

BHARATHIAR UNIVERSITY
COIMBATORE

**A three-year Under-Graduate
Programme in
B. Sc. (Blended) Biosciences**

**Offered By
Centre for International Affairs (CIA), Bharathiar
University in collaboration with The University of
Melbourne**

(For the students admitted during the academic year 2026 – 27 onwards)

**Syllabus for SEM I–VI
(To Be Implemented from Academic Year 2026–2027)**

Overview of the B.Sc., (Blended) Course

Bharathiar University is offering an innovative Bachelor's Degree known as B.Sc. (Blended) in collaboration with the University of Melbourne (UoM), Australia, to strengthen science education at the undergraduate level.

Bharathiar University is among the top universities in the country and has been at the forefront of initiating innovative programs. The UoM is ranked #1 in Australia and has been among the top 50 universities in the world.

The B.Sc. (Blended) course is a joint initiative of BU-UoM, offering a transparent and internationally recognized bachelor's degree that clearly outlines the teaching objectives and learning outcomes. In the first two years of the degree program, students will study all four basic sciences (Biology, Chemistry, Mathematics, and Physics), and in the third year, they will specialize in either Biosciences, Physics or Chemistry. The UoM will provide support in terms of special lectures, workshops, and quality assurance.

The B.Sc. (Blended) course aims to achieve the following objectives:

- Introduce students to the fundamental concepts of science education.
- Enrich students' knowledge in all basic sciences, including Biology, Chemistry, Mathematics, and Physics.
- Help students develop an interdisciplinary approach to learning that integrates various scientific fields.
- Inculcate a sense of scientific responsibility, social awareness, and environmental consciousness in students.
- Assist students in building a successful and progressive career in academia and industry by providing them with the necessary skills and knowledge.

The B.Sc. (Blended) course will be jointly conducted by Bharathiar University and the University of Melbourne (UoM).

The following features are included in the course:

- Special lectures will be delivered by expert faculty from UoM.
- The course will be quality assured by UoM, ensuring that it meets the highest standards of education.

- Upon completion, the degree will be considered equivalent to a degree from UoM, enabling students to pursue higher studies at UoM or any other Australian university.
- The collaboration with UoM ensures that students receive an internationally recognized education of the highest quality, opening up opportunities for further academic pursuits and careers in various fields. The students will be imparted solid training to enable them to pursue Masters and Integrated Ph.D. degrees in reputed institutes such as IITs, IISERs and Central Universities

Eligibility

Higher Secondary School Certificate (10+2) or its equivalent Examination in Science stream with either PCM group (Physics, Chemistry & Mathematics) or PCMB group (Physics, Chemistry, Mathematics & Biology)

Course Structure

- The B.Sc. (Blended) course follows a semester and credit system that spans over six semesters of 14-16 weeks each. The course curriculum is divided into two phases: the first two years and the third year.
- During the first two years, students will receive instruction in the four basic sciences, namely Biology, Chemistry, Mathematics, and Physics alongside language courses. In the third year, students will specialize in either Biosciences, Physics or Chemistry.
- The curriculum is designed to provide students with a well-rounded education in the sciences, preparing them for further academic pursuits or careers in various scientific fields.

Examination and Grading

- The B.Sc. (Blended) course follows a credit-based system, and its examination process comprises two parts: continuous assessment (internal 50%) and end-semester examination (50%).
- The internal assessment will be based on various parameters, including classroom examinations (subjective/objective), fieldwork, viva-voce, assignments, lab work, tutorials, and group discussions. The grading will be carried out in accordance with the university norms applicable to the credit system.

- This examination process ensures that students are regularly assessed and evaluated based on their academic performance, facilitating a more comprehensive understanding of the subjects and enhancing the overall learning experience. The grading will be as per the university norms applicable to credit system.

University Terms

- The commencement and conclusion dates for the odd and even semesters of the B.Sc. (Blended) course will adhere to the university regulations applicable to other departments.
- To be eligible for the term-end examination, students must fulfill the minimum attendance requirement of 75 percent for both theory and practical courses. Additionally, students must demonstrate satisfactory performance during the term.
- Adherence to these guidelines ensures that students attend classes regularly and maintain consistent academic performance throughout the term. This, in turn, promotes a positive and conducive learning environment for all students.

Intake capacity of student: B.Sc., Blended course:60 (20 for Biosciences, 20 for Physics and 20 for Chemistry)

Duration: The duration of **B.Sc., (Blended)** Degree Program shall be of three years.

Medium of Instruction: The medium of instruction for the course shall be English.

Scheme of Examinations (CBCS Pattern)

- Number of weeks in a semester: 14-16
- Nomenclature: BIO: Biology. CHM: Chemistry. MTH: Mathematics PHY: Physics
ENG: English; COMP –Computing; IDC: Interdisciplinary Course; FLX: Flexible timetabling
- 1 Credit =1 Contact hour per week both for theory and lab courses

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
MTH101	Maths 1: Calculus	4	4	-	50	50	100
PHY101	Physics 1: Introductory Classical Physics	4	4	-	50	50	100
CHM101	Chemistry 1: Introductory and Organic Chemistry	4	4	-	50	50	100
BIO101	Biology 1: The Diversity of Life	4	4	-	50	50	100
PHY102	Physics Practical	2	-	2	25	25	50
CHM102	Chemistry Practical	2	-	2	25	25	50
BIO102	Biology Practical	2	-	2	25	25	50
FLX101* (11T/11H/11M/ 11K)	Part I: Language Paper I- Tamil/Malayalam/French/Hindi/ Kanada	4	4	-	50	50	100
FLX102** (12E)	Part II: English I	4	4	-	50	50	100
1FA#	Value Added 1/Foundation course: Environmental Studies	2	2	-		50	50
Total		32	26	6	375	425	800

* **and** ** indicates the mandatory language papers for all UG students as per the TN state government.
indicates the UGC mandatory course that all students must opt for. This course will be taught either in online mode or offline mode.

SECOND SEMESTER							
Course Code	Title of the Course	Credits	Theory	Practical	CIA	ESE	Total
MTH201	Maths 2: Algebra	4	4	-	50	50	100
PHY201	Physics 2: Modern Physics	4	4	-	50	50	100
CHM201	Chemistry 2: Inorganic and Physical Chemistry	4	4	-	50	50	100
BIO201	Biology 2: Biology of Cells	4	4	-	50	50	100
PHY202	Physics Practical	2	-	2	25	25	50
CHM202	Chemistry Practical	2	-	2	25	25	50
BIO202	Biology Practical	2	-	2	25	25	50
IDC201	Scientific Computation and Modeling: Introduction to simple models and programming	2		2	25	25	50
FLX201* (21T/21H/21M/21K)	Part I: Language Paper II- Tamil/Malayalam/French/Hindi/ Kanada	4	4	-	50	50	100
FLX202** (22E)	Part II: English II	4	4	-	50	50	100
2FB#	Value Added 2/Foundation course: Human Rights	2	2	-		50	50
Total		34	26	8	400	450	850

** and ** indicates the mandatory language papers for all UG students as per the TN state government.
indicates the UGC mandatory course that all students must opt for. This course will be taught either in online mode or offline mode.*

THIRD SEMESTER							
Course Code	Title of the Course	Credits	Theory	Practical	CIA	ESE	Total
MTH301	Maths 3: Vector Calculus, and Differential Equations	4	4	-	50	50	100
PHY301	Physics 3: Quantum mechanics and Thermodynamics	4	4	-	50	50	100
CHM301	Chemistry 3: Reactions and Synthesis	4	4	-	50	50	100
BIO301	Biology 3: Functional Biology of Organisms	4	4	-	50	50	100
PHY302	Physics Practical	2	-	2	25	25	50
CHM302	Chemistry Practical	2	-	2	25	25	50
BIO302	Biology Practical	2	-	2	25	25	50
IDC301	Scientific Computation and Modeling: Projects	2	-	2	25	25	50
FLX301* 31T/31H/31M/31K	Part I: Language Paper III- Tamil/Malayalam/French/Hindi/ Kanada	4	4	-	50	50	100
FLX302** (32E)	Part II: English III	4	4	-	50	50	100
3FC#	Value added 3/Foundation course: Yoga for Human Excellence	2	2			50	50
HW	Health & Wellness	1	-	2	25	-	25
	Total	36	26	10	425	450	875

** and ** indicates the mandatory language papers for all UG students as per the TN state government.*

indicates the UGC mandatory course that all students must opt for. This course will be taught either in online mode or offline mode.

FOURTH SEMESTER							
Course Code	Title of the Course	Credits	Theory	Practical	CIA	ESE	Total
MTH401	Maths 4: Probability and Statistics	4	4	-	50	50	100
PHY401	Physics 4: Electricity, magnetism, Special Relativity and Optics	4	4	-	50	50	100
CHM401	Chemistry 4: Structure and properties	4	4	-	50	50	100
BIO401	Biology 4: Genetics Evolution and Ecology	4	4	-	50	50	100
PHY402	Physics Practical	2	-	2	25	25	50
CHM 402	Chemistry Practical	2	-	2	25	25	50
BIO402	Biology Practical	2	-	2	25	25	50
FLX401* 41T/41H/41M/41K	Part I: Language Paper IV- Tamil/Malayalam/French/Hindi/ Kanada	4	4	-	50	50	100
FLX402** (42E)	Part II: English IV	4	4	-	50	50	100
4FD#	Value added 4/Foundation course: General Awareness	2	2			50	50
	Total	32	26	6	375	425	800

* **and** ** indicates the mandatory language papers for all UG students as per the TN state government.
indicates the UGC mandatory course that all students must opt for. This course will be taught either in online mode or offline mode.

FIFTH SEMESTER

Course Code	Title of the Course	Credits	Theory	Practical	CIA	ESE	Total
BIO 501	Biochemistry	4	4	-	50	50	100
BIO 502	Molecular Biology	4	4	-	50	50	100
BIO 503	Animal Sciences	4	4	-	50	50	100
BIO 504	Plant Sciences	4	4	-	50	50	100
BIO 505	Elective – 1: Methods in Biology	2	2	-	25	25	50
BIO 506	Elective – 2: Genetic Engineering	2	2	-	25	25	50
BIO 507	Biology Lab I: Biochemistry and Molecular Biology Practical's	2	-	2	25	25	50
BIO 508	Biology Lab II: Plant and Animal Sciences Practical's	2	-	2	25	25	50
BIO 509	Graduate Level Thesis	2	-	2	25	25	50
Total		26	20	6	325	325	650

SIXTH SEMESTER

Course Code	Title of the Course	Credits	Theory	Practical	CIA	ESE	Total
BIO 601	Evolutionary Developmental Biology	4	4	-	50	50	100
BIO 602	Systematics and Evolution	4	4	-	50	50	100
BIO 603	Microorganisms and Diseases	4	4	-	50	50	100
BIO 604	Computational Biology	4	4	-	50	50	100
BIO 605	Elective – 3: Applied Biology	2	2	-	25	25	50
BIO 606	Elective – 4: Scientific Writing	2	2	-	25	25	50
BIO 607	Biology Lab III: Evolutionary Developmental Biology Practical's	2	-	2	25	25	50
BIO 608	Biology Lab IV: Computational Biology Practical's	2	-	2	25	25	50
BIO 609	Graduate Level Thesis	2	-	2	25	25	50
Total		26	20	6	325	325	650
Grand Total		186	144	42	2225	2400	4625

SEMESTER I

Course code	MTH 101	Maths-1 Calculus	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Higher Secondary Mathematics	Syllabus Version	2026-27
Course Objectives 1. To understand fundamental concepts of logic, set theory, and proof techniques. 2. To develop knowledge of number systems and complex numbers. 3. To analyze limits, continuity, and differentiation of functions. 4. To understand integral calculus and its applications. 5. To introduce ordinary differential equations and real-world applications				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Explain concepts of sets, logic, number systems and mathematical proof techniques.	K1, K2	Remembering & Understanding	
CO2	Apply properties of complex numbers and solve problems involving algebraic and polar representations.	K2, K3	Understanding & Applying	
CO3	Analyze limits, continuity and differentiation of functions using standard calculus rules.	K3, K4	Applying & Analyzing	
CO4	Evaluate integrals using various integration techniques and interpret applications such as area and volume.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Solve ordinary differential equations and interpret mathematical models in physical and real-world systems.	K3, K4, K6	Applying, Analyzing & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit:1	Logic and Proof			11 L
• Basic Set Theory Sets, Subsets, Power Sets - Operations: Union, Intersection, Difference, Complement, Venn Diagrams - Cardinality: Finite and Infinite Sets, Countable and Uncountable Sets, Cartesian Products, Indexed Families of Sets • Number System Natural Numbers, Integers, Rational Numbers - Real Numbers - Properties of Real Numbers and Completeness Property of Real Numbers • Logic Logical Connectives (Conjunction, Disjunction, Negation, Conditional, Biconditional) and Truth Tables - Propositional Logic, Logical Equivalence, Logical Laws - Quantifiers Predicate Calculus - Negation of Quantified Statements • Methods of Proof Direct Proof, Contrapositive - Contradiction, Proof by Cases- Induction				
Unit:2	Complex Numbers			02 L

• Review of Complex Numbers Definition of Complex Numbers, Algebra of Complex Numbers, Argand Plane, Cartesian and Polar Form - Exponential Form: $z = r(\cos \theta + i \sin \theta)$ Euler's Formula • Roots of Complex Numbers Fundamental Theorem of Algebra - Finding nth Roots of Unity and De Moivre's Theorem; Roots of Complex Numbers		
Unit:3	Differential Calculus	09 L
• Limits, Continuity and Differentiation Definitions Using ε-δ (limit and continuity), One-sided Limits - Limits at Infinity, Continuity and Types of Discontinuities - Rules: Product, Quotient, Chain Rule - Derivative of Functions (incl. Polynomials, Trigonometric, Exponential, Log Functions) - Higher Order Derivatives • Inverse Trigonometric Functions and Implicit Differentiation Inverse Trigonometric Function and Their Derivatives - Implicit Differentiation		
Unit:4	Integral Calculus	09 L
• Reimann Integration Definition of Reimann Integral, Partition, Norm of Partition, Upper and Lower Sums, Conditions for Integrability • Fundamental Theorem of Calculus; Review of Standard Antiderivatives Statement and Explanation of Fundamental Theorem, Relationship Between-Differentiation and Integration, Common Antiderivatives (Power, Exponential,- Trigonometric and Logarithmic Functions) • Techniques of Integration Derivative Present Substitution, Linear Substitution- Integration of Trigonometric Functions Using Identities - Integration of Rational Functions Including Partial Fractions, Integration Yielding Inverse Trigonometric Functions- Trigonometric Substitutions; Integration By Parts • Definite Integral Definite Integral, Properties and Interpretation of Area, Fundamental Theorem of Calculus Improper Integrals • Applications of Integration Areas Between Curves - Volumes of Surfaces of Revolution		
Unit:5	Ordinary Differential Equations and Applications	09 L
• Ordinary Differential Equations – Basic Concepts Definition of ODE, Order, General Solution, Initial Conditions; Separable ODEs • First Order ODEs Separable Equations, Homogeneous and Non-Homogeneous Equations, Linear First-Order Equations (Integrating Factor) • Applications of First Order ODEs Ecology Models - Chemical Reaction Rates - Newton's Law of Cooling • Second Order ODEs Definitions of Homogeneous/Inhomogeneous, Linear/Non-Linear; Solution of Homogeneous Constant-Coefficient Linear ODEs- Particular Solutions Of Inhomogeneous Constant Coefficient Linear ODEs Using Method of - Undetermined Coefficients; Principle of Superposition		

- **Applications of Second Order ODEs**
Springs - LRC series electrical circuits
- **Real World Application of ODEs**
Real World Contextual Examples in Physics and Chemistry and the Application of ODEs
(Selection of Examples Depending on Student Cohort)

Suggested Reference books:

Logics and Proof:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, 7th Edition, McGraw Hill, 2012.
2. Gary Chartrand, Albert D. Polimeni and Ping Zhang, Mathematical Proofs – A Transition to Advanced Mathematics, 3rd Edition, Pearson Education, Inc., 2012.

