HOURS

SOFT SKILL

Module 1: Agribusiness Communication & Market Coordination (5 Hours)

1. Communication in agri-marketing and agri-sales operations
2. Stakeholder interaction with distributors, retailers, and agri-business partners
3. Professional negotiation in agricultural business environments
4. Supply chain communication and agricultural operations coordination
5. Customer relationship management in agribusiness sectors
6. Professional communication for agricultural product promotion

Module 2: Sustainable Agriculture & Rural Development Communication (5 Hours)

1. Communication for sustainable agriculture and eco-friendly farming initiatives
2. Environmental awareness communication in agricultural practices
3. Rural development outreach and community participation strategies
4. Professional communication for organic farming and sustainability programmes
5. Strategic communication for climate-resilient agricultural systems
6. Ethical, agricultural communication and social responsibility

Module 3: Agricultural Leadership & Team Coordination (5 Hours)

1. Leadership communication in agricultural organizations and field teams
2. Decision-making in agricultural and agribusiness operations
3. Conflict management in rural and agricultural environments
4. Collaborative coordination during agricultural campaigns and projects
5. Operational accountability in field management
6. Professional workforce coordination in agricultural environments

Course Outcomes (COs)

CO1: Demonstrate agribusiness communication and agricultural market coordination skills effectively.

CO2: Apply sustainable agriculture and rural outreach communication strategies professionally.

CO3: Develop leadership, workforce coordination, and operational management competencies in agricultural environments.

APTITUDE

Module 1: Advanced Quantitative & Operational Aptitude **(5 Hours)**

1. Advanced arithmetic and scientific analytical reasoning
2. Probability, statistics, and operational interpretation
3. Quantitative comparison and structured analytical evaluation
4. Scientific data analysis under complex conditions
5. Strategic aptitude-solving methodologies

Module 2: Advanced Logical & Clinical Reasoning **(5 Hours)**

1. Advanced analytical deduction and critical reasoning
2. Operational interpretation during healthcare and agricultural scenarios
3. Strategic problem-solving during multidisciplinary environments
4. Decision-making during laboratory and operational coordination
5. Analytical resilience and structured evaluation

Module 3: Applied Leadership & Analytical Coordination **(5 Hours)**

1. Leadership-oriented analytical reasoning
2. Strategic coordination during operational workflows
3. Collaborative reasoning during institutional environments
4. Professional accountability during analytical operations
5. Operational effectiveness and multidisciplinary adaptability

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, scientific reasoning, and structured analytical interpretation competencies effectively.

CO2: Apply operational reasoning, analytical problem-solving, and industry-oriented evaluation techniques professionally.

CO3: Develop placement-oriented aptitude, multidisciplinary analytical readiness, and professional strategic decision-making competencies.

SEMESTER 5 – SOFT SKILLS AND APTITUDE V COURSE CODE – CLL5005

CONTACT HOURS – 30 HOURS

SOFT SKILL

Module 1: Agricultural Industry Exposure & Corporate Interaction (5 Hours)

1. Understanding agribusiness industry expectations and operational standards

2. Corporate communication in agri-business and agri-tech organizations

3. Client handling and stakeholder communication in agricultural sectors

4. Cross-functional coordination in agri-corporate environments

5. Professional communication during agricultural expos and trade events

6. Corporate interaction in agriculture and allied industries

Module 2: Professional Branding & Agricultural Career Development (5 Hours)

1. Professional resume development for agricultural careers

2. Agricultural portfolio and professional profile presentation

3. SOP writing for agribusiness and higher education opportunities

4. Professional networking and agricultural career communication

5. Email etiquette for agri-business correspondence

6. Personal branding in agricultural and rural development sectors

Module 3: Workplace Communication & Strategic Interaction (5 Hours)

1. Group discussion techniques for agricultural industries

2. Professional interaction and meeting etiquette in agribusiness environments

3. Strategic communication during agricultural operations

4. Communication under seasonal and operational pressure

5. Decision-making communication in agricultural projects

6. Collaborative communication in agribusiness organizations

Course Outcomes (COs)

CO1: Develop professional communication and corporate interaction skills aligned with agricultural industries.

CO2: Prepare resumes, portfolios, SOPs, and professional profiles effectively for placements and higher studies.

CO3: Demonstrate workplace communication, strategic interaction, and professional decision-making competencies.

APTITUDE

Module 1: Placement Aptitude & Analytical Evaluation
(5 Hours)

1. Placement-oriented aptitude-solving techniques
2. Analytical interpretation during assessments
3. Decision-making during operational scenarios
4. Scientific and healthcare analytical comparison methodologies
5. Professional aptitude-solving under time constraints

Module 2: Advanced Data Interpretation & Research Aptitude
(5 Hours)

1. Advanced scientific-data interpretation methodologies
2. Research-oriented analytical evaluation techniques
3. Operational reasoning during analytical assessments
4. Analytical communication and structured interpretation
5. Professional analytical effectiveness enhancement

Module 3: Professional Operational Aptitude
(5 Hours)

1. Operational problem-solving during healthcare and agricultural workflows
2. Strategic adaptability during multidisciplinary scenarios
3. Professional analytical coordination techniques
4. Workplace reasoning and analytical resilience
5. Operational accountability and structured evaluation

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, scientific reasoning, and structured analytical interpretation competencies effectively.

CO2: Apply operational reasoning, analytical problem-solving, and industry-oriented evaluation techniques professionally.

CO3: Develop placement-oriented aptitude, multidisciplinary analytical readiness, and professional strategic decision-making competencies.

SEMESTER 6 – SOFT SKILLS AND APTITUDE V COURSE CODE – CLL5006

CONTACT HOURS – 30 HOURS

SOFT SKILL

Module 1: Placement Communication & Professional Readiness (5 Hours)

1. Technical and HR interview preparation for agricultural industries
2. Executive communication and professional confidence
3. Placement process communication and recruitment readiness
4. Professional interaction during client-facing agricultural roles
5. Corporate communication standards in agribusiness organizations
6. Career planning and professional adaptability in agricultural sectors

Module 2: Agri-preneurship & Innovation Management (5 Hours)

1. Entrepreneurial communication in agribusiness ecosystems
2. Professional pitching for Agri-startups and rural enterprises
3. Business proposal presentation and investor interaction
4. Innovation communication in smart agriculture sectors
5. Strategic stakeholder engagement in agricultural ventures
6. Professional communication for agri-business growth

Module 3: Career Sustainability & Agricultural Leadership (5 Hours)

1. Leadership readiness in agricultural and agribusiness environments
2. Professional resilience and adaptability in agricultural industries
3. Long-term career sustainability in agricultural sectors
4. Continuous learning and agricultural upskilling approaches
5. Professional networking and stakeholder relationship management
6. Strategic leadership communication in agricultural organizations

Course Outcomes (COs)

CO1: Demonstrate placement readiness, executive communication, and professional interaction skills for agricultural industries.

CO2: Apply Agri-preneurship communication, innovation pitching, and stakeholder engagement techniques effectively.

CO3: Develop agricultural leadership, career sustainability, and long-term professional growth competencies.

APTITUDE

Module 1: Executive Scientific & Analytical Aptitude
(5 Hours)
1. Executive-level analytical reasoning and scientific interpretation
2. Advanced quantitative evaluation methodologies
3. Strategic operational reasoning techniques
4. Professional analytical adaptability during high-pressure environments
5. Executive aptitude-solving and structured decision-making

Module 2: Industry-Oriented Strategic Reasoning
(5 Hours)
1. Industry-oriented analytical leadership techniques
2. Advanced decision-making during healthcare and agricultural operations
3. Strategic coordination and analytical problem-solving
4. Operational reasoning during multidisciplinary industry scenarios
5. Professional resilience and executive analytical effectiveness

Module 3: Career Sustainability & Professional Analytical Readiness
(5 Hours)
1. Placement-oriented analytical readiness and adaptability
2. Professional reasoning during workplace assessments
3. Long-term professional analytical growth strategies
4. Industry readiness and strategic operational interpretation
5. Executive analytical sustainability and leadership readiness

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, scientific reasoning, and structured analytical interpretation competencies effectively.

CO2: Apply operational reasoning, analytical problem-solving, and industry-oriented evaluation techniques professionally.

CO3: Develop placement-oriented aptitude, multidisciplinary analytical readiness, and professional strategic decision-making competencies.