Complex Numbers:

1. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Edition, McGraw Hill Higher Education, 2008.
2. L. V. Ahlfors, Complex Analysis, Third Edition, McGraw Hill Book Company, 2013.

Differential Calculus, Integral Calculus and Ordinary Differential Equations:

1. James Stewart, Daniel Clegg and Saleem Watson, Calculus – Early Transcendentals, 9th Edition, Cengage, 2021.
2. Robert A. Adams and Christopher Essex, Calculus – A Complete Course, 7th Edition, Pearson Canada, 2009.
3. Robert T. Smith and Roland B. Minton, Calculus, 4th Edition, McGraw Hill, 2012.
4. Maurice D. Weir, Joel Hass, P. Sivaramakrishna Das and C. Vijaykumari, Calculus, Pearson, 2018.
5. Mukesh Kumar, A.P. Singh and Ashok Kumar, Integral Calculus, Medtech, 2008.
6. S.B. Gaikwad, K.C. Takale, V.S. Jadhav, P.G.Jadhav, S.M. Waingade, S.R. Patil, Calculus, Nirali Prakashan, 2019

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	–	✓

Course code	PHY 101	Introductory Classical Physics/ Classical Mechanics	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Algebra & Trigonometry	Syllabus Version	2026-27

Course Objectives

1. To understand fundamental principles of classical mechanics including motion, forces, energy, and rotational dynamics.
2. To explain gravitational interactions, orbital motion, and planetary dynamics.
3. To develop knowledge of thermodynamic laws and heat transfer mechanisms.
4. To study elasticity, fluid mechanics, gas behavior, and their real-world applications.
5. To apply ordinary differential equations in modeling physical and chemical systems.

Course Outcomes with K-Level Mapping

CO Code	Course Outcome Statement	Bloom's Level	Description
CO1	Describe motion, vectors, Newton's laws, work–energy principles and rotational dynamics in classical mechanics.	K1, K2	Remembering & Understanding
CO2	Explain gravitational forces, orbital motion, escape velocity and Kepler's laws governing planetary motion.	K2, K3	Understanding & Applying
CO3	Apply thermodynamic laws and heat transfer concepts to analyze physical systems.	K3, K4	Applying & Analyzing
CO4	Analyze elasticity, fluid mechanics, gas laws and real-world physical applications.	K3, K4, K5	Applying, Analyzing & Evaluating
CO5	Solve ordinary differential equations and apply them to mechanical, thermal and electrical systems.	K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Unit: 1	Classical Mechanics	08 L

Straight-line motion: review of 1D motion problems; distance-velocity, velocity-acceleration, and distance-acceleration graphs. Vectors: properties, gradient, scalar and vector products, frames of reference, coordinate systems, basis vectors, polar coordinates. Two- and three-dimensional kinematics: constant acceleration in 2D, velocity and acceleration as vectors, equations in components. Newton's Laws: first law, inertial and non-inertial frames, second law, linear momentum, forces; third law, internal and external forces, gravity, electrostatic force. Drag and friction: elastic force, viscosity, static and dynamic friction. Work-energy theorem: kinetic energy, work, and power. Potential energy and conservation of energy: conservative force and potential function, constant energy surfaces. Collisions in 1D and 2D: conservation of linear momentum, elastic and inelastic collisions. Rotational motion: uniform circular motion, angular velocity, and angular acceleration. Angular momentum I: angular momentum, rotational kinetic energy, moment of inertia. Angular momentum II: torque, conservation of angular momentum.

Unit: 2	Gravitation	05 L
Newton's law of gravitation: force of gravity at, above and within the Earth; escape velocity. Work and gravitational potential energy; orbital motion and energy. Kepler's laws: motion under central force, conservation of angular momentum, Kepler's laws, periods of planets and satellites.		
Unit: 3	Thermal Physics	09 L
Zeroth Law of Thermodynamics and concept of temperature; thermal expansion and absorption of heat; heat transfer – conduction, emission and absorption. First Law of Thermodynamics: adiabatic processes, constant-volume processes, enthalpy, cyclical processes and free expansions. Second Law of Thermodynamics: irreversible processes, entropy, free energy, specific heat and adiabatic expansion.		
Unit: 4	Elasticity, Fluids and Gases	08 L
Equilibrium and elasticity. Density and pressure; Pascal's and Archimedes' principles. Continuity and Bernoulli's equation. Ideal gases and kinetic theory: mean free path and molecular speed distribution. Real-world applications: solar energy, geothermal, wind power, hydro power, blood circulation, water in plants, materials, osmosis, wind and atmosphere.		
Unit: 5	Ordinary Differential Equations (shared: Maths, Physics & Chemistry)	12 L
Definition of ODE, order, general solution, initial conditions; separable ODEs; solving linear ODEs using integrating factor. Applications of 1st-order ODEs: ecology models; chemical reaction rates and Newton's law of cooling. Second-order ODEs: definitions of homogeneous/inhomogeneous, linear/non-linear; solution of homogeneous constant-coefficient linear ODEs. Particular solutions of inhomogeneous constant-coefficient linear ODEs using undetermined coefficients; principle of superposition. Applications of 2nd-order ODEs: springs and LRC series electrical circuits. Real-world contextual examples in physics and chemistry.		

CO vs K-Level Coverage Matrix

Suggested Text:	
1	University Physics, Vol. 1 &2- OpenStax
2	Fundamentals of Physics - David Halliday & Robert Resnick -10th edn- Wiley
Reference books:	
1	Kleppner, D. & Kolenkow, R. J.. An introduction to mechanics (2nd ed.). Cambridge University Press(2021).
2	Clark, E. Physics-Mechanics: Theory and 153 solved problems. CBS Publishers & Distributors(2001).
3	Serway and Jewett, Physics for Scientists and Engineers, 7th edn, Brooks/Cole Publishers (2008).
4	Zemansky M. W., Heat and thermodynamics, McGraw Hill Education; 8th edition (2017)
5	Callen H.B., Thermodynamics and an Introduction to Thermostatistics, Wiley student edition (2005).
6	Kundu P. K., Cohen I. R. and Dowling D. R. -Fluid Mechanics, Academic Press; 5th edition (2011)

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	-	-	-	-
CO2	-	✓	✓	-	-	-
CO3	-	-	✓	✓	-	-
CO4	-	-	✓	✓	✓	-
CO5	-	-	✓	✓	✓	✓

Course code	CHM 101	General Chemistry	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Basic Chemistry	Syllabus Version	2026-27

Course Objectives

1. To understand the organization of elements in the periodic table and the nature of chemical bonding and molecular geometry.
2. To develop knowledge of acids, bases, buffers, stoichiometry, and their biological and analytical significance.
3. To explain the structure, bonding, reactivity, and mechanisms of organic compounds and reactions.
4. To understand the principles of thermodynamics, chemical kinetics, and applications of differential equations in chemistry.
5. To acquire practical laboratory skills in chemical analysis, organic preparation, purification, and scientific software applications.

Course Outcomes with K-Level Mapping

CO Code	Course Outcome Statement	Bloom's Level	Description
CO1	Describe the organization of the modern periodic table including s, p, d and f block elements, periodic trends, chemical bonding and molecular geometry using VSEPR theory.	K1, K2	Remembering & Understanding
CO2	Explain concepts of acids, bases, HSAB theory, buffers, stoichiometry and balancing of chemical reactions in chemical and biological systems.	K2, K3	Understanding & Applying
CO3	Apply knowledge of organic chemistry including carbon bonding, hybridization, resonance, reaction mechanisms, nucleophilic and electrophilic substitutions, and elimination reactions.	K3, K4	Applying & Analyzing
CO4	Analyze thermodynamic principles, entropy, free energy, chemical kinetics and applications of differential equations in chemical and environmental systems.	K3, K4, K5	Applying, Analyzing & Evaluating
CO5	Evaluate laboratory techniques including volumetric and gravimetric analysis, titrations, chromatography, organic preparations and chemistry software applications for structure drawing and IUPAC nomenclature.	K3, K4, K5	Applying, Analyzing & Evaluating

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Unit: 1	The Periodic Table & Chemical Bonding	06 L

Review of development of the periodic table. s, p, d, f block elements in the modern periodic table. Trends across periods and groups: atomic size, valency, electronegativity, ionization potential. Types of bonds – ionic, covalent, coordinate covalent, metallic, hydrogen bonding, Van der Waals. Shapes of atomic orbitals and their relation to molecular structure. VSEPR theory and molecular geometry.

Unit: 2	Acids, Bases and Stoichiometry	05 L
Types of acids and bases – Arrhenius, Lowry-Brønsted, Lewis, hard and soft acid/base (HSAB) theory. Strong and weak acids and bases based on pK _a and pK _b . Derivation of Henderson's equation. Buffer action and buffer capacity. Role of buffers in biological systems – carbonate and phosphate buffers. Mole concept, molecular weight, equivalent weight, valency; rules for balancing chemical reactions.		
Unit: 3	Organic Chemistry – Structure, Bonding & Reactions	12 L
Carbon as the basis of life; bonding in carbon and significance for biomolecules. Structure and bonding in alkanes (sp ³), alkenes (sp ²), alkynes (sp) and benzene – geometry, inductive effect and resonance in mono-, di- and tri-substituted benzenes. Functional groups – general formula and reactivity. Organic redox reactions of aldehydes, ketones and carboxylic acids. Addition reactions: hydrogenation, hydration. Nucleophilic addition and SN1/SN2 substitution – mechanism, energy profile, optical properties. Electrophilic aromatic substitution. Elimination reactions E1, E2 and E2cB.		
Unit: 4	Thermodynamics and Chemical Kinetics	08 L
First Law of Thermodynamics: adiabatic, constant-volume and cyclical processes; enthalpy, free expansion. Second Law of Thermodynamics: entropy, irreversible processes, free energy. Real-world applications – solar energy, geothermal, wind power.		
Unit: 5	Differential Equations and Applications	06 L
Applications of first-order ODEs: Ecology models. Applications of first-order ODEs: Chemical reaction rates, Newton's law of cooling. Second-order ODEs: Homogeneous and inhomogeneous equations; linear and non-linear equations; solutions of homogeneous constant-coefficient linear ODEs.		

Suggested Text and Reference books:	
1	S.H. Maron and C.F. Prutton; Principles of Physical Chemistry, 4th edition (1965), Collier Macmillan Ltd.
2	P. Atkins and J. de Paula; The Elements of Physical Chemistry, 5th edition (2009), W. H. Freeman Publication, USA.
3	C.N.R. Rao; University General Chemistry, 1st edition (2000), Macmillan Publishers, India.
4	P.S. Kalsi; Stereochemistry: Conformation and Mechanism, S. Chand Publication.
5	Jonathan Clayden, Nick Greeves and Stuart Warren; Organic Chemistry, Oxford University Press.
6	Samuel Glasstone; An Introduction to Electrochemistry, reprint edition (2011), BiblioBazaar, USA..
7	R. Chang; Physical Chemistry for Biological Sciences, 1st edition (2005), University Science Books, USA.
8	David Ball; Physical Chemistry, 1st edition (2003), Thomson Learning, USA.
9	B.S. Bahl, G.D. Tuli, Arun Bahl; Essentials of Physical Chemistry, 24th edition (2000), S. Chand Limited, India.
10	Robert Thornton Morrison; Organic Chemistry, 6th edition (1992), Pearson Publication, Dorling Kindersley (India Pvt. Ltd.).
11	Peter Sykes; Guide Book to Mechanism in Organic Chemistry, 6th edition (1996), Prentice Hall.
12	J.D. Lee; Concise Inorganic Chemistry, 5th edition (2008), John Wiley & Sons, USA.

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	—	—	—	—
CO2	—	✓	✓	—	—	—
CO3	—	—	✓	✓	—	—
CO4	—	—	✓	✓	✓	—
CO5	—	—	✓	✓	✓	✓

Course code	BIO 101	Evolution and the Diversity of Life	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		General Biology / Evolutionary Biology	Syllabus Version	2026-27
Course Objectives 1. To understand the origin of life, early evolution, and development of cellular organization. 2. To explain the diversity and evolutionary significance of protists and the origin of multicellularity. 3. To study the evolution, classification, and ecological importance of fungi and early land plants. 4. To understand the evolution and diversification of vascular plants, including seed plants and angiosperms. 5. To analyze animal diversity and evolutionary relationships leading to vertebrate and primate evolution.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe the origin of life, chemical evolution, cell theory and evolutionary relationships explaining biological diversity.	K1, K2	Remembering & Understanding	
CO2	Explain diversity, classification and life cycle strategies of protists and the evolutionary transition from unicellular to multicellular organisms.	K2, K3	Understanding & Applying	
CO3	Apply knowledge of fungal diversity, reproduction, ecological roles and early land plant evolution including bryophytes.	K3, K4	Applying & Analyzing	
CO4	Analyze evolutionary development of vascular plants including seed plants, angiosperms, reproductive adaptations and plant phylogeny.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Evaluate animal diversity and evolutionary relationships from invertebrates to vertebrates including primate evolution.	K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Origin of Life and Early Evolution			08 L
- Theory of evolution: understanding life's diversity - Evolutionary relationships and phylogenetic classification - Chemical evolution of life: molecules to cells - Cell theory and origin of life - Prokaryotic cells: structure and diversity of Bacteria and Archaea (2 lectures) - Evolution of the eukaryotic cell i) Endosymbiotic theory, ii) Origin of organelles, iii) Endosymbiosis concept				
Unit: 2	Protists and Evolution of Multicellularity			06 L

• Protists I: Red algae and Green algae i) Features, ii) Life cycles, iii) Evolutionary significance • Protists II: Chromists i) Diatoms, ii) Brown algae, iii) Related groups • Protists III: Protozoan protists Dinoflagellates, Apicomplexans, Flagellates, Ciliates, Amoebae • Evolution of sex Origin and significance of sex in eukaryotes, Sexual life cycles: haplontic, diplontic, haplodiplontic • Comparative life cycle strategies in protists, fungi, and algae • Origin of multicellularity Transition from unicellular to multicellular organisms, Genetic and structural adaptations		
Unit: 3	Fungi and Early Land Plants	03 L
• Slime moulds Plasmodial and cellular types, Life cycle, and ecological role • Fungi General characteristics, Classification, Reproduction and life cycles, Ecological roles and economic importance • Fungi II (advanced fungal diversity) • Introduction to land plants • Bryophytes Characteristics and significance		
Unit: 4	Evolution of Vascular Plants	06 L
• Evolution of vascular tissue • Lycophytes and fern allies • Early fossil land plants: diversity and evolutionary relevance • Ferns • Seed plants Structure and function, Types of seeds, Secondary growth, Cycads and Ginkgo • Conifer diversity and biology • Angiosperms Structure and diversity, Flower structure, Double fertilization, Reproductive strategies • Angiosperm phylogeny and evolution • Wood formation, Vascular cambium		
Unit: 5	Animal Diversity and Evolution	13 L
• Introduction to animals (Metazoa) • Simple animals • Protostomes, Flatworms, Annelids • Molluscs • Arthropods • Deuterostomes, Echinoderms, Chordates • Vertebrate Evolution • Fishes, Sharks and rays, Teleosts, Coelacanth, Lungfish • Amphibians		

• Reptiles • Birds • Mammals • The Primate story

Suggested Text and Reference books:		CO vs K-
1	Evolution, Strickberger. Fifth Edition, Jones and Bartlett Publishers, Inc (2013).	
2	Biology, P.H. Raven, G.B. Johnson, K.A. Mason, L. Jonathan, T. Duncan, Twelfth Edition, McGraw Hill (2019)	
3	Campbell Biology, L. Urry, M. Cain, S. Wasserman , P. Minorsky, J. Reece 11th Edition, Pearson, (2017).	
4	Evolution, Douglas Futuyma, Mark Kirkpatrick, 4th edition, Sinauer, 2017	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.,]		
1	https://www.easybiologyclass.com/chemical-evolution-theory-biochemical-origin-of-life-short-lecture-notes/	
2	https://bio.libretexts.org/Introductory_and_General_Biology/Diversity_of_Microbes_Fungi_and_Protists	
3	https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/ Diversity_of_Plants	
4	https://www.khanacademy.org/science/biology-india/ animal-kingdom	

Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	—	—	—	—
CO2	—	✓	✓	—	—	—
CO3	—	—	✓	✓	—	—
CO4	—	—	✓	✓	✓	—
CO5	—	—	✓	✓	✓	✓

Course code	PHY 102	PHYSICS PRACTICAL	2 Credits	
Core/Elective/SBS		PRACTICAL PAPER		
Prerequisite Course		Basic Physics	Syllabus Version	2026-27

Course Objectives

1. To understand fundamental principles of mechanics through laboratory experiments.
2. To develop experimental skills in measurement, data collection, and graphical analysis.
3. To study oscillatory motion and elastic properties of materials experimentally.
4. To determine physical constants such as acceleration due to gravity, viscosity, and elastic moduli.
5. To enhance scientific observation, precision, and laboratory safety practices.

Course Outcomes with K-Level Mapping

CO Code	Course Outcome Statement	Bloom's Level	Description
CO1	Describe basic laboratory instruments and measurement techniques used in mechanics experiments.	K1, K2	Remembering & Understanding
CO2	Perform experiments on oscillations and determine the acceleration due to gravity.	K2, K3	Understanding & Applying
CO3	Determine elastic constants such as Young's modulus and rigidity modulus using experimental methods.	K3, K4	Applying & Analyzing
CO4	Evaluate frictional forces and viscosity using standard experimental procedures.	K3, K4, K5	Applying, Analyzing & Evaluating
CO5	Interpret experimental data using graphical and statistical methods and estimate experimental errors.	K4, K5, K6	Analyzing, Evaluating & Creating

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

List of Experiments

S. No	Title
1.	Simple Pendulum: To plot a L-T ² graph using a simple pendulum and find the effective length of the simple pendulum for a given time period using the graph.
2.	To calculate the acceleration due to gravity at a place.
3.	Torsional Pendulum: To find the moment of inertia of the disc and the rigidity modulus of the material of the suspension wire subjected to torsional oscillations.
4.	Young's Modulus: To determine the Young's modulus of elasticity of the material of a given wire using Searle's apparatus.
5.	Spring: To determine the restoring force per unit extension of a spiral spring by statistical and dynamical methods and also to determine the mass of the spring.
6.	Euler's Method: To determine the coefficient of friction by Euler's Method.
7.	Viscosity: To determine Coefficient of Viscosity by Stoke's Method.

Text Book(s)	
1	A textbook of practical Physics, M.N. Srinivasan, S. Balasubramanian, R. Ranganathan, Sultan Chand & Sons (2017)
2	Practical Physics and Electronics, C.C. Ouseph, U.J.Rao, V. Vijayendran, S. Viswanathan Publishers (2007)
Reference	
1	https://nptel.ac.in/course.html/physics/experimentalphysicsI,IIandIII
2	https://nptel.ac.in/courses/115/105/115105110/
3	https://www.youtube.com/playlist?list=PLuiPz6iU5SQ8-rZn_LgLoFRX7n8z4tHYK

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	–	✓	✓	✓

Course code	CHM 102	CHEMISTRY PRACTICAL	2 Credits	
Core/Elective/SBS		PRACTICAL PAPER		
Prerequisite Course			Syllabus Version	2026-27
Course Objectives 1. To develop fundamental laboratory skills in physical, inorganic, and organic chemistry experiments. 2. To understand principles of quantitative chemical analysis and reaction kinetics. 3. To train students in volumetric, gravimetric, and instrumental experimental techniques. 4. To identify organic compounds using functional group analysis and purification techniques. 5. To cultivate scientific observation, data interpretation, and safe laboratory practices.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe laboratory safety rules, basic analytical terminology, and principles involved in physical, inorganic, and organic chemistry experiments.	K1, K2	Remembering & Understanding	
CO2	Explain concepts of reaction kinetics, thermochemistry, volumetric analysis, and organic functional group identification.	K2, K3	Understanding & Applying	
CO3	Apply experimental techniques such as titration, calorimetry, purification, chromatography, and organic preparation methods.	K3, K4	Applying & Analyzing	
CO4	Analyze experimental data to determine rate constants, equilibrium parameters, enthalpy changes, and quantitative composition of mixtures.	K4, K5	Analyzing & Evaluating	
CO5	Design systematic procedures for compound identification, data interpretation, and preparation of chemical compounds following good laboratory practices.	K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
List of Experiments				
S. No	Title			
List of Physical Chemistry experiments (Any 2)				
1.	To determine the rate constant of the hydrolysis of Ethyl acetate using an acid catalyst.			
2.	Molar mass determination of some base metals, gases.			
3.	Determination of dissociation constant of a weak acid.			
4.	Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known substance.			
5.	Calculation of the enthalpy of ionization of ethanoic acid.			

List of Inorganic Chemistry Experiments (Any 2)	
Basic Analytical Terms: Volumetric and Gravimetric analysis, Titration, Types of titration viz. acid base, redox, iodometric, iodometric and complexometric titrations, Types of indicators, Selection of indicator, Aquametry (Karl-Fisher titration)	
1.	Oxalate Complexes of Aluminum and Chromium.
2.	Estimation of Fe (II) with K ₂ Cr ₂ O ₇ using internal external (diphenylamine, anthranilic acid) and external indicator.
3.	Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
4.	Estimation of Fe (II) and oxalic acid using standardized KMnO ₄ solution.
List of Organic Chemistry Experiments (Any 3 in Each Group)	
1.	Techniques: Crystallization, Sublimation, Distillation, Steam Distillation, Vacuum Distillation, Column Chromatography, Thin Layer Chromatography. Record Melting Point & Boiling Point.
2.	Functional group tests following functional groups Alcohols, Alkenes, Aldehydes and Ketones, Acids, Phenols, Amines, Amides, Esters, Aromatic compounds. approach (using ceric ammonium nitrate). Bromination of cinnamic acid.
3.	Preparations: 1. Preparation of 4, 4'-Dimethoxy-dibenzylideneacetone 2. Preparation of 4-tert-Butylphenol 3. Reduction of p-nitro benzaldehyde by sodium borohydride 4. Nitration of Salicylic acid by green
Text Book(s)	
1.	Basic Principles of Practical Chemistry, Kulandaivelu A.R., Veeraswamy R., Venkateswaran, Sultan Chand & Sons, 2017
2.	Practical Chemistry for B.Sc Chemistry, A.O. Thomas
3.	Practical Chemistry, Pandey D.N., Sultan Chand Publishers, 2018
4.	https://www.freebookcentre.net/chemistry-books-download/Chemistry-Laboratory-Manual-by-CSOS.html
Reference	
1.	Vogel's Text book of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Fifth Edition, Bath Press, Great Britan, 1989
2.	Vogel's Textbook of Quantitative Chemical Analysis, G H Jeffery, J Bassett, J Mendham, R C Denney, Fifth Edition, Bath Press, Great Britan, 1989

CO vs K-Level Coverage Matrix

CO / K-Level	K1	K2	K3	K4	K5	K6
CO1	✓		–	–	–	–
CO2	–	✓	–	–	–	–
CO3	–	–	✓	–	–	–
CO4	–	–	✓	✓	–	–
CO5	–	–	–	✓	✓	–
CO6	–	–	–	–	✓	✓

Course code	BIO 102	BIOLOGY PRACTICAL		2 Credits	
Core/Elective/SBS		PRACTICAL PAPER			
Prerequisite Course		General Biology / Evolutionary Biology		Syllabus Version	2026-27
Course Objectives 1. To understand the principles and operation of basic laboratory instruments and sterilization techniques used in biological experiments. 2. To perform quantitative estimation of biomolecules such as proteins and DNA using standard biochemical methods. 3. To identify and differentiate carbohydrates through qualitative biochemical tests. 4. To observe, collect, and identify zooplankton samples to understand aquatic biodiversity and ecological significance. 5. To analyze environmental water quality by determining dissolved oxygen and interpreting ecological health indicators.					
Course Outcomes with K-Level Mapping					
CO Code	Course Outcome Statement		Bloom's Level	Description	
CO1	Describe basic laboratory instruments, sterilization methods and safety procedures used in biological experiments.		K1, K2	Remembering & Understanding	
CO2	Perform biochemical estimations such as protein and DNA quantification using standard laboratory methods.		K2, K3	Understanding & Applying	
CO3	Apply qualitative biochemical tests for identification of carbohydrates and biomolecules.		K3	Applying	
CO4	Analyze aquatic biodiversity through microscopic observation and identification of zooplankton samples.		K3, K4	Applying & Analyzing	
CO5	Evaluate environmental water quality through dissolved oxygen determination and ecological interpretation.		K3, K4, K5	Applying, Analyzing & Evaluating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create					
List of Experiments					
S. No	Title (Any 6)				
1.	Basic instrumentation techniques – Principles and Operation				
2.	Laboratory Sterilization Methods - Principles and Operation				
3.	Estimation of proteins: Bradford Assay				
4.	Estimation of DNA: DPA(diphenylamine)method				
5.	Identification of sugars/carbohydrates.				
6.	Observation of zooplankton from pond samples under microscope.				
7.	Determination of dissolved oxygen in water sample				

Text Book(s)	
1	Laboratory manual in biochemistry by J. Jayaraman, Wiley Eastern Publishers
2	Biochemical Methods- Sadasivam and Manickam, 3rd Edition, New Age International Publishers
3	Zooplankton Methodology, Collection & Identification – - a field manual, S.C Goswami,
Reference	
1	Roy, K. Gupta, S., Nandi, S. K. (2016) Int. J. Res. Biol. Sci. 6 (1):1-6 2.
2	Aneesh E. M., Fathibi, K. and Ambalaparambil, V. S. (2017) Int. J. Recent Sci. Res. 8 (10): 20999-21015; available at https://www.researchgate.net/publication/321025466_Indian_Fresh_Water_Zooplankton_A_Review_Int_J_Recent_Sci_Res_810_pp_209_99-21015

CO / K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

VALUE ADDED 1: ENVIRONMENTAL STUDIES

Course code	VA-1	Environmental Studies	L	T	P	C
Value Added		Value Added 1	2	-	-	2
Pre-requisite		Understanding in Environment	Syllabus Version		2023-24	
Course Objectives:						
The main objectives of this course are to:						
1. Evolve into ecologically informed and socially responsible citizens who are empowered to protect the natural resources while ensuring sustainable lifestyle and developmental mode						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Gaining in-depth knowledge on natural processes that sustain life				K1, K2	
2	Predicting the consequences of human actions on the web of life, global economy, and quality of human life.				K1, K2	
3	Develop critical thinking for environmental protection and conservation				K1, K2	
4	Acquiring values and attitudes towards understanding environmental-economic-social challenges.				K1, K2	
5	Adopting sustainability as a practice in life, society, and industry.				K1, K2	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyse; K5 - Evaluate; K6 - Create						
Unit:1	Multidisciplinary nature of environmental studies				3 Hours	
Unit:2	Natural Resources				4 Hours	
Unit:3	Ecosystems				3 Hours	
Unit:4	Biodiversity and its conservation				3 Hours	
Unit:5	Environmental Pollution				3 Hours	

Unit:6	Contemporary Issues	2 Hours
Case Study, Expert Lectures, Online Seminars –Webinars		
Total Lecture Hours		18 Hours
Textbook(s)		
1	Erach Barucha, Textbook for Environmental Studies, UGC	
2	Dr. Radha (2019), Environmental Studies, Revised Edition Prasanna Publishers	
Reference Books		
1	Dharmendra S. Sengar, (2007) ‘Environmental law’, Prentice hall of India	
2	G. Tyler Miller and Scott E. Spoolman, (2014) “Environmental Science”, Cengage Learning India	
3	Rajagopalan, R, (2005) ‘Environmental Studies-From Crisis to Cure’, Oxford University Press,	
4	Benny Joseph, (2006) ‘Environmental Science and Engineering’, Tata McGraw-Hill, New Delhi,	
5	Gilbert M. Masters, (2004) ‘Introduction to Environmental Engineering and Science’, 2nd edition, Pearson Education,	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	Environmental Studies - By Dr. Tushar Banerjee Devi Ahilya Viswavidyalaya, Indore - SWAYAM	
Course Designed By: Bharathiar University		

SEMESTER II

Course code	MTH 201	Maths 2: Algebra	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Higher Secondary Mathematics	Syllabus Version	2026-27
Course Objectives				
1. To understand limits, continuity and differentiability of real-valued functions.				
2. To develop knowledge of sequences, series and convergence techniques.				
3. To understand vector algebra and geometry in three dimensions.				
4. To introduce matrices and systems of linear equations.				
5. To develop understanding of vector spaces and linear transformations.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Explain limits, continuity and differentiability of functions and apply differentiation techniques.	K1, K2	Remembering & Understanding	
CO2	Analyze convergence and divergence of sequences and infinite series using standard tests.	K2, K3	Understanding & Applying	
CO3	Apply vector algebra concepts including dot product, cross product and equations of lines and planes.	K3, K4	Applying & Analyzing	
CO4	Solve systems of linear equations using matrices and interpret algebraic and geometric solutions.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Analyze vector spaces and linear transformations including basis, dimension, rank and kernel.	K3, K4, K6	Applying, Analyzing & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit:1	Analysis			07 L
- Limits Limits of Real-Valued Functions Proving Limits using the Definition - Continuity & Differentiability Continuity abd Differentiability Examples of Differentiable and Non-Differentiable Functions; Continuity and Differentiability of Standard Functions Including Polynomials, Trigonometric, Exponential, Log Functions and Their Inverses - Applications of Differentiation Techniques for Evaluating Limits Including L'Hopital's Rule, Sandwich Theorem Mean Value Theorem and Applications Applications of Differential Calculus Eg. Related Rates				