COMMUNICATIVE ENGLISH SYLLABUS FOR B. TECH

SEMESTER 1 – Communicative English **Course Code – ENG11053**
Total Hours: 30

Module 1: Functional English & Language Basics

(10 Hours)

1. Introduction to functional English usage in academic environments
2. Sentence formation and common sentence errors
3. Subject–Verb Agreement and practical grammar usage
4. Prepositions and Prepositional Phrases in communication
5. Vocabulary building through contextual speaking and usage

Module 2: Spoken Communication & Confidence Building

(10 Hours)

1. Fundamentals of verbal and non-verbal communication
2. Breaking communication anxiety and stage fear
3. Pronunciation, articulation, and fluency improvement
4. Listening comprehension and interpretation skills
5. Introduction to storytelling and structured speaking

Module 3: Applied Grammar & Written Communication

(10 Hours)

1. Active and Passive voice transformation
2. Basic Narration and Sentence transformation techniques
3. Idioms, Phrases, and practical expression building
4. Professional email drafting and paragraph writing
5. Digital etiquette and responsible communication practices

Course Outcomes –

CO1: Develop foundational English communication skills with improved grammatical accuracy and confidence.

CO2: Demonstrate effective verbal interaction, listening ability, and structured speaking techniques.

CO3: Apply functional written communication, digital etiquette, and practical language usage in academic contexts.

SEMESTER 2 – Communicative English **Course Code – ENG11053**

Total Hours: 30

Module 1: Advanced Grammar & Professional Language Usage

(10 Hours)

1. Advanced Subject–Verb Agreement and sentence refinement
2. Complex sentence structuring and coherence development
3. Advanced Voice change and Narration techniques
4. Idiomatic expressions and professional vocabulary enhancement
5. Functional business and workplace English usage

Module 2: Analytical Speaking & Interactive Communication

(10 Hours)

1. Group discussion strategies and participation techniques
2. Persuasive speaking and opinion expression
3. Analytical listening and interpretation skills
4. Public speaking with logical sequencing of ideas
5. Presentation structuring and audience engagement

Module 3: Workplace Writing & Professional Communication

(10 Hours)

1. Professional correspondence and formal drafting
2. Report writing and structured documentation basics
3. Workplace communication etiquette and standards
4. Meeting communication and professional interaction
5. Digital professionalism and communication ethics

Course Outcomes -

CO1: Apply advanced grammar, structured expression, and professional vocabulary effectively in communication.

CO2: Demonstrate analytical speaking, presentation, and interactive communication competencies confidently.

CO3: Develop workplace-ready writing, professional correspondence, and formal communication skills.

SOFT SKILLS & APTITUDE SYLLABUS FOR B.TECH

Semester 2 – Soft Skills and Aptitude II **Course code – CLL11102**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Engineering Communication & Professional Interaction **(5 hours)**
1. Professional communication in engineering and technical environments
2. Technical explanation and articulation of engineering concepts
3. Professional email drafting and engineering workplace correspondence
4. Communication clarity during laboratory and workshop interaction
5. Listening, interpretation, and response management in technical discussions
6. Professional communication ethics and engineering workplace conduct

Module 2: Technical Documentation & Academic Communication **(5 hours)**
1. Technical documentation and engineering report writing fundamentals
2. Project documentation and structured technical communication
3. Vocabulary enhancement for engineering and technology sectors
4. Reading comprehension and interpretation of technical content
5. Presentation structuring and communication clarity
6. Professional collaboration and academic interaction practices

Module 3: Engineering Professionalism & Internship Readiness **(5 hours)**
1. Professional identity development for engineering careers
2. Executive presence and professional body language
3. Workplace professionalism and engineering discipline
4. Internship readiness and workplace adaptability
5. Resume basics and technical profile development
6. Confidence building and stakeholder interaction

Course Outcomes (COs)

CO1: Demonstrate professional communication skills required for engineering and technical environments.

CO2: Apply technical documentation, workplace interaction, and structured communication techniques effectively.

CO3: Develop engineering professionalism, internship readiness, and workplace adaptability competencies.

APTITUDE

Module 1: Foundational Quantitative & Technical Reasoning **(5 hours)**

1. Basic numerical operations and engineering arithmetic applications
2. Percentage, ratio, proportion, and technical-data interpretation
3. Quantitative comparison and analytical calculations
4. Structured technical problem-solving methodologies
5. Foundational operational reasoning approaches

Module 2: Foundational Logical & Engineering Analytical Skills **(5 hours)**

1. Logical deduction and analytical sequencing techniques
2. Pattern recognition and structured interpretation methodologies
3. Critical observation and analytical reasoning fundamentals
4. Reasoning accuracy and structured technical evaluation
5. Foundational computational and operational reasoning

Module 3: Engineering & Research Aptitude Foundations **(5 hours)**

1. Analytical interpretation during technical and laboratory environments
2. Research-oriented critical thinking methodologies
3. Operational reasoning during multidisciplinary engineering scenarios
4. Professional analytical discipline and accountability
5. Problem-solving adaptability during engineering workflows

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

Semester 3 – Soft Skills and Aptitude III **Course code – CLL11103**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Project Coordination & Agile Collaboration **(5 hours)**

1. Communication in Agile, Scrum, and collaborative project environments
2. Technical demonstration and engineering project presentation techniques
3. Client communication and stakeholder interaction
4. Cross-functional coordination in engineering workflows
5. Problem-solving communication and technical clarification
6. Professional interaction in multidisciplinary engineering teams

Module 2: Innovation, Analytical Thinking & Decision Making **(5 hours)**

1. Analytical reasoning and engineering problem-solving approaches
2. Innovation management and strategic thinking
3. Decision-making and accountability in engineering workflows
4. Critical thinking and solution-oriented communication
5. Professional ownership and operational responsibility
6. Collaborative engineering communication practices

Module 3: Engineering Ethics & Industry Preparedness **(5 hours)**

1. Professional ethics in engineering and technology industries
2. Cybersecurity awareness, data responsibility, and professional conduct
3. Workplace professionalism and organizational accountability
4. Adaptability in dynamic technology environments
5. Time management and productivity in engineering projects
6. Professional discipline in industrial environments

Course Outcomes (COs)

CO1: Demonstrate project coordination, Agile collaboration, and stakeholder interaction skills effectively.

CO2: Apply analytical thinking, innovation, and engineering decision-making competencies professionally.

CO3: Develop ethical professionalism, workplace accountability, and industry preparedness skills.

APTITUDE

Module 1: Quantitative Analysis & Technical Interpretation **(5 hours)**

1. Arithmetic applications and engineering-data evaluation
2. Time-management and operational reasoning methodologies
3. Analytical comparison and quantitative interpretation
4. Technical analytical calculation techniques
5. Structured engineering-data interpretation approaches

Module 2: Applied Logical & Computational Reasoning **(5 hours)**

1. Critical reasoning and analytical deduction techniques
2. Logical sequencing and computational interpretation
3. Decision-making during engineering operational scenarios
4. Structured evaluation and technical reasoning methodologies
5. Problem-solving during multidisciplinary technical environments

Module 3: Industry-Oriented Technical Aptitude **(5 hours)**

1. Operational reasoning during engineering and industrial workflows
2. Research-data interpretation and analytical adaptability
3. Structured technical evaluation methodologies
4. Professional accountability during operational environments
5. Industry-oriented analytical effectiveness approaches

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

Semester 4 – Soft Skills and Aptitude IV **Course code – CLL11104**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Industrial Communication & Workplace Coordination **(5 hours)**
1. Corporate communication standards in engineering organizations

2. Workplace coordination and operational communication practices

3. Meeting etiquette and technical interaction standards

4. Communication during industrial operations and project execution

5. Professional interaction with clients, vendors, and technical stakeholders

6. Engineering communication under operational pressure

Module 2: Leadership & Engineering Team Management **(5 hours)**
1. Leadership communication in technical teams

2. Conflict management and collaborative negotiation techniques

3. Strategic communication in engineering operations

4. Professional diplomacy and workforce coordination

5. Decision-making during technical and operational challenges

6. Managerial interaction in engineering environments

Module 3: Technical Presentation & Research Communication **(5 hours)**
1. Technical presentation and engineering solution pitching

2. Research communication and technical reporting practices

3. Analytical presentation and structured technical explanation

4. Communication of engineering innovations and product ideas

5. Professional documentation during industrial and academic projects

6. Professional interaction during technical reviews and evaluations

Course Outcomes (COs)

CO1: Demonstrate industrial communication, workplace coordination, and operational interaction skills effectively.

CO2: Apply leadership communication, negotiation, and workforce management strategies professionally.

CO3: Develop technical presentation, research communication, and engineering reporting competencies.