Unit:2	Sequences and Series	09 L
• Sequences and Limits Sequences, Limits, Convergence and Divergence Proving Limits using Definition • Methods for evaluating limits Methods for Evaluating Limits: Standard Limits, Limit Theorems, Continuity Rule, Sandwich Theorem • Series and Its Types Series, Convergence and Divergence of Series, Geometric Series, Harmonic Series • Convergence Tests Divergence Test, Comparison Test Ratio Test, Integral Test, Alternating Series Test • Types of Series Power Series, Taylor Polynomials Taylor Series Taylor's Theorem, Error in Taylor Polynomial Estimates		
Unit:3	Vectors	04 L
• Algebra of Vectors Vector Arithmetic, Vector Projections (Review) • Product of Vectors Vector Dot Product, Vector Cross Product Scalar Triple Product, Vector Triple Product • Parametric Form of Vector Equation Lines and Planes in $\mathbb{R}^3$		
Unit:4	Integral Calculus	07 L
• Matrix Manipulations Matrices, Matrix Addition, Multiplication, Transpose And Properties (Review) - Matrix Inverse - Determinant • Systems of Linear Equations Solving Systems of Linear Equations with Gaussian Elimination - Solutions of Systems of Linear Equations - Consistency, Uniqueness - Geometric Interpretation of Solutions • Field		
Unit:5	Techniques to purify and characterize biomolecules	11 L
• Vector Space $\mathbb{R}^n$ as a Vector Space, Linear Independence of Vectors in $\mathbb{R}^n$ - Span of a Set of Vectors, Subspaces of $\mathbb{R}^n$ - Basis and Dimension in $\mathbb{R}^n$ - Abstract Vector Space Axioms; Examples and Non-Examples of Vector Spaces - Bases, Dimension and Co-Ordinates in (Finite Dimensional) Abstract Vector Spaces • Linear Transformation Definition of Linear Transformation and Examples/Non-Examples Linear Transformations of the Plane • Linear Transformation in Matrix Form Change of Basis and Linear Transformations Matrix Representation of a Linear Transformation		

- **Applications of Linear Transformation in Matrix Form**
Image and Kernel of a Linear Transformation - Rank and Nullity

Suggested Reference books:
Analysis:
1. Edwin Jed Herman and Gilbert Strang, Calculus - Volume I, OpenStax, 2020. 2. James Stewart, Calculus – Early Transcendentals, 7th Edition, Brooks/Cole, Cengage Learning, 2012.
Sequences and Series:
1. James Stewart, Calculus – Early Transcendentals, 7th Edition, Brooks/Cole, Cengage Learning, 2012. 2. Robert A. Adams and Christopher Essex, Calculus – A Complete Course, 7th Edition, Pearson Canada, 2009. 3. Edwin Jed Herman and Gilbert Strang, Calculus - Volume I, OpenStax, 2020.
Vector:
1. Susan Jane Colley, Vector Calculus, 4th Edition, Pearson, 2011
Linear Algebra
1. Jim Defranza and Daniel Gagliardi, Introduction to Linear Algebra and Applications, 3rd Edition, McGraw Hill Higher Education, 2017. 2. John W. Dettman, Introduction to Linear Algebra and Differential Equations, Dover Publications, Inc., 2008. 3. S. Arumugam and A.T. Isaac, Modern Algebra, Scitech Publications (India) Pvt. Ltd., 2003

**CO
vs
K-**

Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–

Course code	PHY 201	Modern Physics	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Modern Physics	Syllabus Version	2026-27
Course Objectives 1. To understand fundamental principles of electricity, electrostatics and electromagnetic phenomena. 2. To explain current electricity, magnetism and electromagnetic induction. 3. To study oscillations, wave motion and optical phenomena including interference and diffraction. 4. To understand concepts of relativity and foundations of quantum physics. 5. To analyze atomic, nuclear and particle physics concepts underlying modern physics.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe concepts of electric charge, electric fields, potentials and capacitors.	K1, K2	Remembering & Understanding	
CO2	Explain principles of current electricity, magnetic fields, electromagnetic induction and Maxwell's equations.	K2, K3	Understanding & Applying	
CO3	Apply knowledge of oscillations, wave behavior and optical systems including interference and diffraction.	K3, K4	Applying & Analyzing	
CO4	Analyze relativistic effects and quantum mechanical principles governing microscopic systems.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Evaluate atomic structure, nuclear reactions and fundamental particle interactions in modern physics.	K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Electricity and Electrostatics		09 L	
Electric charge, conductors and insulators. Coulomb's law and superposition principle. Electric field and superposition; field lines and flux. Gauss's law and applications. Energy and electric field; electric potential; calculating potential from the field; equipotential surfaces. Electric dipoles and field due to a dipole. Capacitance; parallel-plate capacitors; energy stored in capacitors; dielectrics; series and parallel connections				
Unit: 2	Current Electricity and Magnetism		06 L	
Conductors, electric current, electric power; Ohm's law; resistors in series and parallel. Kirchhoff's laws and applications. Magnetic field, flux and force; magnetic materials. Lorentz force, cyclotrons, ion velocity filter, Hall effect. Biot-Savart law, Ampere's law, solenoids, Earth's magnetic field. Magnetic field due to current-carrying wires and electromagnetic induction. Lenz's law, Faraday's law and Maxwell's equations				
Unit: 3	Oscillations, Waves and Optics		06 L	

Simple harmonic motion; simple pendulum; spring-mass system; diatomic molecules. Damped and forced oscillations; resonance; electronic circuits; population evolution. One-dimensional waves; waves on strings; interference and standing waves; wave equation and separable solution. Sound waves and speed of sound; intensity; resonance; physics of music: sound levels and modes of musical instruments. Doppler effect and supersonic motion; shock waves. **Optics-** Mirrors and images: image formation by plane, spherical and parabolic mirrors. Thin lenses; image formation by lenses; combination of lenses; optical instruments – microscope and telescope. Young's experiment: superposition of waves and interference. Thin films and thin-film interference; phase change. Diffraction by slits and apertures; diffraction expression. Diffraction by gratings and X-ray diffraction. Optical microscopy: types of microscopes – brightfield, darkfield, confocal. Spectroscopy: inelastic scattering, Raman spectroscopy and fluorescence.

Unit: 4	Relativity and Quantum Physics	04 L
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Challenges to classical physics and special relativity: Michelson-Morley experiment; Einstein's postulates. Lorentz transformation; transformation of velocities; length contraction; time dilation; twin paradox; Doppler effect. Relativistic momentum and energy; rest mass; mass-energy relation $E = mc^2$. Photons and photoelectric effect: Einstein's equation; quantum of energy; Compton effect. Quantum physics: blackbody radiation; de Broglie waves; Schrödinger equation; uncertainty principle. Trapped particles and tunneling: 1D potential well and barrier.

Unit: 5	Atomic, Nuclear and Particle Physics	07 L
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Bohr-Sommerfeld and Schrödinger models of hydrogen atom; origin of quantum numbers. Complex atoms: Pauli exclusion principle; periodic table; selection rules and spectra. Nuclear physics: semi-empirical mass equation; nucleons; nuclear decay; alpha, beta and gamma emission. Nuclear fission and fusion. Fundamental particles: quarks, leptons and the Big Bang.

Suggested Text:	
1	University Physics, Vol. 2 & 3- OpenStax
2	David Halliday & Robert Resnick - Fundamentals of Physics - 10th edn- Wiley
3	Serway and Jewett, Physics for Scientists and Engineers, 7th edn, Brooks/Cole Publishers (2008).
Reference books:	
1	A.P. French, Vibrations and Waves, CBS Publishers & Distributors Pvt Ltd, India (2003)
2	A Beiser- Concepts of Modern Physics, McGraw Hill (India)(2020)
3	Edward M. Purcell , David J. Morin, Electricity and Magnetism, Cambridge University Press; 3rd edition (2013)
4	Eugene Hecht - Optics , Pearson India; 4th edition (2008)

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
C01	✓	✓	—	—	—	—
C02	—	✓	✓	—	—	—
C03	—	—	✓	✓	—	—
C04	—	—	✓	✓	✓	—
C05	—	—	✓	✓	✓	✓

Course code	CHE 201	Chemistry of Life/ Inorganic and Physical Chemistry	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Basic Chemistry and Biology	Syllabus Version	2026-27

Course Objectives

1. To understand the biological significance of elements, water, and inorganic molecules in living systems.
2. To explain the structure, properties, and functions of biologically important molecules including carbohydrates, proteins, lipids, and nucleic acids.
3. To develop knowledge of enzymes, catalyzed reactions, metabolism, and bioenergetics.
4. To analyze concepts of inorganic chemistry, electrochemistry, coordination chemistry, quantum chemistry, and stereochemistry relevant to biological systems.
5. To apply chemical principles in understanding molecular interactions, metabolic pathways, and stereochemical behavior in biological processes.

Course Outcomes with K-Level Mapping

CO Code	Course Outcome Statement	Bloom's Level	Description
CO1	Describe the biological importance of elements, water, gases, and inorganic molecules involved in living systems and environmental processes.	K1, K2	Remembering & Understanding
CO2	Explain the structure, properties, and functions of biomolecules including carbohydrates, proteins, lipids, DNA, and RNA.	K2, K3	Understanding & Applying
CO3	Apply concepts of enzyme catalysis, reaction kinetics, metabolism, ATP synthesis, and bioenergetics in biological reactions.	K3, K4	Applying & Analyzing
CO4	Analyze principles of inorganic chemistry, electrochemistry, coordination chemistry, quantum chemistry, and their applications in biological systems.	K3, K4, K5	Applying, Analyzing & Evaluating
CO5	Evaluate stereochemical properties, molecular chirality, isomerism, and biochemical interactions to interpret structure–function relationships in nature.	K4, K5, K6	Analyzing, Evaluating & Creating

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Unit: 1	The Biological Periodic Table & Role of Water	05 L
Elements essential for life. Role of Group 1 and 2 elements as electrolytes and structural materials (e.g. Ca²⁺ in teeth and bones). Role of C, N, S and P as components of biomolecules. Role of transition metals in enzymes, transport molecules (haemoglobin, myoglobin) and redox processes. Access to essential elements – humans via nutrition/atmosphere; plants via soil and atmosphere. Role of water: H-bonding in water, structure of ice, density vs. liquid. Properties of water: liquid temperature range, high specific heat and consequences for living systems; solvent for salts and covalent molecules.		
Unit: 2	Small Inorganic Molecules of Biological Importance	05 L

Gases: solubility of gases (O₂, CO₂, N₂, He, CH₄), Henry's Law, methane clathrates, Lake Nyos tragedy, divers and the 'bends'. Oxygen and ozone: structures, properties, role of O₂ in respiration (thermodynamic data), role of O₃ in UV screening, ozone degradation and CFCs. Oxygen transport via haemoglobin and myoglobin. Oxides of carbon: CO and CO₂ formation, structures, CO toxicity, CO₂ and photosynthesis, CO₂ as greenhouse gas. Acid-base properties of CO₂; H₂CO₃ equilibria; acid rain from nitrogen and sulfur oxides. Carbon cycling through bio- and geospheres. Nitrogen structure and properties; NH₃, hydrazine, oxides of nitrogen (NO, NO₂, N₂O₄) and biological roles of NO. Phosphorus: allotropes, P₄O₁₀ formation and reaction with water to give H₃PO₄; phosphate esters; phosphodiester link in DNA; ADP/ATP and bioenergetics.

Unit: 3	Enzymes and Catalyzed Reactions	04 L
Concept of reaction rate; factors affecting rate: concentration, temperature, physical state and catalysts. Thermodynamic versus kinetic control. Enzymes as biological catalysts: classification, specificity, mechanism of action (energy diagram for catalysed and uncatalysed reactions). Examples of enzyme-catalysed reactions, e.g. carbonic anhydrase and its role in CO ₂ transportation.		
Unit: 4	Biomolecules – Carbohydrates, Amino Acids, Proteins, Lipids & DNA	10 L
Carbohydrates: synthesis via photosynthesis; simple sugars (glucose, fructose); formation of acetals; complex carbohydrates – acetal-linked simple sugars; polysaccharides – cellulose, starch and glycogen; cell surface carbohydrates – ABO blood system and influenza viruses. Amino acids, peptides and proteins: structure of amino acids, zwitterions, peptide bond formation, side-chain residues, protein structure (primary, secondary, tertiary, quaternary) with examples; H-bonding, salt links and disulfide bridges; protein denaturation; roles of proteins. Lipids: ester formation; fats and oils – glycerol, saturated and unsaturated fatty acids, triglyceride formation. DNA: purine and pyrimidine bases; nucleosides, nucleotides, phosphodiester link; Watson-Crick double helix; factors stabilizing helix; UV absorption and mutagenic effects; DNA vs. RNA; Central Dogma.		
Unit: 5	Metabolism & Stereochemistry	06 L
Catabolism overview: hydrolysis of foods to small molecules; cellular degradation to acetyl CoA; citric acid cycle; electron transport chain and ATP synthesis. Chemistry of ADP/ATP; coupled reactions, e.g. phosphorylation of glucose. Anabolism: carbohydrate biosynthesis overview. Inorganic chemistry: ionic compounds and solutions; crystalline and amorphous solids, unit cell, Bravais lattices; main group chemistry; electrochemistry – Daniel cell, Nernst equation, pH, solubility product, fuel cells and batteries; coordination chemistry – IUPAC nomenclature, types of ligands, cisplatin applications; quantum chemistry – Schrödinger equation, Heisenberg uncertainty principle, Bohr model, Pauli exclusion principle, nuclear fission and fusion. Stereochemistry: constitutional and stereoisomers; enantiomers, CIP rules (R/S), meso compounds; chirality in nature; cis-trans isomerism and E/Z designation.		

Suggested Reference Books:	
1	S.H. Maron and C.F. Prutton; Principles of Physical Chemistry, 4th edition (1965), Collier Macmillan Ltd.
2	P. Atkins and J. de Paula; The Elements of Physical Chemistry, 5th edition (2009), W. H. Freeman Publication, USA.

3	C.N.R. Rao; University General Chemistry, 1st edition (2000), Macmillan Publishers, India.
4	P.S. Kalsi; Stereochemistry: Conformation and Mechanism, S. Chand Publication.
5	Jonathan Clayden, Nick Greeves and Stuart Warren; Organic Chemistry, Oxford University Press.
6	Samuel Glasstone; An Introduction to Electrochemistry, reprint edition (2011), BiblioBazaar, USA.
7	R. Chang; Physical Chemistry for Biological Sciences, 1st edition (2005), University Science Books, USA.
8	David Ball; Physical Chemistry, 1st edition (2003), Thomson Learning, USA.
9	B.S. Bahl, G.D. Tuli, Arun Bahl; Essentials of Physical Chemistry, 24th edition (2000), S. Chand Limited, India.
10	Robert Thornton Morrison; Organic Chemistry, 6th edition (1992), Pearson Publication, Dorling Kindersley (India Pvt. Ltd.).
11	Peter Sykes; Guide Book to Mechanism in Organic Chemistry, 6th edition (1996), Prentice Hall.
12	J.D. Lee; Concise Inorganic Chemistry, 5th edition (2008), John Wiley & Sons, USA.

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	–	✓	✓	✓

Course code	BIO 201	The Biology of Cells	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Cell Biology / Molecular Biology	Syllabus Version	2026-27
Course Objectives 1. To understand basic principles of cell structure, cytoplasmic organization and cytoskeletal components. 2. To explain information flow in cells including DNA organization, genes and regulation of gene expression. 3. To study structure and function of endomembrane systems and intracellular transport mechanisms. 4. To understand cellular energy metabolism including respiration and photosynthesis. 5. To analyze cell division, cell communication, differentiation and development of multicellularity.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe fundamental concepts of cell biology including cell structure, cytoplasm, cytoskeleton and extracellular components.	K1, K2	Remembering & Understanding	
CO2	Explain information flow in cells including nucleus organization, DNA structure, genetic code and regulation of gene expression.	K2, K3	Understanding & Applying	
CO3	Apply knowledge of endomembrane system organization and intracellular trafficking including ER, Golgi apparatus, vesicular transport and lysosomal functions.	K3, K4	Applying & Analyzing	
CO4	Analyze cellular energy processes including mitochondrial respiration, ATP synthesis, photosynthesis and photosystem mechanisms.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Evaluate mechanisms of cell division, meiosis, cellular communication, differentiation and development of multicellularity.	K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	The Biology of Cells and the cell contained			09 L
• Introduction to Cell Biology • Cell walls, extracellular matrix, cellulose synthesis, other cell wall components • Cytoplasm: content, chemistry and properties • Cytoskeleton, actin filaments, microtubules				
Unit: 2	Information flow in the cell			06 L
• Nucleus, chromosomes, DNA • Genes and the genetic code • Control of gene expression				

Unit: 3	Endomembrane system and intracellular Trafficking	06 L
• ER and ribosome, proteins and enzymes • Golgi apparatus • Vesicles, transport and secretion, Lysosomes		
Unit: 4	Harvesting energy	04 L
• Mitochondria, ATP, energetic reactions, electron transport pathways, cellular respiration (ATP synthesis and energetic reactions, electron transport chain and oxidative phosphorylation) • Chloroplasts, photosynthesis, historical experiments (in photosynthesis research), pigments, photosystems (Structure and function of chloroplast, photosynthetic pigments, photosystem 1&2).		
Unit: 5	Multicellularity and the Dividing Cell	07 L
• Cell division, cell cycle, mitosis, cytokinesis, division and distribution of organelles • Meiosis, formation of haploid cells • Communication and signaling, recognizing and responding • Cell differentiation and multicellularity		

Suggested Text and Reference books:	
1	Molecular cell biology, Harvey Lodish, 8th edition, W.H. Freeman, (2016).
2	Cell and Molecular Biology concepts and Experiments, Gerald Karp, Janet Iwasa, Wallace Marshall, 9th Edition, Wiley (2019)
3	Molecular Biology of the cell, Bruce Alberts, 6th edition, Garland Science (2014)
4	The Cell: A molecular approach, Geoffrey M. Cooper, Robert E. Hausman, Sixth edition, Sinauer (2013)
5	Essential Cell Biology, Bruce Alberts, 5th edition, Garland Science (2019).
6	Lewin's Genes XII, 2017, Jocelyn E Krebs, Elliott S. Goldstein, and Stephen T. Kilpatrick Jones, Bartlett Publishers, 12th revised edition
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.,]	
1	https://www.easybiologyclass.com/chemical-evolution-theory-biochemical-origin-of-life-short-lecture-notes/
2	https://www.larberthigh.com/_documents/%5B1405%5DUnit_1_Cell_biology_summary_notes.pdf
3	https://nptel.ac.in/courses/102/103/102103012/
4	https://www.khanacademy.org/science/ap-biology/cell-structure-and-function

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
C01	✓	✓	—	—	—	—
C02	—	✓	✓	—	—	—
C03	—	—	✓	✓	—	—
C04	—	—	✓	✓	✓	—
C05	—	—	✓	✓	✓	✓

Course code	PHY 202	PHYSICS PRACTICAL	2 Credits
Core/Elective/SBS	PRACTICAL PAPER		
Prerequisite Course		Syllabus Version	2026-27
Course Objectives 1. To understand the fundamental principles of experimental physics and measurement techniques. 2. To develop practical skills in mechanics, heat, electricity, and magnetism experiments. 3. To perform optical experiments using spectrometer and diffraction techniques. 4. To analyze experimental data using graphical methods and error analysis. 5. To enhance scientific observation, experimental accuracy, and laboratory safety practices.			
Course Outcomes with K-Level Mapping			
CO Code	Course Outcome Statement	Bloom's Level	Description
CO1	Demonstrate knowledge of basic laboratory instruments and measurement techniques.	K1, K2	Remembering & Understanding
CO2	Perform mechanical and thermal experiments to determine physical constants.	K2, K3	Understanding & Applying
CO3	Apply electrical circuit laws and analyze capacitor charging and discharging behavior.	K3, K4	Applying & Analyzing
CO4	Conduct optical experiments using spectrometer and diffraction grating for wavelength and refractive index determination.	K3, K4, K5	Applying, Analyzing & Evaluating
CO5	Interpret experimental data using graphical analysis and evaluate experimental accuracy and errors.	K4, K5, K6	Analyzing, Evaluating & Creating
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create			
List of Experiments			
S. No	Title		
1.	Young's Modulus – Non-uniform bending methods		
2.	Determination of the radius of a current carrying coil 2-Determination of magnetic field with the variation of distance along the axis of current carrying coil.		
3.	To determine the Wavelength of main spectral line of mercury light using plane transmission grating.		
4.	To determine the Refracting Angle, Refractive Index and Dispersive power of prism using spectrometer.		
5.	To determine the coefficient of thermal Conductivity of bad conductor by Lee's Disc		
6.	Charging and Discharging of Capacitor.		
7.	Verification of Kirchhoff's law.		

Text Book(s)	
1	A textbook of practical Physics, M.N. Srinivasan, S. Balasubramanian, R. Ranganathan, Sultan Chand & Sons (2017)
2	Practical Physics and Electronics, C.C. Ouseph, U.J.Rao, V. Vijayendran, S. Viswanathan Publishers (2007)
Reference	
1	https://nptel.ac.in/course.html/physics/experimentalphysicsI,IIandIII
2	https://nptel.ac.in/courses/115/105/115105110/
3	https://www.youtube.com/playlist?list=PLuiPz6iU5SQ8-rZn_LgLoRX7n8z4tHYK

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	–	✓	✓	✓

Course code	CHM 202	CHEMISTRY PRACTICAL	2 Credits	
Core/Elective/SBS		PRACTICAL PAPER		
Prerequisite Course			Syllabus Version	2026-27
Course Objectives 1. To provide hands-on training in advanced physical, inorganic, and organic chemistry experiments. 2. To understand reaction kinetics, thermodynamic properties, and electrochemical measurements. 3. To develop skills in synthesis and quantitative estimation of inorganic complexes. 4. To perform organic derivative preparation and single-stage organic synthesis techniques. 5. To introduce computer-assisted molecular drawing and IUPAC nomenclature using chemistry software				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe principles of reaction kinetics, thermochemistry, enzyme catalysis, and vapour pressure measurements used in physical chemistry experiments.	K1, K2	Remembering & Understanding	
CO2	Explain synthesis, bonding, and analytical estimation methods involved in transition metal complexes and iodometric titrations.	K2, K3	Understanding & Applying	
CO3	Apply laboratory techniques for inorganic synthesis, organic derivative preparation, and single-stage organic synthesis reactions.	K3, K4	Applying & Analyzing	
CO4	Analyze experimental data obtained from titration, calorimetric, electrochemical, and synthetic procedures with appropriate calculations.	K4, K5	Analyzing & Evaluating	
CO5	Design molecular structures using chemistry software and interpret IUPAC nomenclature for organic compounds.	K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
List of Experiments				
S. No	Title			
List of Physical Chemistry experiments (Any 2)				
1.	To determine the rate of chemical reaction by using hydrolysis of tert-Butyl chloride.			
2.	Effects of catalase enzyme obtained from potato in cleaving H2O2 into H2O and O2.			
3.	To measure the vapour pressure of n-Pentane by using high vacuum line. 4 5			
4.	Heat of solution of KNO3/ NH4Cl.			

5.	Glass electrode- Buffer solutions: To titrate a weak base (Na ₂ CO ₃) with a strong acid a) an acid-base indicator,(b) a glass electrode
List of Inorganic Chemistry Experiments (Any 2)	
1.	Synthesis of hexamine nickel (II) [Ni(NH ₃) ₆]I ₂
2.	Cuprous Chloride, Cu ₂ Cl ₂
3.	The transition metals: a survey (Transition metals in biological systems and Bonding in complex ions).
4.	Estimation of Cu (II) and K ₂ Cr ₂ O ₇ using sodium thiosulphate solution (Iodometrically).
5.	Estimation of available chlorine in bleaching powder iodometrically.
List of Organic Chemistry Experiments (Any 3 in Each Group)	
1.	Preparation of Derivatives: Oxime, 2, 4-DNP, Acetyl, Benzoyl, Semicarbazone, Anilide, Amide, Aryloxyacetic acid.
2.	Organic single stage preparation: 1. The preparation of paracetamol. 2. The synthesis of meso-1,2-Dihydroxy-1,2-Diphenylethane. 3. Preparation of α-phenyl Cinnamic acid from Benzaldehyde. 4. Preparation of benzyl alcohol from Benzaldehyde. 5. Preparation glucose pentaacetate from Glucose. 6. Preparation of 2-iodobenzoic acid from Anthranilic acid.
Use of Computer (Chemistry Software)	
Chem Draw-Sketch, ISI – Draw, Draw the structure of simple aliphatic, aromatic, heterocyclic organic compounds with substituent's. Get the correct IUPAC name.	
Text Book(s)	
1.	Basic Principles of Practical Chemistry, Kulandaivelu A.R., Veeraswamy R., Venkateswaran, Sultan Chand & Sons, 2017
2.	Practical Chemistry for B.Sc Chemistry, A.O. Thomas
3.	Practical Chemistry, Pandey D.N., Sultan Chand Publishers, 2018
4.	https://www.freebookcentre.net/chemistry-books-download/Chemistry-Laboratory-Manual-by-CSOS.html
Reference	
1.	Vogel's Text book of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Fifth Edition, Bath Press, Great Britan, 1989
2.	Vogel's Textbook of Quantitative Chemical Analysis, G H Jeffery, J Bassett, J Mendham, R C Denney, Fifth Edition, Bath Press, Great Britan, 1989
3.	ChemDraw 17.0 User Guide, PerkinElmer Informatics Inc, 1998-2017

CO vs K-Level Coverage Matrix

CO / K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	–	✓	✓	–
CO5	–	–	–	✓	✓	✓

Course code	BIO 202	BIOLOGY PRACTICAL	2 Credits
Core/Elective/SBS	PRACTICAL PAPER		
Prerequisite Course	Cell Biology / Molecular Biology	Syllabus Version	2026-27
Course code - To develop skills in microscopy techniques and cellular structure observation. - To perform staining techniques for visualization and differentiation of cellular components and microorganisms. - To understand DNA structure, protein interaction and basic bioinformatics visualization tools. - To quantify cell number and viability using hemocytometer counting and vital staining methods. - To isolate DNA and analyze cell division stages through gel electrophoresis and mitotic studies.			
Course Outcomes with K-Level Mapping			
CO Code	Course Outcome Statement	Bloom's Level	Description
CO1	Describe cellular structures and organelles using microscopy and prepared specimen observation.	K1, K2	Remembering & Understanding
CO2	Demonstrate staining techniques for visualization of cellular components and microorganisms.	K2, K3	Understanding & Applying
CO3	Apply bioinformatics tools for visualization of DNA-protein interactions and molecular structures.	K3	Applying
CO4	Analyze cell number and viability using hemocytometer counting and Trypan blue staining methods.	K3, K4	Applying & Analyzing
CO5	Perform DNA isolation, gel electrophoresis and mitotic observation to interpret cellular division and genetic organization.	K3, K4, K5	Applying, Analyzing & Evaluating
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create			
List of Experiments			
S. No	Title (Any 6)		
1.	Microscopy and observation recording of representative organelle readymade specimens.		
2.	Staining of cell for observations of-Flagella, cell wall, endospores, etc. a. Plant cell, bacterial, fungi samples. b. Malachite green, safranin, Leifson flagella stain/RYU flagella stain, nitric acid, crystals of potassium chlorate (any suitable stain)		
3.	Introduction and visualization DNA-Proteins insilico.		
4.	Demonstration of confocal/ fluorescence microscopy at the central instrumentation facility of Bharathiar University.		
5.	Counting of cells using hemocytometer, observation of dead cells-Trypan blue staining.		
6.	Isolation of DNA: gel electrophoresis.		

7.	Mitosis in onion root tips – Microscopic observation
Text Book(s)	
1	Cappuccino, James G., and Natalie Sherman. "Microbiology: a laboratory manual." (2005)
2	Wilson, K. and Walker, J. (2010). Principles and techniques of Biochemistry and Molecular Biology. 7th Edition. Cambridge University Press.
3	Tiwari, G. S. Hoondal, (2005). Laboratory Techniques In Microbiology & Biotechnology. Swastik publishers
Reference	
1	Sri Jayachamarajendra (2018)/ pdf. Cell Biology and Genetics Lab.
2	K. R. Aneja; Laboratory Manual of Microbiology and Biotechnology, 2018. ED-TECH

CO vs K-Level Coverage Matrix

CO / K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	–	✓	✓	–
CO5	–	–	–	✓	✓	✓

VALUE ADDED 2: HUMAN RIGHTS

Course code	2FB	Human Rights	L	T	P	C	
Value Added		Value Added 2		2	-	-	2
Pre-requisite		Awareness on Ethics and Values		Syllabus Version		2023-24	
Course Objectives:							
The main objectives of this course are to:							
1. Create awareness, conviction and commitment to values for improving the quality of life through education, and for advancing social and human wellbeing							
Expected Course Outcomes:							
On the successful completion of the course, student will be able to:							
1	Understand human values and value education					K1	
2	Learn their role in national development					K1	
3	Understand global development with ethics and values					K1	
4	Learn various therapeutic methods					K1	
5	Learn and understand human rights					K1	
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyse; K5 - Evaluate; K6 - Create							
Unit:1	Concept of Human Values, Value Education Towards Personal Development					3 Hours	
Aim of education and value education; Evolution of value-oriented education; Concept of Human values; types of values; Components of value education. Personal Development: Self-analysis and introspection; sensitization towards gender equality, physically challenged, intellectually challenged. Respect to - age, experience, maturity, family members, neighbors, co-workers. Character Formation Towards Positive Personality: Truthfulness, Constructivity, Sacrifice, Sincerity, Self-Control, Altruism, Tolerance, Scientific Vision.							
Unit:2	Value Education Towards National and Global Development					4 Hours	
National and International Values: Constitutional or national values - Democracy, socialism, secularism, equality, justice, liberty, freedom, and fraternity. Social Values - Pity and probity, self-control, universal brotherhood. Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality, and faith. Religious Values - Tolerance, wisdom, character. Aesthetic values - Love and appreciation of literature and fine arts and respect for the same. National Integration and international understanding.							
Unit:3	Impact of Global Development on Ethics and Values					3 Hours	

Conflict of cross-cultural influences, mass media, cross-border education, materialistic values, professional challenges, and compromise. Modern Challenges of Adolescent Emotions and behaviour; Sex and spirituality: Comparison and competition; positive and negative thoughts.		
Unit:4	Therapeutic Measures	3 Hours
Control of the mind through a. Simplified physical exercise b. Meditation – Objectives, types, effect on body, mind and soul c. Yoga – Objectives, Types, Asanas d. Activities: (i)Moralisation of Desires (ii)Neutralisation of Anger (iii)Eradication of Worries (iv)Benefits of Blessings		
Unit:5	Human Rights	3 Hours
Concept of Human Rights – Indian and International Perspectives a. Evolution of Human Rights b. Definitions under Indian and International documents 2. Broad classification of Human Rights and Relevant Constitutional Provisions. a. Right to Life, Liberty and Dignity b. Right to Equality c. Right against Exploitation d. Cultural and Educational Rights e. Economic Rights f. Political Rights g. Social Rights 3.Human Rights of Women and Children a. Social Practice and Constitutional Safeguards (i) Female Foeticide and Infanticide (ii) Physical assault and harassment (iii) Domestic violence (iv) Conditions of Working Women 4.Institutions for Implementation a. Human Rights Commission b. Judiciary 5.Violations and Redressal a. Violation by State b. Violation by Individuals c. Nuclear Weapons and terrorism d. Safeguards.		
Unit:6	Contemporary Issues	2 Hours
Case Study, Expert Lectures, Online Seminars - Webinars		
Total Lecture Hours		18 Hours
Textbook(s)		
1	Value Education – Human Rights, Bharathiar University	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	Human Rights in India - By Prof. (Dr.) Y.S.R. Murthy O.P. Jindal Global University - SWAYAM	
Course Designed By: Bharathiar University		