APTITTUDE

Module 1: Engineering Data Interpretation & Analytics **(5 hours)**

1. Table-based and graphical engineering-data interpretation
2. Comparative analytical evaluation using technical datasets
3. Statistical reasoning and operational interpretation
4. Analytical reasoning using structured engineering information
5. Data-driven technical problem-solving methodologies

Module 2: Technical Reasoning & Operational Decision-Making **(5 hours)**

1. Analytical reasoning during engineering operations
2. Operational interpretation during manufacturing and technical workflows
3. Decision-making during industrial and computational scenarios
4. Critical reasoning under structured technical conditions
5. Problem-solving environments in engineering coordination environments

Module 3: Applied Technical Aptitude & Research Interpretation **(5 hours)**

1. Research-oriented analytical reasoning methodologies
2. Operational adaptability during technical projects
3. Structured technical problem-solving approaches
4. Professional analytical resilience during engineering environments
5. Strategic interpretation during multidisciplinary technical operations

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

Semester 5 – Soft Skills and Aptitude V **Course code – CLL11105**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Corporate Interaction & Engineering Workplace Practices **(5 hours)**

1. Corporate professionalism in engineering and technology organizations
2. Professional interaction during industrial collaboration and operations
3. Stakeholder communication and client relationship management
4. Cross-functional communication in engineering environments
5. Communication under project deadlines and operational pressure
6. Professional accountability in engineering workflows

Module 2: Placement Communication & Professional Branding **(5 hours)**

1. Professional resume and technical portfolio development
2. SOP writing and engineering profile presentation
3. Professional networking and LinkedIn profile optimization
4. Email etiquette for placements and industrial interaction
5. Professional branding and workplace image management
6. Career awareness in engineering and technology industries

Module 3: Group Discussion & Workplace Decision Making **(5 hours)**

1. Group discussion techniques for engineering industries
2. Strategic workplace interaction and professional meeting etiquette
3. Professional negotiation and operational communication
4. Decision-making communication in engineering projects
5. Collaborative communication in industrial environments
6. Professional adaptability and workplace resilience

Course Outcomes (COs)

CO1: Demonstrate corporate interaction and engineering workplace communication skills effectively.

CO2: Prepare professional resumes, portfolios, SOPs, and engineering profiles for placements and higher studies.

CO3: Develop workplace decision-making, negotiation, and professional collaboration competencies.

APTITUDE

Module 1: Advanced Quantitative & Technical Aptitude **(5 hours)**

1. Advanced arithmetic and engineering analytical reasoning
2. Probability, statistics, and operational interpretation
3. Advanced quantitative comparison and evaluation techniques
4. Technical analytical calculations under complex conditions
5. Strategic aptitude-solving methodologies

Module 2: Advanced Computational & Technical Reasoning **(5 hours)**

1. Advanced analytical deduction and computational reasoning
2. Critical reasoning during technical and operational scenarios
3. Decision-making during industrial and engineering workflows
4. Technical problem-solving during multidisciplinary environments
5. Analytical resilience and operational adaptability

Module 3: Placement-Oriented Technical Aptitude **(5 hours)**

1. Placement-oriented aptitude-solving techniques
2. Technical analytical interpretation during assessments
3. Professional reasoning during competitive evaluations
4. Operational problem-solving during workplace simulations
5. Industry readiness for engineering and technology ecosystems

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

Semester 6 – Soft Skills and Aptitude V **Course code – CLL11106**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Interview Skills & Technical Placement Communication **(5 hours)**

1. Technical and HR interview preparedness for engineering industries
2. Executive communication and professional confidence
3. Placement process communication and recruitment readiness
4. Professional body language and executive presence
5. Client-facing communication and technical interaction
6. Professional adaptability in corporate engineering environments

Module 2: Advanced Corporate Communication & Strategic Interaction **(5 hours)**

1. Strategic communication in engineering and technology organizations
2. Corporate diplomacy and stakeholder management
3. Conflict handling and collaborative coordination
4. Professional communication during industrial operations
5. Leadership readiness and operational accountability
6. Technical communication for organizational growth

Module 3: Innovation Management & Emerging Technology Interaction **(5 hours)**

1. Communication for emerging technologies and engineering innovation
2. Professional interaction in AI, automation, IoT, and smart systems environments
3. Innovation-driven communication in technology ecosystems
4. Strategic pitching of engineering solutions
5. Professional interaction during technical transformation initiatives
6. Communication for technology adoption and operational advancement

Course Outcomes (COs)

CO1: Demonstrate interview preparedness, executive communication, and technical interaction skills effectively.

CO2: Apply strategic communication, stakeholder management, and leadership coordination techniques professionally.

CO3: Develop innovation management, emerging technology interaction, and organizational communication competencies.

APITITIDE

Module 1: Executive Technical Analytical Aptitude **(5 hours)**

1. Executive-level engineering analytical reasoning
2. Advanced quantitative interpretation methodologies
3. Strategic technical decision-making techniques
4. Operational reasoning during complex engineering situations
5. Executive aptitude-solving and analytical coordination

Module 2: Industry-Oriented Strategic Reasoning **(5 hours)**

1. Strategic problem-solving during engineering and research workflows
2. Analytical interpretation during technical coordination
3. Operational adaptability during multidisciplinary projects
4. Professional analytical leadership methodologies
5. Structured evaluation during industrial operations

Module 3: Advanced Research & Innovation Aptitude **(5 hours)**

1. Research-oriented analytical leadership techniques
2. Innovation-driven problem-solving methodologies
3. Analytical reasoning during R&D and project workflows
4. Strategic adaptability during emerging technology scenarios
5. Professional resilience during advanced technical environments

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

Semester 7 – Soft Skills and Aptitude V **Course code – CLL11107**
Contact hours – 30 hours

SOFT SKILLS

Module 1: Executive Leadership & Engineering Professionalism **(5 hours)**

1. Executive leadership communication in engineering organizations
2. Strategic workplace influence and managerial coordination
3. Corporate diplomacy and professional negotiation
4. Leadership readiness in industrial and technology environments
5. Executive professionalism and operational accountability
6. Strategic workplace communication and engineering management

Module 2: Career Sustainability & Global Engineering Practices **(5 hours)**

1. Career sustainability and long-term engineering professional growth
2. Global workplace communication and cross-cultural interaction
3. Continuous learning and technical upskilling approaches
4. Professional networking and stakeholder relationship management
5. Workplace resilience and adaptability in evolving industries
6. Leadership sustainability and engineering professionalism

Module 3: Engineering Innovation & Organizational Transformation **(5 hours)**

1. Strategic innovation communication in engineering environments
2. Digital transformation and industrial adaptability
3. Professional communication during organizational change
4. Engineering transformation and operational leadership
5. Technology-driven organizational innovation management
6. Professional readiness for evolving engineering ecosystems

Course Outcomes (COs)

CO1: Demonstrate executive leadership, engineering professionalism, and strategic communication competencies.

CO2: Apply global workplace interaction, professional networking, and career sustainability strategies effectively.

CO3: Develop innovation-driven communication and organizational transformation competencies.

APTITUDE

Module 1: Advanced Placement-Oriented Engineering Aptitude (5 hours)

1. Integrated aptitude-solving during technical assessments
2. Advanced analytical interpretation and structured reasoning
3. Strategic technical problem-solving during operational scenarios
4. Decision-making during multidisciplinary engineering environments
5. Executive analytical effectiveness techniques

Module 2: Industry Simulation & Analytical Evaluation (5 hours)

1. Mock technical aptitude assessments and analytical diagnostics
2. Professional reasoning during competitive evaluations
3. Operational interpretation and workplace analytical reasoning
4. Advanced adaptability during engineering simulations
5. Strategic analytical coordination during technical operations

Module 3: Career Sustainability & Technical Leadership Aptitude (5 hours)

1. Long-term technical analytical growth strategies
2. Strategic reasoning during organizational transformation
3. Professional adaptability in evolving engineering ecosystems
4. Executive-level technical leadership readiness
5. Industry-oriented analytical sustainability methodologies

Course Outcomes (COs)

CO1: Demonstrate quantitative aptitude, engineering analytical reasoning, and structured technical interpretation competencies effectively.

CO2: Apply operational reasoning, technical problem-solving, and industry-oriented analytical evaluation techniques professionally.

CO3: Develop placement-oriented engineering aptitude, research analytical readiness, and executive technical decision-making competencies.