SEMESTER III

Course code	MTH 301	Maths 3:Vector Calculus and Differential Equations	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Calculus and Linear Algebra fundamentals	Syllabus Version	2026-27
Course Objectives				
1. To develop understanding of eigenvalues, eigenvectors and matrix diagonalization. 2. To introduce inner product spaces and orthogonality concepts. 3. To analyze functions of several variables using vector calculus techniques. 4. To apply multiple integrals and integral theorems in physical applications. 5. To understand partial differential equations and Fourier methods used in scientific modelling.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Explain characteristic equations, eigenvalues, eigenvectors and diagonalization of matrices.	K1, K2	Remembering & Understanding	
CO2	Apply concepts of inner product spaces, orthogonality and Gram–Schmidt process.	K2, K3	Understanding & Applying	
CO3	Analyze functions of several variables using partial derivatives, gradients and vector fields.	K3, K4	Applying & Analyzing	
CO4	Evaluate multiple integrals, line and surface integrals using Green's, Gauss and Stokes' theorems.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Solve partial differential equations using Fourier series and transforms for physical applications.	K3, K4, K6	Applying, Analyzing & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit:1	Linear Algebra			11 L
• Characteristic Equation Characteristic And Minimal Polynomial - Cayley-Hamilton Theorem • Eigenvectors, Eigenvalues and Diagonalisation Definition of Eigenvectors and Eigenvalues - Calculating Eigenvalues and Eigenvectors- Diagonalisation of Matrices; Matrix Powers - Orthogonal Matrices, Real Symmetric Matrices - Applications of Eigenvectors/Diagonalisation Eg Markov Chains • Inner Product Space Inner Product Axioms; Examples/Non-Examples of Inner Products - Length, Angle, Cauchy-Schwarz Inequality in-terms of Inner Product - Orthogonality, Projections in-terms of Inner Product - Gram-Schmidt Algorithm				
Unit:2	Vector Calculus			10 L

• Differentiation in Several Variables Functions of Several Variables; Level Curves and Cross Sections of Surfaces - Common Surfaces Including Paraboloid, Ellipsoid, Hyperboloid - Domains and Ranges of Functions of Several Variables - Limits and Continuity of Functions of Several Variables; Definition Of CN - Partial Derivatives, Tangent Plane - Differentiability of Functions of Several Variables - Chain Rule and Total Derivative - Directional Derivative, Gradient • Vector-Valued Functions Parameterization of Paths - Vector Fields, Div and Curl Operators		
Unit:3	Maxima and Minima in Several Variables	08 L
• Maxima and Minima in Several Variables Stationary Points of Surfaces, Classification of Stationary Points using Second Derivatives Optimization Applications – Constrained Extrema using Lagrange Multiplier Method • Multiple Integration Double Integrals, Changing Order of Integration - Polar Co-Ordinates, Change of Variables for Double Integrals - Triple Integrals - Change of Variables For Triple Integrals; Cylindrical Co-Ordinates - Spherical Co-Ordinates		
Unit:4	Integrals	08 L
• Line Integrals Line Integrals of Scalar Functions - Line Integrals of Vector Functions - Integrals of Scalar Functions Over Surfaces, Applications of Surface Integrals Eg. Surface Area, Mass - Integrals of Vector Functions Over Surfaces, Flux - Green's Theorem • Surface Integrals and Its Applications Gauss Divergence Theorem - Stokes' Theorem - Applications of Integral Theorems Eg. Maxwell's Equations		
Unit:5	Partial Differential Equations	09 L
• Fourier Series Fourier Series - Fourier Series: Dirichlet's, Discontinuities and Differentiation Fourier Series: Weak Convergence and Series Summation - Linearity and Superposition • Applications of Partial Differential Equations Wave Equation - Heat and Diffusion Equation - Laplace Equation and Harmonic Functions • Fourier Transform Fourier Transform - Fourier Transform: Properties		

Suggested Reference books:	
Linear Algebra:	
1. Seymour Lipschitz and Marc Lipson, Linear Algebra, 3rd Edition, McGraw Hill Higher Education, 2017. 2. Thomas S. Shores, Applied Linear Algebra and Matrix Analysis, Springer International Publishing AG, 2018. 3. S.G. Venkatachalapathy, Modern Algebra, Margham Publications, 2011. 4. Kenneth Hoffman and Ray Kunze, Linear Algebra, Second Edition, Prentice-Hall of India Pvt. Ltd, 2013. 5. S.R. Patil, M.D. Bhagat, R.S. Bhamare, S.M. Waingade, N.M. Phatangare, K.D. Masalkar, Linear Algebra, Nirali Prakashan, 2018.	
Vector:	
1. Susan Jane Colley, Vector Calculus, 4th Edition, Pearson, 2011. 2. Gerald B. Folland, Advanced Calculus, Upper Saddle River, NJ : Prentice Hall, 2002. 3. Edwin Jed Herman and Gilbert Strang, Calculus - Volume II, OpenStax, 2016.	
Partial Differential Equations:	
1. T. Veerarajan, Transforms and Partial Differential Equations, 3rd Edition, McGraw Hill Education, 2016. 2. P. Sivaramakrishna Das and C. Vijaykumari, Transforms and Partial Differential Equations, 6th Edition, Pearson India, 2018. 3. G. Balaji, Transforms and Partial Differential Equations, 12th Edition, G. Balaji Publishers, 2016.	

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	–	✓

Course code	PHY 301	Quantum mechanics and Thermodynamics		4 Credits	
Core/Elective/SBS		CORE PAPER			
Prerequisite Course		Modern Physics		Syllabus Version	2026-27
Course Objectives 1. To develop the mathematical foundations required for advanced physics. 2. To understand principles and formalism of quantum mechanics. 3. To analyze microscopic physical systems using quantum models. 4. To understand laws of thermodynamics and equilibrium processes. 5. To apply differential equations to physical phenomena such as wave motion and heat transfer					
Course Outcomes with K-Level Mapping					
CO Code	Course Outcome Statement		Bloom's Level	Description	
CO1	Describe linear algebra concepts including eigenvalues, eigenvectors and inner product spaces.		K1, K2	Remembering & Understanding	
CO2	Explain quantum mechanical principles and wave mechanics formulation.		K2, K3	Understanding & Applying	
CO3	Apply quantum mechanics to atomic systems and tunneling phenomena.		K3, K4	Applying & Analyzing	
CO4	Analyze thermodynamic laws, entropy, free energy and equilibrium systems.		K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Solve partial differential equations describing waves, diffusion and heat flow.		K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create					
Unit: 1	Linear Algebra			11 L	
Change of basis and linear transformations - Definition of eigenvectors and eigenvalues - Calculation of eigenvalues and eigenvectors - Diagonalisation of matrices; matrix powers - Orthogonal matrices and real symmetric matrices - Characteristic and minimal polynomials; Cayley–Hamilton theorem - Applications of eigenvectors and diagonalisation (Markov chains) - Inner product axioms; examples and non-examples - Length, angle and Cauchy–Schwarz inequality - Orthogonality and projections - Gram–Schmidt orthogonalization.					
Unit: 2	Quantum Mechanics			18 L	
Breakdown of classical physics: failure to explain blackbody radiation; Planck's quantization; photoelectric effect. Matter waves and quantum interpretation: de Broglie waves; experimental confirmation; electron double-slit experiment; wave-particle duality. Quantum mechanics in one dimension: basic postulates; time-dependent and time-independent Schrödinger equation; stationary states; probabilistic interpretation; 1D infinite square well; harmonic oscillator – eigenfunctions and energy eigenvalues. Expectation values, observables and operators: Hermitian operators; commutator algebra; uncertainty principle. Tunneling phenomena: free particle; finite potential barrier; tunneling; alpha particle emission. Quantum mechanics in 3D: 3D Coulomb					

potential and degeneracy. Hydrogen atom, hydrogenic ions and helium atoms: qualitative solution; eigenvalues and wavefunctions. Hydrogen molecule ion and hydrogen molecule: qualitative discussion.

Unit: 3	Thermodynamics	17 L
Temperature and the Zeroth Law; thermal equilibrium. Heat, work and internal energy; First Law; heat capacity and enthalpy; compression of ideal gas; latent heats. Transport, conduction, conductivity and diffusion in gases. Entropy, spontaneous change and the Second Law; interacting ideal gases and entropy of mixing. Heat engines: Carnot cycle, Otto cycle, Stirling cycle. Multiplicity and ideal gases; kinetic theory; equipartition theorem; Boltzmann distribution. Gibbs free energy and spontaneity; Helmholtz free energy; standard free energies; Maxwell's relations (qualitative). Thermodynamic criteria for chemical and phase equilibria; chemical potential; partial molar quantities; Gibbs free energy minimum; equilibrium constant; molecular description of equilibrium; response to temperature. Thermodynamics of liquids and liquid mixtures: chemical potentials; ideal liquid mixtures; Raoult's law; Henry's law; vapour pressure diagrams; liquid-liquid phase diagrams; excess functions; activity coefficients; osmotic pressure.		
Unit: 4	Partial Differential Equations – PDEs	09 L
Fourier series. Fourier series: Dirichlet conditions, discontinuities and differentiation. Fourier series: weak convergence and series summation. Linearity and superposition. Wave equation. Heat and diffusion equation. Laplace equation and harmonic functions. Fourier transform. Fourier transform: properties.		

Suggested Text:	
1	Principles of Quantum Mechanics: R. Shankar (2010) 2nd edition, Springer
2	Quantum Mechanics by Thiagarajan and Ghatak, Gasiorowicz, Stephen, Quantum Physics (3rd ed.). Wiley(2003)
3	Zemansky, Mark W.; Dittman, Richard (1996). Heat and Thermodynamics (7th ed.). McGraw-Hill.
Reference books	
1	Eisberg, Robert; Resnick, Robert (1985). Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles (2nd ed.). Wiley & Sons.
2	French, A. P.; Taylor, Edwin (1978). An Introduction to Quantum Physics. W. W. Norton & Company.
3	Pedro Pereyra, Fundamentals of Quantum Physics: Textbook for Students of Science and Engineering (Undergraduate Lecture Notes in Physics) 2012

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

Course code	CHE 301	Reactions and Synthesis	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Fundamentals of Organic, Inorganic and Physical Chemistry	Syllabus Version	2026-27
Course Objectives 1. To understand the principles and mechanisms of carbon–carbon bond–forming reactions in organic synthesis. 2. To develop knowledge of inorganic redox, substitution, coordination, and exchange reactions along with their thermodynamic basis. 3. To explain the laws and applications of thermodynamics in chemical systems, equilibria, and phase behavior. 4. To apply retrosynthetic analysis and problem-solving strategies in designing organic synthetic pathways. 5. To enhance analytical and evaluative skills in interpreting chemical reactivity, mechanisms, and thermodynamic data.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe the preparation, properties, and reactions of organometallic reagents, enolates, and carbonyl compounds involved in C–C bond formation.	K1, K2	Remembering & Understanding	
CO2	Explain mechanisms and applications of Aldol, Claisen, Michael, Malonate, and related organic synthesis reactions using retrosynthetic approaches.	K2, K3, K4	Understanding, Applying & Analyzing	
CO3	Apply concepts of inorganic redox chemistry, substitution reactions, coordination chemistry, HSAB theory, and electrochemical diagrams to chemical systems.	K3, K4	Applying & Analyzing	
CO4	Analyze thermodynamic principles, including entropy, free energy, equilibrium, phase behavior, and liquid mixtures in chemical processes.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Design synthetic pathways and solve advanced problems involving retrosynthetic disconnections, thermodynamic calculations, and inorganic reaction mechanisms.	K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Organic Synthesis – C-C Bond Forming Reactions			12 L
Grignard reagents and organolithiums: formation and reaction with carbonyl compounds. Organometallic reagents in synthesis: organocerium and organocuprate reagents. Carbonyl compounds and tautomerism: keto-enol tautomerism, mechanism. Generation of enolate anions; base catalysts for enolization of aldehydes, ketones, esters and β-Di carbonyl compounds; general α-substitution. Reactions of enols and enolates: α-substitution with H/D+, stereochemical consequences, deuterium incorporation. Halogenation of carbonyl compounds: haloform reaction.				

Hell-Volhard-Zelinsky reaction; synthetic applications of α -halo carbonyl compounds. Alkylation of enolates, LDA: scope and limitations. Aldol reaction: mechanism, retrosynthesis, inter- and intramolecular variants, mixed aldol. Claisen reaction: mechanism, retrosynthesis, mixed Claisen and Dieckmann reaction. Malonate diester and acetoacetate chemistry: synthesis of substituted acetic acid and acetone derivatives. Michael addition: reaction of enolates with Michael electrophiles. Kinetic and thermodynamic enolates; enamines and silyl enol ethers; retrosynthetic analysis.

Unit: 2	Inorganic Reactions & Synthesis – Redox and Substitution	12 L
Redox and acid-base reactions: oxidation of elements by halogens and dioxygen; halides and oxides of metals and main group elements; amphoteric behaviour; thermodynamic vs. kinetic control. Thermodynamic aspects: Born-Haber cycle; Ellingham diagrams for halides and oxides. Oxidation of metals by protons; aqua ions; hydrolysis in TM aqua ions; Latimer and Frost diagrams. Frost diagram interpretation for complex main group chemistry. Pourbaix diagrams combining redox and acid-base reactions. Exchange reactions: transport reactions, solid-state material preparation, metathesis, solubility trends, common ion effect. HSAB theory: thermodynamic basis, prediction of equilibrium direction and solubility. Substitution reactions: inert and labile complexes; stability constants; Irving-William's series; chelate effect; siderophores; chelation therapy. Mechanism of substitution: square planar Pt complexes; trans effect; chemotherapeutic applications. Dissociative, interchange and associative mechanisms in octahedral complexes. Combination of substitution and redox in TM systems; inner- and outer-sphere electron transfer. Template reactions; atom transfer; metal-directed ligand synthesis.		
Unit: 3	Thermodynamics of Chemical Systems	15 L
Ideal gases, kinetic theory, equipartition theorem, Boltzmann distribution. Heat, work and internal energy; First Law; heat capacity and enthalpy; compression of ideal gas; latent heats. Multiplicity and ideal gases; entropy; spontaneous change; Second Law; entropy of mixing. Gibbs free energy and spontaneity; Helmholtz free energy; standard free energies; free energy as function of P and T; Fundamental equation; Maxwell relations. Thermodynamics criteria for chemical and phase equilibria; chemical potential; partial molar quantities; Gibbs free energy minimum; equilibrium constant; molecular description of equilibrium; temperature dependence. Thermodynamics of liquids and liquid mixtures: chemical potentials; ideal liquid mixtures; Raoult's Law; Henry's Law; vapour pressure diagrams; liquid-liquid phase diagrams; free energy and entropy of mixing; excess functions; activity coefficients; osmotic pressure.		
Unit: 4	Applications & Retrosynthetic Analysis	04 L
Integrated retrosynthetic analysis of multi-step organic syntheses using enolate chemistry, Aldol, Claisen, Malonate and Michael reactions. Selected exercises in designing synthetic routes for target molecules. Introduction to green chemistry principles in synthesis. Overview of industrial applications of C-C bond forming reactions.		
Unit: 5	Problem Solving & Review	02 L
Numerical problems on thermodynamic functions, equilibrium constants, Pourbaix and Frost diagrams, solubility products and standard electrode potentials. Problem-solving strategies for multi-step organic synthesis and retrosynthetic disconnections.		