	CLL Foreign Language French UG Semester 1	L	T	P	C
Version 1.0	**Contact Hours - 30**	2	0	0	2
Course Codes	AEC107 (2 credits), CLL11201 (2 credits), CLL11201N (Non-Credit)				
Pre-requisites/Exposure	-				
Co-requisites	-				
Academic Year	2026-2027				

Programme Educational Objectives (PEO)

The French Programme aims to equip students with fundamental linguistic, cultural and communicative competencies for practical applications. The educational objectives are:

PEO1 – Equip students with essential French language skills for basic communication in everyday contexts
PEO2 – Strengthen linguistic competence through a structured progression of vocabulary, grammar and writing skills
PEO3 – Foster an appreciation of Francophone cultures, enhancing intercultural sensitivity and global perspectives

Course Description

This beginner-level course is designed to introduce students to the fundamentals of the French language while fostering an appreciation for Francophone culture. Through a communicative and immersive approach, students will develop essential skills in listening, speaking, reading and writing, along with a foundational understanding of French grammar and cultural nuances.

Course Content

Module 1 : Bonjour, World! — Your First Peek into the Land of the French **[2 hours]**

- Overview of the Indo-European Family of Languages
- Concept of Germanic, Romance and Slavic Languages
- Countries where French is spoken: Canada, Monaco, Belgium, Switzerland, Luxembourg etc.
- French Colonies in India: Chandernagor, Pondicherry

Module 2 : A-B-C, Très Fancy! — The Alphabet That Wears Accents **[2 hours]**

- Alphabet Adventures – Once upon a Letter….
  - A Fun Intro to French Letters
- The five special French characters – accents (é,è,ô,ç,ë) and their significance
- French Pronunciation Rules
  Activities: Pronouncing unknown French words
  Reading unknown French texts with correct pronunciation

Module 3 : Salut & Smiles — French Greetings for Every Mood **[4 hours]**

- Basic expressions of greetings, expressions of politeness:
  - Bonjour, Salut, Comment allez-vous?, Comment ça va?, Je vais bien, Merci, Au revoir.

Module 4 : Grammar Glamour — Chic Rules for Speaking Like a Parisian: [7 hours]

- Definite and Indefinite Articles
- Common Nouns & Adjectives
- Singular and Plural Forms of Nouns
- Subject Pronouns
- Regular Verbs: ER & IR group
- Irregular Verbs: RE Group
- Construction of Negative Sentences

Module 5: Un, Deux, Trois… Voilà! — Counting the French Way [3 hours]

- High-Five to French!

  -Un, Deux, Trois of French numbers: counting from 1 to 100

- Telling the time in French
  Activities: Listening Exercises on Numbers
  Telling the time by looking at pictures of clocks

Module 6: Cheese, Culture & Oh Là Là— A French Lifestyle Tour [6 hours]

- French Gastronomy: French cheese and wines
  Roquefort, Camembert, Brie, Vin Rouge, Vin Blanc etc.
- Famous French perfumes:
  Dior, Chanel etc.
- French cities and tourist places:
  Paris, Lyon, Lille etc.
- Francophone countries
  La Belgique, La Suisse, Le Canada etc.
- Renowned French personalities:
  Jeanne d'Arc, Marie Curie, Molière etc.
- Significance of the French Flag and Currency

Module 7: Speak Up, Mon Ami! Your First Steps into French Conversations [2 Hours]

- Self-introduction (First Name, Surname, Age, Nationality, Profession etc)
- Introducing someone else (talk about your friend, brother, mother, father etc.)

Module 8: Colours, Cousins & Croissants — Everyday French Words Made Fun! [4 hours]

- Noir, Rouge & everything in between – A Colourful Dive into French!
  - Making colours fun
- From Père to Oncle – Who's Who in the Family Tree?
  -Navigating Family Vocabulary
- From Kitchen to Chambre– A Tour of Your House in French
  -Essential Home Vocabulary
- Food menu in French: From Breakfast to Dinner
  Petit-Déjuener, Déjuener, Pain, Chocolat, Croissant

Course Outcomes (CO):

On completion of this first-semester course, the students will be able to

CO1 - Understand the historical and linguistic background of French within the Indo-European language family
CO2 - Master basic pronunciation rules and apply them to pronounce French words
CO3 – Learn basic French greetings and expressions and practice speaking
CO4 - Develop a foundation in elementary French grammar, in articles, personal Pronouns and verbs
CO5 - Learn to count and tell time in French
CO6 - Gain insights into French cultural norms, traditions and etiquette, helping them blend into native conversations
CO7 – Introduce themselves and others in French
CO8 - Build essential vocabulary for colours, family, colours, parts of the house and food items

Programme Outcomes (PO):

Upon successful completion of this two-semester programme, students will develop the following competencies:

PO1 - Know about the origin of the French language vis-à-vis other European languages
PO2 - Develop French pronunciation skills
PO3 - Learn to count and tell time in French
PO4 - Understand and apply elementary French Grammar
PO5 - Speak in basic French
PO6 - Demonstrate familiarity with French culture
PO7 - Fill up Forms in French and write short French sentences and messages
PO8 - Gain knowledge of basic French vocabulary

Programme Specific Outcomes (PSO):

PSO1 – Learn about French as a Germanic language and its place in the Indo-European School of Languages
PSO2 – Recognize French diphthongs, accents, sounds and phonetic patterns for accurate pronunciation.
PSO3 – Understand formal and informal time and cardinal and ordinal numbers in French
PSO4 – Grasp key grammatical concepts involving definite and indefinite articles, subject pronouns, adjectives, regular, irregular and pronomial verbs, interrogative adjectives and prepositions
PSO5 – Speak and respond confidently in daily communication scenarios and understand and apply common greetings, expressions and conversational starters
PSO6 – Get acquainted with aspects of French culture, like food and dining etiquette, festivals and media
PSO7 – Fill up forms in French by providing personal information and communicate in French through short e-mails and messages and use conventional French salutations and valedictions
PSO8 – Acquire knowledge of vocabulary related to areas like colours, family, parts of the house, food and drinks, public places, transport, weather and clothes

Correlation Matrix between CO and PO and CO and PSO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	3								3							
CO2		3	2	2	2	2	2	2	2	3	2	2	2	2	2	2
CO3		2			3	2		1		2			3	2		1
CO4				3	3		3					3	3		3	
CO5			3								3					
CO6						3		2						3		2
CO7		2		2	3					2		2	3			
CO8		2						3		2						3

Degree of Correlation: 1 – low, 2 – medium, 3 – high

	CLL Foreign Language French UG Semester 2	L	T	P	C
Version 1.0	**Contact Hours - 30**	2	0	0	2
Course Codes	AEC110 (2 credits), CLL11204 (2 credits), CLL11204N (Non-Credit)				
Pre-requisites/Exposure	-				
Co-requisites	-				
Academic Year	2026-2027				

Programme Educational Objectives (PEO)

The French Programme aims to equip students with fundamental linguistic, cultural and communicative competencies for practical applications. The educational objectives are:

PEO1 – Equip students with essential French language skills for basic communication in everyday contexts
PEO2 – Strengthen linguistic competence through a structured progression of vocabulary, grammar and writing skills
PEO3 – Foster an appreciation of Francophone cultures, enhancing intercultural sensitivity and global perspectives

Course Description

This second-semester course builds upon foundational knowledge to deepen students' linguistic competence in the French language and awareness of French culture. Designed for learners with prior exposure to elementary French, the course reinforces everyday communication, introduces nuanced grammatical structures and expands students' confidence in both oral and written expression.

Course Content

Module 1: French on the Go: Talk, Order, Buy, Repeat! [6 hours]

- The Art of Introducing Yourself in French
  Speaking Topics: Personal / Family / Studies / Food / Hobbies and Spare Time/Discussing phone numbers
  Activity: Pair Work - Students pair up for casual dialogues and switch partners every 3 minutes
- Visualising someone's daily life
  Activity: Students speak about their daily life
- Ordering Food at a Restaurant
  Activity: Students practice ordering different items using a mock menu
- Buying items & asking Price
  Activity: Simulated Shopping - "Customer and Store Attendant" practice

Module 2: Unlocking the Grammar Vault of 'la Belle Langue' **[12 hours]**

- How to frame Interrogative Sentences
- Near future
- Recent past
- Possessive adjectives
- Pronominal verbs
- Everyday verbs in present tense:
  Regular -er ending verbs (Porter, Manger, Acheter, Jouer, Donner, Commencer etc.)
  Irregular verbs: Faire, Venir, Boire, Pouvoir, Vouloir
- Prepositions before Countries & Places
- <u>Quizzes and Worksheets</u>

Module 3: The Art of "Joie de Vivre": Celebrating French Culture **[3 hours]**

- French Greetings on Occasions and Holidays:
  Joyeux Noël , Bonne Année etc.
- French Festivals:
  Noël , Le 14 Juillet etc.
- French Newspapers and Magazine:
  Newspapers – Le Monde, 20 Minutes, Le Figaro , Les Echos , Le Matin, L'Express etc.
  Magazines – Lire , Le Point , Paris Match, Numérique, Biba, Elle, Vogue etc.
- French Television Channels :
  TV5 Monde, Canal+, M6, France 2, France 3, France 4, France 5, Arte etc.

Module 4: Pen, Paper, Paris: Writing the French Way **[5 hours]**

- Writing brief e-mails or messages comprising of 20-25 words:
  - Greetings and Salutations: Salut/ Cher/ Chère
  - Valedictory Address: Au Revoir / À Bientôt
  <u>Activity</u>: Students write a short email based on a given scenario like a Birthday Invitation.
- Passage on seen topic
  <u>Activity</u>: Students read the passage and they will answer questions
- How to fill a form in French
  <u>Activity</u>: Students fill different forms in French

Module 5: From "Chat" to "Château": Your French Word Treasures **[4 hours]**

- Different Public Places:
  École, Église , Gare etc.
- Transport:
  Bus, Train, Vélo, Voiture
- The Weather:
  Il fait beau, Il fait Mauvais, Il fait chaud, Il fait froid etc.
- Food & Drinks:
  Baguette, Pain , Chocolat, Poulet, Poisson, Vin, Lait, Café, Thé etc.
- Clothes:
  T-shirt, Pantalon, Jupe, Robe etc.
- Family Members:
  Père, Mère, Parents etc.

Course Outcomes (CO):

On completion of this second-semester course, the students will be able to

CO1 - Introduce themselves, express personal preferences and participate in casual dialogues
CO2 - Order food and handle shopping interactions in French
CO3 - Understand and apply French grammatical structures, including possessive adjectives, pronominal verbs, interrogative adverbs, near future and recent past
CO4 - Evaluate aspects of French culture such as common French greetings, festivals and media
CO5 - Fill out forms in French and compose short messages and emails, using appropriate salutations and valedictions
CO6 - Get acquainted with basic French vocabulary for public places, transport, weather, food and drinks, clothes and family members

Programme Outcomes (PO):

Upon successful completion of this two-semester programme, students will develop the following competencies:

PO1 - Know about the origin of the French language vis-à-vis other European languages
PO2 - Develop French pronunciation skills
PO3 - Learn to count and tell time in French
PO4 - Understand and apply elementary French Grammar
PO5 - Speak in basic French
PO6 - Demonstrate familiarity with French culture
PO7 - Fill up Forms in French and write short French sentences and messages
PO8 - Gain knowledge of basic French vocabulary

Programme Specific Outcomes (PSO):

PSO1 – Learn about French as a Germanic language and its place in the Indo-European School of Languages
PSO2 – Recognize French diphthongs, accents, sounds and phonetic patterns for accurate pronunciation.
PSO3 – Understand formal and informal time and cardinal and ordinal numbers in French
PSO4 – Grasp key grammatical concepts involving definite and indefinite articles, subject pronouns, adjectives, regular, irregular and pronomial verbs, interrogative adjectives and prepositions
PSO5 – Speak and respond confidently in daily communication scenarios and understand and apply common greetings, expressions and conversational starters
PSO6 – Get acquainted with aspects of French culture, like food and dining etiquette, festivals and media
PSO7 – Fill up forms in French by providing personal information and communicate in French through short e-mails and messages and use conventional French salutations and valedictions
PSO8 – Acquire knowledge of vocabulary related to areas like colours, family, parts of the house, food and drinks, public places, transport, weather and clothes

Correlation Matrix between CO and PO and CO and PSO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1		2		2	3					2		2	3			
CO2		2		2	3	1				2		2	3	1		
CO3				3	3		3					3	3		3	
CO4					2	3							2	3		
CO5				3			3	2				3			3	2
CO6		2			2		3	3		2			2		3	3

Degree of Correlation: 1 – low, 2 – medium, 3 – high

	CLL Foreign Language German UG Semester 1	L	T	P	C
Version 1.0	**Contact Hours - 30**	2	0	0	2
Course Codes	AEC108 (2 credits), CLL11202 (2 credits), CLL11202N (Non-Credit)				
Pre-requisites/Exposure	-				
Co-requisites	-				
Academic Year	2026-2027				

Programme Educational Objectives (PEO)

The German Programme aims to equip students with fundamental linguistic, cultural and communicative competencies for practical applications. The educational objectives are:

PEO1 – Develop foundational skills in speaking, reading, writing, and listening, enabling effective communication in German
PEO2 – Gain insight into German cultural practices, traditions and social etiquette
PEO3 – Acquire the ability to use German in real-life contexts, such as introducing oneself, in restaurant interactions, in supermarkets, in commuting and in formal writing
PEO4 – Develop competence in German grammar, understanding articles, pronouns, conjunctions, verb conjugations and sentence structures

Course Description

This beginner-friendly first-semester course is designed to introduce students to the fundamentals of German while immersing them in the rich cultural and linguistic landscape of German-speaking countries. This course will lay a strong foundation for communication, comprehension and cultural knowledge. Through interactive lessons, pronunciation drills, vocabulary-building exercises and cultural insights, students will gain the confidence to speak, listen and understand the basics of German in everyday scenarios.

Course Content

Module 1: Introduction **[2 hours]**

- Overview of the Indo-European Family of Languages
- Concept of Germanic, Romance and Slavic Languages
- European Countries where German is spoken:
  Germany, Austria, Switzerland, Luxembourg, Lichtenstein et. al.
- Variation of German accents across Germany, Austria and Switzerland
  Hochdeutsch, Österreichisches Deutsch and Schweizerdeutsch

Module 2: The German Alphabet **[2 hours]**

- Letter by Letter – Building Blocks of a New Language
  - A Fun Intro to German Letters
- The four special German characters – ä, ö, ü, ß and their significance
  Activity: Pronounce the Letters shown

Module 3: Pronunciation Rules (From Bahnhof to Brötchen – Speaking Like a Local) [8 hours]

- Rules for Vowels: a, o, e
- Rules for Special characters: ä, ö, ü
- Rules for Diphthongs: ie, ei, ai, au, aü, eu
- Rules for Consonants: b/d/g, h, j, r, s, v, y, z
- Rules for Consonant Clusters: ch, sch, tsch, chs, sp/st, pf, ck, tz, ng
- Rule for ig

  Activities: Pronouncing unknown German words from a Word Montage
  Reading elementary, unknown German texts with correct pronunciation

Module 4: German Numbers [3 hours]

- High-Five to German!
  - The eins, zwei, drei of German Numbers: counting from 1 to 100
- Ordinal Numbers

  Activity: Listening Exercises on Numbers

Module 5: Reading the Clock like a Native German – Tick-Tock auf Deutsch [3 hours]

Wie spät ist es? /Wie viel Uhr ist es?

- Formal Time
- Informal Time

  Activity: Telling the time by looking at pictures of clocks

Module 6: Grammar - Mission: Grammatik Possible [2 hours]

- Definite and Indefinite Articles in the Nominativ Case
- Personal Pronouns in the Nominativ

  Activities: Students become Grammar Detectives and solve the Case by adding der/die/das in front of Nouns shown on Flashcards
  Students identify themselves and others by using Personal Pronouns

Module 7: Speaking German – Basic German Greetings and Expressions: [3 hours]

- Hallo or Guten Tag?
  Navigating the Art of First Impressions - Mastering German Greetings
- From Tschüss to Bis Bald! – Saying Goodbye
  Farewell in German
- Wie Geht's? – How are you?
  Conversational Starters
- Danke, Bitte, Entschuldigung – The Magic Words You'll Use Every Day
  Essential German Politeness
- Ja, Nein, Vielleicht – Yes, No, Perhaps
  Common Responses & Reactions
- Jawohl! Ach So! – Expressions That Make You Sound Like a Local
  Authentic German Exclamations

  Activity: Role Play - Students exchange greetings

Module 8: German Culture **[3 hours]**

- Why Germans Love Punctuality – And How to Never Be 'Zu Spät!' Again!
  (Understanding Social Etiquette)
- Dining Etiquette: How to say "Guten Appetit!" and "Prost!" correctly
- The 'Feierabend' Philosophy – How Germans Unwind After Work
  Work-Life Balance & Leisure Culture
- "Kuchen und Kaffee" – What Germans eat and drink
  Traditional German Food and Everyday Eating Habits
- Karneval , Oktoberfest, Ostern, Christmas Markets & Silvester
  German Festivals and Seasonal Events