Suggested Reference Books:	
1	S.H. Maron and C.F. Prutton; Principles of Physical Chemistry, 4th edition (1965), Collier Macmillan Ltd.
2	P. Atkins and J. de Paula; The Elements of Physical Chemistry, 5th edition (2009), W. H. Freeman Publication, USA.
3	C.N.R. Rao; University General Chemistry, 1st edition (2000), Macmillan Publishers, India.
4	P.S. Kalsi; Stereochemistry: Conformation and Mechanism, S. Chand Publication.
5	Jonathan Clayden, Nick Greeves and Stuart Warren; Organic Chemistry, Oxford University Press.
6	Samuel Glasstone; An Introduction to Electrochemistry, reprint edition (2011), BiblioBazaar, USA.
7	R. Chang; Physical Chemistry for Biological Sciences, 1st edition (2005), University Science Books, USA.
8	David Ball; Physical Chemistry, 1st edition (2003), Thomson Learning, USA.
9	B.S. Bahl, G.D. Tuli, Arun Bahl; Essentials of Physical Chemistry, 24th edition (2000), S. Chand Limited, India.
10	Robert Thornton Morrison; Organic Chemistry, 6th edition (1992), Pearson Publication, Dorling Kindersley (India Pvt. Ltd.).
11	Peter Sykes; Guide Book to Mechanism in Organic Chemistry, 6th edition (1996), Prentice Hall.
12	J.D. Lee; Concise Inorganic Chemistry, 5th edition (2008), John Wiley & Sons, USA.

CO vs K-Level Coverage Matrix

COs / K-Levels	K1	K2	K3	K4	K5	K6
CO1	✓	✓	-	-	-	-
CO2	-	✓	✓	✓	-	-
CO3	-	-	✓	✓	-	-
CO4	-	-	✓	✓	✓	-
CO5	-	-	-	✓	✓	✓

Course code	BIO 301	Functional Biology of Organisms	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		General Biology / Functional Biology	Syllabus Version	2026-27
Course Objectives 1. To understand principles of functional biology, including the organization and function of major animal organ systems. 2. To explain physiological regulation mechanisms such as metabolism, circulation, respiration, immunity, and reproduction in animals. 3. To study plant physiological processes, including growth, transport, nutrition, metabolism, and stress responses. 4. To understand hormonal signaling, development, and environmental responses in plants. 5. To introduce basic concepts of microbial physiology and functional adaptations of microorganisms.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe principles of functional biology including organization of tissues, organs and physiological systems in animals.	K1, K2	Remembering & Understanding	
CO2	Explain structure and functions of major organ systems including nervous, endocrine, circulatory, respiratory, digestive and excretory systems.	K2, K3	Understanding & Applying	
CO3	Apply concepts of metabolism, thermoregulation, immunity and reproductive biology in maintaining physiological homeostasis.	K3, K4	Applying & Analyzing	
CO4	Analyze plant physiological processes including growth, transport systems, photosynthesis, mineral nutrition, signaling and stress responses.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Evaluate microbial physiological processes and integrate functional adaptations across plants, animals and microorganisms.	K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Introduction to Functional Biology			01 L
• Introduction to Functional Biology				
Unit: 2	Introduction to Functional Biology			18 L
• Anatomy and Function 1: Tissues, Organs and Viscera, Anatomy and Function 2: Skeletal & Muscular system • Nervous system 1: The central nervous system (CNS) and nervous tissues, Nervous system 2: Autonomic nervous system and motor responses				

• Endocrine system 1: Endocrine and Exocrine glands, Endocrine system 2: HPA axis introduction • Respiration and Metabolism 1: Breathing in air and water, Respiration and Metabolism 2: Regulation of metabolism • Cardiovascular and circulatory system 1: Regulation of the circulatory system, Cardiovascular and circulatory system 2: Peripheral circulation • Digestive system • Urinary and Excretion systems 1: Anatomy and function, Urinary and Excretion systems 2: Osmoregulation in terrestrial & aquatic environments • Thermal dynamics • Immunology 1: Innate immune system, Immunology 2: Adaptive/Humoral immune system • Reproduction and Development 1: Gonads and the Reproductive tract, Reproduction and Development 2: Gametes, Fertilization and conception.		
Unit: 3	Plant Biology	16 L
• Growth and Development, Photosynthesis, Water Balance, Water Relations and Transport (Xylem & Phloem), Phloem and translocation, Mineral nutrition and nutrient assimilation, Respiration and lipid metabolism, Reproduction, Signaling; hormones, light responses, control of flowering, Abiotic stress, Secondary metabolism and defence		
Unit: 4	Microbial physiology	02 L
• Microbial physiology		

Suggested Text and Reference books:	
1	Molecular cell biology, Harvey Lodish, 8th edition, W.H. Freeman, (2016).
2	Cell and Molecular Biology concepts and Experiments, Gerald Karp, Janet Iwasa, Wallace Marshall, 9th Edition, Wiley (2019)
3	Molecular Biology of the cell, Bruce Alberts, 6th edition, Garland Science (2014)
4	The Cell: A molecular approach, Geoffrey M. Cooper, Robert E. Hausman, Sixth edition, Sinauer (2013)
5	Essential Cell Biology, Bruce Alberts, 5th edition, Garland Science (2019).
6	Lewin's Genes XII, 2017, Jocelyn E Krebs, Elliott S. Goldstein, and Stephen T. Kilpatrick Jones, Bartlett Publishers, 12th revised edition
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.,]	
1	https://microbenotes.com/category/cell-biology/
2	https://www.larberthigh.com/_documents/%5B1405%5DUnit_1

	_Cell_biology_summary_notes.pdf
3	https://nptel.ac.in/courses/102/103/102103012/
4	https://www.khanacademy.org/science/ap-biology/cell-structure-and-function

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

Course code	PHY 302	PHYSICS PRACTICAL		2 Credits	
Core/Elective/SBS		RACTICAL PAPER			
Prerequisite Course		General Physics Laboratory		Syllabus Version	2026-27
Course Objectives					
1. To understand advanced experimental techniques in modern physics.					
2. To study wave optics and interference phenomena using precision instruments.					
3. To analyze electron properties through electromagnetic and quantum experiments.					
4. To determine fundamental physical constants through laboratory measurements.					
5. To develop skills in data analysis, graphical interpretation, and error estimation.					
6. To enhance experimental accuracy, observation skills, and scientific reporting.					
Course Outcomes with K-Level Mapping					
CO Code	Course Outcome Statement			Bloom's Level	Description
CO1	Demonstrate understanding of modern physics experiments and laboratory instrumentation.			K1, K2	Remembering & Understanding
CO2	Perform interference and diffraction experiments to determine wavelength and Rydberg constant.			K2, K3	Understanding & Applying
CO3	Analyze electron behavior using e/m measurement and electron diffraction experiments.			K3, K4	Applying & Analyzing
CO4	Evaluate quantum phenomena such as photoelectric effect and determine Planck's constant and work function.			K3, K4, K5	Applying, Analyzing & Evaluating
CO5	Determine fundamental constants like electronic charge using Millikan oil drop experiment and interpret experimental results.			K4, K5, K6	Analyzing, Evaluating & Creating
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create					
List of Experiments					
S. No	Title				
1.	Michealson's interferometer: To find the wavelength of given laser beam.				
2.	Specific charge of the electron(e/m): To find the specific charge of the electron from the path of an electron beam in crossed electric and magnetic fields of variable strength.				
3.	Rydberg's constant: To find Rydberg's constant using diffraction grating.				
4.	Photoelectric effect: To estimate Planck's constant and work function of the photoelectrons by measuring the variation of stopping potential with the frequency of light. To see the graph of current Vs voltage for different intensity and frequency of light.				
5.	Electron diffraction: To measure diameter of smallest diffraction rings at different anode voltages.				
6.	Millikan soil drop experiment: To measure to charge of the electron.				
Text Book(s)					

1	A textbook of practical Physics, M.N. Srinivasan, S. Balasubramanian, R. Ranganathan, Sultan Chand & Sons (2017)
2	Practical Physics and Electronics, C.C. Ouseph, U.J.Rao, V. Vijayendran, S. Viswanathan Publishers (2007)
Reference	
1	https://nptel.ac.in/course.html/physics/experimentalphysicsI,IIandIII
2	https://nptel.ac.in/courses/115/105/115105110/
3	https://www.youtube.com/playlist?list=PLuiPz6iU5SQ8-rZn_LgLoRX7n8z4tHYK

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	–	✓	✓	✓

Course code	CHM 302	CHEMISTRY PRACTICAL	2 Credits	
Core/Elective/SBS		PRACTICAL PAPER		
Prerequisite Course			Syllabus Version	2026-27
Course Objectives 1. To provide advanced experimental training in physical, inorganic, and organic chemistry techniques. 2. To understand thermodynamic, electrochemical, spectroscopic, and instrumental analytical methods. 3. To develop skills in quantitative analysis of ores, alloys, soil, and environmental samples. 4. To perform separation and synthesis of organic compounds using classical laboratory methods. 5. To enhance analytical thinking, interpretation of experimental data, and research-oriented laboratory skills.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe principles of electrochemical measurements, spectrophotometry, colorimetry, conductometry, and polarographic analysis.	K1, K2	Remembering & Understanding	
CO2	Explain thermodynamic parameters, equilibrium concepts, and instrumental analytical techniques used in physical chemistry experiments.	K2, K3	Understanding & Applying	
CO3	Apply quantitative analytical methods for analysis of ores, alloys, soil, water samples, and ion-exchange chromatography experiments.	K3, K4	Applying & Analyzing	
CO4	Analyze experimental results to determine equilibrium constants, stability constants, concentrations, and physicochemical properties.	K4, K5	Analyzing & Evaluating	
CO5	Design strategies for separation of binary mixtures and synthesis of organic compounds using systematic laboratory procedures.	K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
List of Experiments				
S. No	Title			
List of Physical Chemistry experiments (Any 2)				
1.	Thermodynamic data of electrochemical cell by e.m.f. measurements.			
2.	Determination of the equilibrium constant of tri-iodide ion formation			
3.	Determination of dipole moment f liquid at various temperatures			
4.	Dissociation constant of an acid-base indicator by spectrophotometry			

5.	Flame Photometric determination of Na, K, Li and Ca (Working curve method, standard addition method and Internal standard method)
6.	A photometric titration of a mixture of Bi and Cu with EDTA(-745nm)
7.	The reaction between potassium per sulphate and potassium iodide by colorimetry.
8.	Hydrolysis constant of aniline hydrochloride by distribution coefficient method.
9.	Thermodynamic data of electrochemical cell by e.m.f. measurements.
10.	Determination of the equilibrium constant of tri-iodide ion formation
11.	Determination of dipole moment of liquid at various temperatures
12.	Determination of concentration of sulfuric acid, acetic acid and copper sulphate by conductometric titration with sodium hydroxide.
13.	Determine the formula and stability constant of a metal ion complex (Lead Oxalate) by polarography.
List of Inorganic Chemistry Experiments (Any 2)	
1.	1. Analysis of ore (Any one) i) Pyrolusite ore –Estimation of silica gravimetrically and Manganese volumetrically. ii) Chromite ore–Estimation of Iron gravimetrically and Chromium volumetrically
2.	Analysis of Alloy Solder alloy– Estimation of Tin gravimetrically and Lead volumetrically
3.	Column Chromatography: Ion exchange capacity of resins by Co and Ni.
4.	Characterization of soil and water.
List of Organic Chemistry Experiments (Any 3 in Each Group)	
1.	Separation of Binary Mixture (8-10 samples)
2.	Preparations: Single Stage a. Ethyl benzene from acetophenone b. P-Nitrobenzyl cyanide from Benzyl cyanide. c. 2,4-dinitroanisole from anisole d. Azo dye from Anthranilic acid e. Osazone from Glucose f. Cinnamic acid dibromide from Cinnamic acid g. Chalcone from P-chloro Benzaldehyde. h. Hippuric acid from Glycine i. 4-formyl resorcinol from Resorcinol. j. Adipic acid from Cyclohexanone k. 4,6 dimethyl coumarin from p-cresol. l. Cannizzaro reaction of aromatic aldehyde.

Text Book(s)	
1.	Basic Principles of Practical Chemistry, Kulandaivelu A.R., Veeraswamy R., Venkateswaran, Sultan Chand & Sons, 2017
2.	Practical Chemistry for B.Sc Chemistry, A.O. Thomas
3.	Practical Chemistry, Pandey D.N., Sultan Chand Publishers, 2018
4.	https://www.freebookcentre.net/chemistry-books-download/Chemistry-Laboratory-Manual-by-CSOS.html
Reference	
1.	Vogel's Text book of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Fifth Edition, Bath Press, Great Britan, 1989
2.	Vogel's Textbook of Quantitative Chemical Analysis, G H Jeffery, J Bassett, J Mendham, R C Denney, Fifth Edition, Bath Press, Great Britan, 1989
3.	ChemDraw 17.0 User Guide, PerkinElmer Informatics Inc, 1998-2017

CO vs K-Level Coverage Matrix

CO / K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	–	✓	✓	–
CO5	–	–	–	✓	✓	✓

Course code	BIO 302	BIOLOGY PRACTICAL		2 Credits	
Core/Elective/SBS		PRACTICAL PAPER			
Prerequisite Course		Cell Biology / Molecular Biology		Syllabus Version	2026-27
Course Objectives					
1. To prepare sterile culture media and perform aseptic microbial culturing techniques. 2. To isolate and quantify microorganisms using plating methods and serial dilution techniques. 3. To analyze microbial growth patterns through bacterial growth curve studies. 4. To evaluate enzyme activity and kinetics under different environmental conditions. 5. To assess antimicrobial susceptibility using antibiotic sensitivity testing.					
Course Outcomes with K-Level Mapping					
CO Code	Course Outcome Statement		Bloom's Level	Description	
CO1	Describe principles of aseptic techniques, laboratory safety, and microbial culture handling procedures.		K1, K2	Remembering & Understanding	
CO2	Demonstrate preparation of culture media, sterilization methods, and microbial isolation using plating techniques.		K2, K3	Understanding & Applying	
CO3	Apply quantitative microbiological and biochemical techniques including serial dilution, colony counting, and glucose estimation.		K3, K4	Applying & Analyzing	
CO4	Analyze bacterial growth patterns and enzyme kinetics under varying experimental conditions.		K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Evaluate antimicrobial activity using antibiotic sensitivity testing and interpret microbial resistance mechanisms.		K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create					
List of Experiments					
S. No	Title (Any 6)				
1.	Preparation of media, autoclaving and culturing of bacteria.				
2.	Plating techniques a) Pour plate b) Streaking c) Spread plate technique				
3.	Dilution and colony counting.				
4.	Bacterial Growth curve.				
5.	Enzyme kinetics (effect of pH, temperature, substrate and enzyme concentration).				
6.	Estimation of glucose.				
7.	Antibiotic sensitivity test: zone of inhibition.				