Module 9: Elementary Vocabulary **[4 hours]**

- From Montag Blues to Winter Views
  - Weekdays, Months and Seasons in German
- Schwarz, Weiss & everything in between – A Colourful Dive into German!
  - Making colours fun
- From Oma to Onkel – Who's Who in the Family Tree?
  -Navigating Family Vocabulary
- From Küche to Keller – A Tour of Your House in German
  -Essential Home Vocabulary
- Hop On, Hop Off – Mastering German Transport Without Missing Your Bus
  - Understanding Transport Terms
  <u>Activities</u>: Audio Comprehensions
  Identification of Objects from Pictures shown

Course Outcomes (CO):

On completion of this first-semester course, the students will be able to

CO1 - Understand the historical and linguistic background of German within the Indo-European language family
CO2 - Master basic pronunciation rules and apply them to pronounce German words
CO3 - Learn to count and tell time in German
CO4 - Develop a foundation in elementary German grammar, in articles and personal pronouns
CO5 – Learn basic German greetings and expressions and practice speaking
CO6 - Gain insights into German cultural norms, traditions and etiquette, helping them blend into native conversations
CO7 - Build essential vocabulary for greetings, family, colours, transport and daily interactions

Programme Outcomes (PO):

Upon successful completion of this two-semester programme, students will develop the following competencies:

PO1 - Know about the origin of the German language vis-à-vis other European languages
PO2 - Develop German pronunciation skills
PO3 - Learn to count and tell time in German
PO4 - Understand and apply elementary German Grammar
PO5 - Speak in basic German
PO6 - Demonstrate familiarity with German culture
PO7 - Fill up Forms in German and write short German sentences and messages
PO8 - Gain knowledge of basic German vocabulary and answer questions based on unseen German texts

Programme Specific Outcomes (PSO):

PSO1 – Learn about German as a Germanic language and its place in the Indo-European School of Languages
PSO2 – Recognize German diphthongs, consonant clusters, sounds and phonetic patterns for accurate pronunciation.
PSO3 – Understand formal and informal time and cardinal and ordinal numbers in German
PSO4 – Grasp key grammatical concepts involving main verbs, modal verbs, conjunctions and articles and personal pronouns as subjects
PSO5 – Speak and respond confidently in daily communication scenarios and understand and apply common greetings, expressions and conversational starters
PSO6 – Get acquainted with aspects of German culture, like food and dining etiquette, punctuality, festivals, media, football craze and cars
PSO7 – Fill up forms in German by providing personal information and communicate in German through short e-mails and messages and use conventional German salutations and valedictions
PSO8 – Acquire knowledge of vocabulary related to areas like colours, family, home, clothes, transport, cities, weather and parts of the body and read simple, unseen German texts and answer questions based on these texts

Correlation Matrix between CO and PO and CO and PSO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	3								3							
CO2		3	2	2	2	2	2	2	2	3	2	2	2	2	2	2
CO3			3								3					
CO4				3	3		3	3				3	3		3	3
CO5					3	2	1						3	2	1	
CO6						3		2						3		2
CO7			1		2	2	3	3			1		2	2	3	3

Degree of Correlation: 1 – low, 2 – medium, 3 – high

P	CLL Foreign Language German UG Semester 2	L	T	P	C
Version 1.0	Contact Hours - 30	2	0	0	2
Course Codes	AEC111 (2 credits), CLL11205 (2 credits), CLL11205N (Non-Credit)				
Pre-requisites/Exposure	-				
Co-requisites	-				
Academic Year	2026-2027				

Programme Educational Objectives (PEO)

The German Programme aims to equip students with fundamental linguistic, cultural and communicative competencies for practical applications. The educational objectives are:

PEO1 – Develop foundational skills in speaking, reading, writing, and listening, enabling effective communication in German
PEO2 – Gain insight into German cultural practices, traditions and social etiquette
PEO3 – Acquire the ability to use German in real-life contexts, such as introducing oneself, in restaurant interactions, in supermarkets, in commuting and in formal writing
PEO4 – Develop competence in German grammar, understanding articles, pronouns, conjunctions, verb conjugations and sentence structures

Course Description

The Second Semester of the German Language Course is designed to equip students with fundamental grammar, vocabulary, conversational skills and cultural insights essential for effective communication. Students will gain practical exposure to real-life scenarios, including introductions, ordering food, shopping and navigating public transport. Through structured activities such as role-playing, writing exercises and interactive simulations, learners will develop confidence in expressing themselves in German while understanding key aspects of German culture.

Course Content

Module 1: Grammar - Mission: Grammatik Possible **[10 hours]**

- Everyday Verbs in the Present Tense
  Verbs of type: kaufen / antworten / fahren / essen / geben / lesen / haben / sein and similar verbs
- The Power of German Modal Verbs - From “Ich kann nicht!” to “Ich muss doch!”
  Modal Verbs: sollen / wollen / können / dürfen / mögen / müssen / möchten
- Hast du eine Frage?—Frame questions using Verbs
- Coordinate Conjunctions: und / oder / aber / sondern / denn
  Activity: Formulating and Answering Questions based on Words given in Cue Cards
  Exercise: Quizzes and Worksheets

Module 2: Speaking German – Real Life Scenarios in Germany: **[8 hours]**

- The Art of Introducing Yourself in German - "Ich heiße... und du?”
  Speaking Topics: Personal / Family / Studies / Food / Hobbies and Spare Time
  Activity: Pair Work -
  Students pair up for casual dialogues and switch partners every 3 minutes
- Essential Ordering Phrases in a German Restaurant
  " Von Schnitzel bis Erdbeerkuchen mit Sahne”

Activity: Restaurant Simulation -
Students practice ordering different items using a mock menu

- Lost in the Aisles? Navigating a German Supermarkt Without Panic
  Shopping Conversations: Prices, Discounts, Preferences
  Activity: Simulated Shopping - "Customer and Store Attendant / Cashier" practice
- Asking for Directions and using Public Transport
  Navigating bus stops and train stations
  Buying tickets and asking about timetables
  Activity: Role Play -
  Students ask for directions to famous places in Germany
  Students buy train tickets at a railway station

Module 3: German Culture **[3 hours]**

- Mastering German Greetings on Occasions and Holidays:
  Alles Gute!
  Gesundheit!
  Herzlichen Glückwunsch zum Geburtstag! / zur Hochzeit!
  Alles Gute zum Jahrestag!
  Viel Glück für die Zukunft!
  Frohe / Fröhliche Weihnachten!
  Frohes neues Jahr! / Prosit Neujahr! / Guten Rutsch ins neue Jahr!
  Frohe Ostern!
- German Media: Brief Overview
  Newspapers – Die Zeit / Frankfurter Allgemeine / Süddeutsche Zeitung / Bild
  Magazines: Spiegel / Stern / Focus / Kicker
  Television: Deutsche Welle (DW) / ZDF / ARD / RTL
  Popular talk shows (Markus Lanz, Anne Will)
- Tor! German Football: Snapshot
  Bundesliga – The top-tier football league
  German Football Clubs – FC Bayern München, Borussia Dortmund, RB Leipzig, Bayer 04 Leverkusen
- German Car Industry: Brief Overview
  Brands – Mercedes Benz, Audi, BMW, Volkswagen, Porsche

Module 4: Elementary Vocabulary **[4 hours]**

- Surviving in a German City Without Getting Lost
  Urban Vocabulary for Everyday Use: From Bahnhof to Brücke
- Dressing the German Way
  Essential Clothing Vocabulary: From Mantel to Mütze
- Talking About the Weather Like a True German
  Mastering Weather Terms: Regen oder Schnee?
- Learning about parts of the body without losing your head
  Requisite Vocabulary for Anatomy: Von Kopf bis Fuß
- Activities: Audio Comprehensions
  Identification of Objects from Pictures shown

Module 5: Writing Skills **[3 hours]**

- Filling out a form with detailed personal information in German
  - Vorname, Nachname, Alter…..
- Writing 20-25 word brief e-mails or messages on instant messaging apps
  Formal e-mails -
  Greetings and Salutations: Sehr geehrte / Sehr geehrter
  Valedictory Address: Mit freundlichen Grüßen / Mit freundlichem Gruß
  Informal e-mails -
  Greetings and Salutations: Hallo / Liebe / Lieber
  Valedictory Address: Tschüss / Bis bald!
  Exercise: Students write short emails / messages based on given scenarios like requesting for, fixing up or cancelling an appointment, inviting someone to a birthday party or accepting / declining such an invitation, then peer-review each other's work

Module 6: Reading Ability: Unseen Comprehension **[2 hours]**

Activity: Students will read short and simple unseen texts and answer questions based on these texts
Comprehension Gym – a workout for the brain, lifting sentences instead of weights.

Course Outcomes (CO):

On completion of this second-semester course, the students will be able to

CO1 - Use essential verbs, modal verbs and conjunctions to form sentences and questions
CO2 - Introduce themselves, express personal preferences and participate in casual dialogues
CO3 - Order food, handle shopping interactions and ask for directions in German
CO4 - Learn common German greetings, football culture and about German media and German car brands
CO5 - Recognize essential words for urban navigation, clothing, weather and parts of the body
CO6 – Fill out forms in German and compose short messages and emails, using appropriate salutations and valedictions
CO7 – Read simple, unseen German texts and answer questions

Programme Outcomes (PO):

Upon successful completion of this two-semester programme, students will develop the following competencies:

PO1 - Know about the origin of the German language vis-à-vis other European languages
PO2 - Develop German pronunciation skills
PO3 - Learn to count and tell time in German
PO4 - Understand and apply elementary German Grammar
PO5 - Speak in basic German
PO6 - Demonstrate familiarity with German culture
PO7 - Fill up Forms in German and write short German sentences and messages
PO8 - Gain knowledge of basic German vocabulary and answer questions based on unseen German texts

Programme Specific Outcomes (PSO):

PSO1 – Learn about German as a Germanic language and its place in the Indo-European School of Languages
PSO2 – Recognize German diphthongs, consonant clusters, sounds and phonetic patterns for accurate pronunciation
PSO3 – Understand formal and informal time and cardinal numbers in German
PSO4 – Grasp key grammatical concepts involving main verbs, modal verbs, conjunctions and articles and personal pronouns as subjects
PSO5 – Speak and respond confidently in daily communication scenarios and understand and apply common greetings, expressions and conversational starters
PSO6 – Get acquainted with aspects of German culture, like food and dining etiquette, punctuality, festivals, media, football craze and cars
PSO7 – Fill up forms in German by providing personal information and communicate in German through short e-mails and messages and use conventional German salutations and valedictions
PSO8 – Acquire knowledge of vocabulary related to areas like colours, family, home, clothes, transport, cities, weather and parts of the body and read simple, unseen German texts and answer questions based on these texts

Correlation Matrix between CO and PO and CO and PSO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1				3	3		3	2				3	3		3	2
CO2		2		3	3			2		2		3	3			2
CO3		2		3	3			1		2		3	3			1
CO4		2			1	3				2			1	3		
CO5					2	1	2	3					2	1	2	3
CO6		1		2	1		3	2		1		2	1		3	2
C07		1		3				3		1		3				3

Degree of Correlation: 1 – low, 2 – medium, 3 – high

	CLL Foreign Language Spanish UG Semester 1	L	T	P	C
Version 1.0	**Contact Hours - 30**	2	0	0	2
Course Codes	AEC109 (2 credits), CLL11203 (2 credits), CLL11203N (Non-Credit)				
Pre-requisites/Exposure	-				
Co-requisites	-				
Academic Year	2026-2027				

Programme Educational Objectives (PEO)

The Spanish Programme aims to equip students with fundamental linguistic, cultural and communicative competencies for practical applications. The educational objectives are:

PEO1 – Equip students with the ability to communicate effectively in basic spoken and written Spanish in familiar contexts
PEO2 – Provide a strong foundation in Spanish grammar, vocabulary and pronunciation
PEO3 – Develop cross-cultural awareness and appreciation of Hispanic cultures and global diversity
PEO4 – Enable students to engage in real-life situations using Spanish through listening, speaking, reading and writing practice

Course Description

This first-semester course offers a lively introduction to the Spanish language. Beginning with the Spanish alphabet and fundamental pronunciation, students will explore practical expressions used in greetings, introductions and everyday conversations. With a blend of situational vocabulary and grammar, learners will acquire useful words related to daily life—covering topics such as food, travel, time and the classroom. Simultaneously, students will master basic grammar concepts including verb conjugation, personal pronouns and articles.

Course Content

Module 1: Introduction **[2 hours]**

- Overview of the Indo-European Family of Languages
- Concept of Germanic, Romance and Slavic Languages
- Countries where Spanish is spoken: Spain, Latin America (Mexico, Colombia, Argentina, Peru, Chile) and others
- Spanish Colonies: Territories formerly controlled by Spain in Latin America, Asia and Africa
- Español vis-à-vis Catalán and Euskera

Module 2: From A to Ñ –A Flamenco of Spanish Letters and Sounds **[4 hours]**

- Alphabet and Pronunciation
- Understanding special alphabets like ll and ch
- Key consonant sounds: h (silent), j, r/rr, c (before e/i), g (before e/i), ñ
  Activity: Reading short Spanish texts with correct pronunciation

Module 3: Uno, Dos, Cha-Cha-Cha! – Dancing with Spanish Numbers **[3 hours]**

- Counting from 1 to 100
- Basic arithmetic expressions like mas y menos

  Activity on numbers: (saying phone numbers and age)

Module 4: Tick-Tock en Español – ¿Qué hora es? **[3 hours]**

- Telling time
- Reading clocks and expressing dates
- Days, months and seasons

  Activity**:** Identify time using images of clocks, telling date of birth and favourite seasons.

Module 5: Grammar Fiesta **[8 hours]**

- Regular verb conjugations in the present tense (ar, er, ir)
- Verb "ser" and nationalities
- Verb "estar" and location
- Personal Pronouns
- Articles (Definite / Indefinite)

Module 6: Saludos y Despedidas – The art of first impressions **[3 hours]**

- Hola, buenos días, buenas tardes, buenas noches
- Farewell expressions: Adiós, hasta luego, nos vemos
- Introducing yourself: name, nationality, profession
- Introductions: Me llamo…, soy de…, estudio

  Activity**:** Rotating Pair Dialogues (Switch Partners every 3 minutes)

Module 7: Hispanic Culture **[3 hours]**

- Spanish and Latin American food culture: Paella, Tapas, Mate, Tortillas, Empanadas
- Everyday lifestyle: Siesta, Meal Schedules (Comida, Tapas, Meriendas, Sobremesa), "Mi casa es tu casa"
- Major festivals: La Tomatina (Buñol), Día de los Muertos, San Fermín (Pamplona), La Feria de Abril (Seville), Fallas de Valencia, La Mercè (Barcelona)

Module 8: From Taco to Techo: Everyday Spanish Words you'll use: **[4 hours]**

- Colours and Shapes
- Food and Drinks
- Travel and Directions
- Classroom and University

  Activity**:** Audio Comprehensions

Course Outcomes (CO):

On completion of this first-semester course, the students will be able to

CO1 - Understand the historical and linguistic background of Spanish within the Indo-European language family
CO2 - Master the Spanish alphabet and build a foundation in pronunciation
CO3 - Count in Spanish, tell time and express dates, days, months and seasons
CO4 - Demonstrate understanding of elementary grammar, including personal pronouns, articles and present tense conjugation of regular and essential irregular verbs
CO5 - Use basic expressions to greet others and introduce themselves
CO6 - Gain insights into Spanish cultural norms, traditions and etiquette, helping them blend into native conversations
CO7 - Identify and use common vocabulary related to colours, food, directions and classroom settings to support communication in relevant contexts

Programme Outcomes (PO):

Upon successful completion of this two-semester programme, students will develop the following competencies:

PO1 – Know about the origin and global spread of the Spanish language across continents
PO2 – Develop accurate Spanish pronunciation skills
PO3 – Learn to count and tell time in Spanish
PO4 – Understand and apply elementary Spanish grammar
PO5 – Speak in basic Spanish in everyday situations
PO6 – Demonstrate familiarity with Spanish and Latin American cultures
PO7 – Write short Spanish sentences and messages
PO8 – Gain knowledge of basic Spanish vocabulary across everyday themes

Programme Specific Outcomes (PSO):

PSO1 – Learn about Spanish as a Romance language and its place in the Indo-European School of Languages
PSO2 – Recognize Spanish vowel sounds, diphthongs, consonant combinations and phonetic patterns for accurate pronunciation
PSO3 – Understand formal and informal time, numbers and basic quantifiers in Spanish
PSO4 – Grasp key grammatical concepts involving regular and irregular verbs, modal verbs, conjunctions, articles, personal pronouns, reflexive verbs and object pronouns
PSO5 – Speak and respond confidently in everyday communication scenarios using greetings, expressions and conversational starters
PSO6 – Get acquainted with Hispanic cultural elements such as food habits, dining etiquette, festivals, media, football culture and traditions across Spain & Latin America
PSO7 – Communicate in Spanish through short emails and messages using conventional Spanish salutations and valediction. Fill up forms in Spanish.
PSO8 – Acquire vocabulary related to areas such as colours and shapes, food and drinks, travel and direction, classroom and university, family members, navigating a city, clothing and accessories, expressions related to weather weather and parts of the body

Correlation Matrix between CO and PO and CO and PSO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1	3								3							
CO2		3	2	2	2	2	2	2	2	3	2	2	2	2	2	2
CO3			3		1		1				3		1		1	
CO4				3	3		3					3	3		3	
CO5					3	2	1						3	2	1	
CO6					2	3		1					2	3		1
CO7					2	2	3	3					2	2	3	3

Degree of Correlation: 1 – low, 2 – medium, 3 – high

	CLL Foreign Language Spanish UG Semester 2	L	T	P	C
Version 1.0	**Contact Hours - 30**	2	0	0	2
Course Codes	AEC112 (2 credits), CLL11206 (2 credits), CLL11206N (Non-Credit)				
Pre-requisites/Exposure	-				
Co-requisites	-				
Academic Year	2026-2027				

Programme Educational Objectives (PEO)

The Spanish Programme aims to equip learners with essential linguistic, cultural and communicative abilities for practical everyday use.

PEO1 – Develop foundational speaking, reading, writing and listening skills for effective communication in Spanish
PEO2 – Understand key aspects of Hispanic cultures, traditions and social behaviour
PEO3 – Use Spanish confidently in real-life contexts such as introductions, shopping, directions and restaurant conversations
PEO4 – Build accuracy in Spanish grammar: verbs, pronouns, articles, possessives, reflexives and everyday sentence structures

Course Description

The Second Semester of the Spanish Language Course enhances students' linguistic competence by introducing practical grammar, thematic vocabulary and conversational fluency. Learners engage with real-life scenarios such as dining in a restaurant, shopping, asking for directions and describing daily routines. Through pair-work, simulations, audio–visual inputs and presentations, students build confidence in expressing themselves effectively in Spanish. Cultural elements from Spain and Latin America—festivals, food, media and traditions—are woven into classroom activities to enrich intercultural understanding.

Course Content

Module 1: Grammar - Misión: Gramática Posible [10 hours]

- Everyday Spanish Verbs in the Present Tense:
  - Verbs like hablar, vivir, comer, escribir, comprar
  - Irregular Verbs: ser, estar, tener, ir, hacer, poner, decir
  - Stem - changing Verbs: pensar, pedir, poder, jugar
  - Reflexive Verbs with reflexive pronoun: levantarse, ducharse, ponerse, vestirse, acostarse
  - Vocabulary: Routines
- Conjunctions:
  y / o / pero / porque / aunque
- Introduction to indirect object pronouns: me, te, le, nos, os, les
- Structure of gustar: me gusta / me gustan / te gusta / le gusta
- Using emphasis: A mí me gusta…, A ella le gusta…

<u>Activities</u>: Grammar Quizzes, Gap-fill Worksheets, Verb conjugation challenges

Module 2: Speaking Spanish – Real Life Situations in the Hispanic World: [10 hours]

- Talking about likes and preferences for food, hobbies, people, activities
  Activities: Pair conversation: "¿Qué te gusta hacer?"
  Students create 5 sentences about their likes/dislikes or quick class survey using gustar (food, sports, music)

- Shopping Without Panic – Spanish Markets
  Useful phrases: ¿Cuánto cuesta?, ¿Tiene otra …..(talla)?, Busco…
  Numbers from 100 - 1000
  Activity: Market Roleplay – "Cliente y dependiente"

- Public Transport & Asking for Basic Directions
  Phrases for bus stops, metro stations and travel
  Expresiones: ¿Dónde está…?, ¿Cómo llego a…?
  Activities: Role Play – Asking for directions to famous cities/landmarks
  Buying tickets at a metro station

Module 3: Spanish Culture [3 hours]

- Mastering Greetings for Festivals & Social Occasions:
  ¡Feliz cumpleaños! / ¡Buena suerte! / ¡Felices fiestas! / ¡Feliz Año Nuevo!

- Spanish & Latin American Media:
  Newspapers: El País, La Vanguardia
  TV/Channels: RTVE, Univisión, Telemundo
  Popular Spanish podcasts

- Football Fever – A Spanish Passion
  La Liga Overview
  Famous Clubs: FC Barcelona, Real Madrid, Atlético de Madrid

Module 4: Writing Skills and Form Filling in Spanish [3 hours]

- Essential form vocabulary:
  nombre, apellido, dirección, fecha de nacimiento, correo electrónico, número de teléfono, firma
  Activity: Fill a brief personal information form or complete a short hotel/registration form based on a given scenario.
- Writing short (20–25 word) E-mails or messages
  Informal: Greetings- Hola / Querido / Querida and Closings- Un abrazo / Nos vemos pronto
  Activity: Students write a short message or email based on a given scenario

Module 5: Elementary Vocabulary [4 hours]

- Family Members: padre, madre, hijo, hija, Hermano, hermana, primo, prima, tio, tia, abuelo, Abuela etc.
- Navigating a City: aeropuerto, estación, calle, farmacia, banco etc.
- Clothing & Accessories: camisa, camiseta, pantalón o pantalones, falda, zapatos, gorro etc.
- Weather Expressions: hace frío, hace sol, hace Viento etc.
- Parts of the Body: cabeza, pierna, corazón, ojo, oreja, mano etc.
  Activity: Audio Comprehension

Course Outcomes (CO):

By the end of the course, students will be able to:

CO1 – Use essential Spanish regular verbs, irregular verbs, conjunctions and indirect object pronouns to form meaningful sentences.

CO2 – Introduce themselves, express personal preferences (including gustar) and participate in casual dialogues and use numbers from 100 – 1000.

CO3 – Order food, handle shopping interactions and ask for directions in Spanish.

CO4 – Learn common Spanish greetings and gain insight into Hispanic festivals, football culture and Spanish/Latin American media.

CO5 – Compose short messages or emails using appropriate Spanish salutations, understand and formulate dialogues and fillup forms in Spanish.

CO6 – Recognize essential Spanish vocabulary related to family members, city navigation, clothing, weather and parts of the body

Programme Outcomes (PO):

Upon successful completion of this two-semester programme, students will develop the following competencies:

PO1 – Know about the origin and global spread of the Spanish language across continents

PO2 – Develop accurate Spanish pronunciation skills

PO3 – Learn to count and tell time in Spanish

PO4 – Understand and apply elementary Spanish grammar

PO5 – Speak in basic Spanish in everyday situations

PO6 – Demonstrate familiarity with Spanish and Latin American cultures

PO7 – Write short Spanish sentences and messages

PO8 – Gain knowledge of basic Spanish vocabulary across everyday themes

Programme Specific Outcomes (PSO):

PSO1 – Learn about Spanish as a Romance language and its place in the Indo-European School of Languages

PSO2 – Recognize Spanish vowel sounds, diphthongs, consonant combinations and phonetic patterns for accurate pronunciation

PSO3 – Understand formal and informal time, numbers and basic quantifiers in Spanish

PSO4 – Grasp key grammatical concepts involving regular and irregular verbs, modal verbs, conjunctions, articles, personal pronouns, reflexive verbs and object pronouns

PSO5 – Speak and respond confidently in everyday communication scenarios using greetings, expressions and conversational starters

PSO6 – Get acquainted with Hispanic cultural elements such as food habits, dining etiquette, festivals, media, football culture and traditions across Spain & Latin America

PSO7 – Communicate in Spanish through short emails and messages using conventional Spanish salutations and valediction. Fill up forms in Spanish.

PSO8 – Acquire vocabulary related to areas such as colours and shapes, food and drinks, travel and direction, classroom and university, family members, navigating a city, clothing and accessories, expressions related to weather weather and parts of the body

Correlation Matrix between CO and PO and CO and PSO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1				3	3		3					3	3		3	
CO2		2	3	2	2					2	3	2	2			
CO3		2		3	3					2		3	3			
CO4				2	1	3						2	1	3		
CO5				2			3	2				2			3	2
CO6		2			2		2	3		2			2		2	3

Degree of Correlation: 1 – low, 2 – medium, 3 – high