Text Book(s)	
1	Cappuccino & Sherman – <i>Microbiology: A Laboratory Manual</i>
2	Tiwari & Hoondal – <i>Laboratory Techniques in Microbiology & Biotechnology</i>
3	Wilson & Walker – <i>Principles and Techniques of Biochemistry and Molecular Biology</i>
Reference	
1	Aneja, K.R. – <i>Laboratory Manual of Microbiology & Biotechnology</i>
2	KAneja, K.R. – <i>Microbiology Laboratory Manual</i>
3	Plummer, D.T. – <i>An Introduction to Practical Biochemistry</i>

CO vs K-Level Coverage Matrix

CO / K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

Course code	MTH 401	Maths 4: Probability		4 Credits	
Core/Elective/SBS		CORE PAPER			
Prerequisite Course		Calculus, Algebra, and Elementary Statistics concepts		Syllabus Version	2026-27
Course Objectives 1. o understand the fundamental concepts of probability theory and random variables. 2. To study discrete and continuous probability distributions. 3. To introduce statistical inference, including estimation and hypothesis testing. 4. To analyze stochastic processes and Markov chains. 5. To apply regression, ANOVA, and chi-square techniques in data analysis.					
Course Outcomes with K-Level Mapping					
CO Code	Course Outcome Statement	Bloom's Level	Description		
CO1	Explain probability concepts, events, conditional probability and random variables.	K1, K2	Remembering & Understanding		
CO2	Apply discrete and continuous probability distributions to real-life problems.	K2, K3	Understanding & Applying		
CO3	Analyze sampling distributions and estimation techniques.	K3, K4	Applying & Analyzing		
CO4	Perform hypothesis testing and ANOVA for statistical decision making.	K3, K4, K5	Applying, Analyzing & Evaluating		
CO5	Apply regression and chi-square analysis for interpretation of experimental data.	K3, K4, K6	Applying, Analyzing & Creating		
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create					
Unit:1	Linear Algebra			14 L	
Probability and Random Variables Review of Probability, Events, Laws of Probability - Conditional Probability, Independent Events - Random Variables; Discrete Random Variables and Distributions; Mean, Variance and Standard Deviation of Discrete Random Variable - Bernoulli Trials Distribution Binomial Distribution, Poisson Distribution and Poisson Process - Continuous Random Variables and Distributions, Probability Density Functions, Cumulative Distribution Function - Mean, Variance, Standard Deviation, Median and Percentiles of a Continuous Distribution - Normal Distribution -Uniform and Exponential Distribution Distributions of Functions of a Random Variable - Sums/Differences/Scalar Multiples of Random Variables, Independent Random Variables, Distributions of Sums/Differences of Independent Random Variables- Central Limit Theorem Normal Approximation to The Binomial Distribution, Distribution of The Sample Mean Distribution of Sample Proportion					
Unit:2	Statistics			06 L	
Stochastic processes and Markov chains 2 Hours Stochastic Processes, Markov Chains - Limiting Behavior of Markov Chains					

• Study design 2 Hours Bias, Confounding, Precision, Comparison, Control - Observational Studies Vs Designed Experiments • Exploratory data analysis 4 Hours Describing and Displaying Categorical Data (Tables, Frequencies, Bar Chart) Describing and Displaying Univariate Numeric Data (Dotplots, Boxplots, Histograms, Mean, Median, Quartiles/Percentiles, Standard Deviation, Variance, IQR) Describing and Displaying Bivariate Numeric Data (Scatterplot, Correlation) Statistical Modeling (Single Mean Model, Multiple Means Model, Regression Model)		
Unit:3	Maxima and Minima in Several Variables	05 L
• Sampling distributions 1 Hour Sampling Distributions: Population Vs Sample, Parameter Vs Statistic; Distribution of Sample Mean, Proportion; Standard Error • Estimation 4 Hours Confidence Intervals, Confidence Interval for Mean (using z), Confidence Interval for Mean using t - Confidence Interval for Difference in Mean, Confidence Intervals for Proportion - Required Sample Size, Confidence Interval Vs Prediction Interval - Theory of estimation: Unbiased Estimators, Maximum Likelihood Estimators 1		
Unit:4	Integrals	05 L
• Hypothesis Testing Concepts and Terminology, Testing a Single Mean (z and t) - Errors, Power, 2-Sample Test, Paired Test, Testing Proportion - Non-Parametric Tests for 2 Samples1 • ANOVA One-Way ANOVA -Theory of ANOVA		
Unit:5	Partial Differential Equations	04 L
• Regression Least Squares Method - Partitioning of Variability in Regression, Significance Testing in Regression • Chi-squared Test Chi-Squared Test for Independence - Chi-Squared Goodness-of-Fit		

Suggested Reference books:
Probability:
1. Seymour Lipschutz and Marc Lars Lipson, Probability, 2nd Edition, McGraw Hill Higher Education, 2010. 2. T. Veerarajan, Probability, Statistics and Random Process, 3rd Edition, McGraw Hill Education, 2017. 3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand and Sons, 2014.

Statistics:

1. S.P. Gupta, Statistical Methods, Sultan Chand & Sons, 2021.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand and Sons, 2014.
3. B.L. Agarwal, Programmed Statistics (Question-Answers), 4th Edition, New Age International Private Limited, 2021.

CO vs K-Level Coverage Matrix

CO Code	K1	K2	K3	K4	K5	K6
CO1	✓	✓				
CO2		✓	✓			
CO3			✓	✓		
CO4			✓	✓	✓	
CO5			✓	✓		✓

SEMESTER IV

Course code	MTH 401	Maths 4: Probability and Statistics	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Higher Secondary Mathematics	Syllabus Version	2026-27
Course Objectives 6. To provide students with a strong foundation in the principles of probability, random variables, and probability distributions. 7. To develop the ability to apply discrete and continuous probability distributions in solving engineering and real-world problems. 8. To introduce stochastic processes, Markov chains, and exploratory data analysis for understanding uncertainty and data behaviour. 9. To equip students with statistical inference techniques, including estimation, confidence intervals, and hypothesis testing. 10. To enable students to analyze data using ANOVA, regression analysis, and Chi-square tests for effective decision-making and research applications				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom’s Level	Description	
CO1	Explain the fundamental concepts of probability, random variables and probability distributions.	K1, K2	Remembering & Understanding	
CO2	Apply discrete and continuous probability distributions to solve engineering and scientific problems.	K2, K3	Understanding & Applying	
CO3	Analyze stochastic processes, Markov chains and perform exploratory data analysis using statistical methods.	K3, K4	Applying & Analyzing	
CO4	Apply estimation techniques and hypothesis testing for statistical inference.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Analyze datasets using ANOVA, regression and Chi-square tests for decision making.	K3, K4, K6	Applying, Analyzing & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Probability				
Unit:1	Probability and Random Variables			
Probability and Random Variables Review of Probability, Events, Laws of Probability - Conditional Probability, Independent Events - Random Variables; Discrete Random Variables and Distributions; Mean, Variance and Standard Deviation of Discrete Random Variable - Bernoulli Trials				
Unit:2	Continuous Probability Distributions and Stochastic Processes			11 L
Distribution				

Binomial Distribution, Poisson Distribution and Poisson Process - Continuous Random Variables and Distributions, Probability Density Functions, Cumulative Distribution Function - Mean, Variance, Standard Deviation, Median and Percentiles of a Continuous Distribution - Normal Distribution -Uniform and Exponential Distribution Distributions of Functions of a Random Variable - Sums/Differences/Scalar Multiples of Random Variables, Independent Random Variables, Distributions of Sums/Differences of Independent Random Variables- Central Limit Theorem Normal Approximation to The Binomial Distribution, Distribution of The Sample Mean Distribution of Sample Proportion. • Stochastic processes and Markov chains Stochastic Processes, Markov Chains - Limiting Behavior of Markov Chains		
Unit:3	Statistics	07 L
• Study design Bias, Confounding, Precision, Comparison, Control - Observational Studies Vs Designed Experiments • Exploratory data analysis 4 Hours Describing and Displaying Categorical Data (Tables, Frequencies, Bar Chart) Describing and Displaying Univariate Numeric Data (Dotplots, Boxplots, Histograms, Mean, Median, Quartiles/Percentiles, Standard Deviation, Variance, IQR) Describing and Displaying Bivariate Numeric Data (Scatterplot, Correlation) Statistical Modeling (Single Mean Model, Multiple Means Model, Regression Model) • Sampling distributions Sampling Distributions: Population Vs Sample, Parameter Vs Statistic; Distribution of Sample Mean, Proportion; Standard Error.		
Unit:4	Estimation and Hypothesis Testing	07 L
• Estimation Confidence Intervals, Confidence Interval for Mean (using z), Confidence Interval for Mean using t - Confidence Interval for Difference in Mean, Confidence Intervals for Proportion - Required Sample Size, Confidence Interval Vs Prediction Interval - Theory of estimation: Unbiased Estimators, Maximum Likelihood Estimators • Hypothesis Testing Concepts and Terminology, Testing a Single Mean (z and t) - Errors, Power, 2-Sample Test, Paired Test, Testing Proportion - Non-Parametric Tests for 2 Samples		
Unit:5	ANOVA, Regression and Chi-square	04 L
• ANOVA One-Way ANOVA -Theory of ANOVA • Regression Least Squares Method - Partitioning of Variability in Regression, Significance Testing in Regression		

- **Chi-squared Test**
Chi-Squared Test for Independence - Chi-Squared Goodness-of-Fit

Suggested Reference books:

Probability:

4. Seymour Lipschutz and Marc Lars Lipson, Probability, 2nd Edition, McGraw Hill Higher Education, 2010.
5. T. Veerarajan, Probability, Statistics and Random Process, 3rd Edition, McGraw Hill Education, 2017.
6. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand and Sons, 2014.

Statistics:

4. S.P. Gupta, Statistical Methods, Sultan Chand & Sons, 2021.
5. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand and Sons, 2014.
6. B.L. Agarwal, Programmed Statistics (Question-Answers), 4th Edition, New Age International Private Limited, 2021.

CO vs K-Level Coverage Matrix

CO Code	K1	K2	K3	K4	K5	K6
CO1	✓	✓				
CO2		✓	✓			
CO3			✓	✓		
CO4			✓	✓	✓	
CO5			✓	✓		✓

Course code	PHY 401	Electricity, magnetism, Special Relativity and Optics	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Basic Electromagnetic Concepts	Syllabus Version	2026-27
Course Objectives 1. To understand electrostatics, electric fields, potentials and dielectric properties of matter. 2. To explain magnetic fields, electromagnetic induction and Maxwell’s equations. 3. To understand principles of Special Relativity and relativistic dynamics. 4. To analyze wave optics, diffraction phenomena and imaging systems. 5. To study optical instruments and modern microscopy applications.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom’s Level	Description	
CO1	Describe electrostatic principles including electric fields, potentials, capacitors and dielectric media.	K1, K2	Remembering & Understanding	
CO2	Explain magnetic fields, electromagnetic induction and Maxwell’s equations governing electromagnetic waves.	K2, K3	Understanding & Applying	
CO3	Apply concepts of Special Relativity including Lorentz transformations and relativistic energy–momentum relations.	K3, K4	Applying & Analyzing	
CO4	Analyze diffraction, interference and Fourier optics for image formation and optical systems.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Evaluate modern optical imaging and microscopy techniques for scientific applications.	K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Transmission Genetics (Mendelian Genetics)		10 L	
Coulomb’s Law and spherical symmetry, Gauss’s Law and electric flux, Electric field and potential, Conductors and insulators, Laplace equation and applications, Dielectrics and electric dipoles, Capacitors and energy stored in electric field, and Current and continuity equation.				
Unit: 2	Magnetism and Electromagnetism		11 L	
Magnetic field and force on moving charges, Magnetic field and vector potential, Induction, Inductance and energy stored in magnetic field, RC circuits, LC and RLC circuits, Displacement current and Maxwell’s equations, Complete Maxwell’s equations, Electromagnetic waves, and Magnetic dipoles and magnetism in matter.				
Unit: 3	Special Relativity		06 L	
Galilean transformation, Einstein axioms for special relativity, Lorentz transformation, Space-time and simultaneity, Relativistic kinematics, Doppler effect, Twin paradox, Relativistic dynamics,				

Relativistic energy and momentum, Mass-energy equivalence, Conservation of four-momentum, Centre of momentum frame, De Broglie waves and photons, Einstein's equivalence principle, gravity, gravitational lenses, gravitational waves, and Special relativity and E and B fields.		
Unit: 4	Optics- Applications and Microscopy	09 L
Classical optics: Fermat's Principle, Fourier Optics: Huygens-Fresnel Principle, Fourier Optics: Fresnel diffraction integral, Fourier Optics: Paraxial approximation, Fourier Optics: Fraunhofer diffraction, Fourier Optics: Apertures and imaging, and Fourier Optics: phase contrast imaging.		
Unit: 5	Microscopy Applications	02
Microscopy applications, imaging, and Fourier microscopy.		

Suggested Text:	
1	Edward M. Purcell , David J. Morin, Electricity and Magnetism, Cambridge University Press(2013)
2	Robert Resnick , Introduction to Special Relativity (2007)
3	Ajoy Ghatak , Optics, 8th Edition (2025)
Reference books:	
1	Serway and Jewett, Physics for Scientists and Engineers, 7th edn, Brooks/Cole Publishers (2008).
2	Griffiths DJ, Introduction to Electrodynamics, 5th ed, Cambridge University, 2024
3	Edward M. Purcell , Electricity and Magnetism, Vol. II: (Berkeley Physics Course)

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

Course code	CHE 401	Structure and Properties	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Basic Knowledge of Organic, Inorganic, and Physical Chemistry	Syllabus Version	2026-27
Course Objectives 1. To understand stereochemistry, molecular symmetry, group theory, and their applications in chemical systems. 2. To develop knowledge of spectroscopic techniques, including NMR, IR, Raman, UV-Vis, EPR, and photoelectron spectroscopy for structural analysis. 3. To explain molecular orbital theory, aromaticity, and organometallic chemistry in relation to bonding and reactivity. 4. To analyze catalytic reactions and mechanistic pathways involving transition metal complexes and organometallic compounds. 5. To apply spectroscopic and stereochemical principles for characterization, interpretation, and problem solving in chemistry.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe stereochemistry, molecular symmetry, point groups, chirality, and stereochemical behavior of organic and inorganic molecules.	K1, K2	Remembering & Understanding	
CO2	Explain the principles and interpretation of NMR, IR, Raman, UV-Vis, EPR, and photoelectron spectroscopy in structural characterization.	K2, K3	Understanding & Applying	
CO3	Apply molecular orbital theory, aromaticity concepts, and organometallic chemistry to explain bonding, stability, and reactivity of chemical systems.	K3, K4	Applying & Analyzing	
CO4	Analyze catalytic mechanisms, transition metal reactions, spectrochemical properties, and organometallic transformations in industrial and research applications.	K4, K5	Analyzing & Evaluating	
CO5	Design and solve integrated chemical problems involving stereochemistry, spectroscopy, molecular symmetry, and organometallic reaction pathways.	K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Stereochemistry & Symmetry		10 L	
Molecular shape and electronic structure; orbitals, hybridization and shapes of molecules; stereochemical consequences of tetrahedral carbon – isomers, enantiomers, R/S, D/L, optical rotation. Molecules with more than one chiral centre: diastereomers, meso compounds, separation of racemic mixtures. Symmetry operations and elements. Group theory: reducible and irreducible representations; use of group theory to determine the irreducible representation. Assignment of point groups. Character tables: irreducible representations and characters. Simple applications:				

labelling molecular shapes and isomers, identifying chiral molecules, dipole moments, optical isomers, orbital symmetry labels (s, p and d orbitals in Td, Oh, D4h). Stereochemistry and reactions: prochirality, chirality in nature, stereochemistry on atoms other than carbon, retrosynthetic analysis. Stereochemistry and mechanism (nucleophilic substitution, elimination from non-cyclic compounds). Alkene addition: hydrogenation, halogenation, HX addition; elimination; epoxide ring-forming reactions. Zeeman effect; magnetochemistry; spin and orbital contributions to magnetic moment. EPR spectroscopy: hyperfine coupling in organic radicals and transition metal complexes.

Unit: 2	Nuclear Magnetic Resonance Spectroscopy	08 L
Nuclear Magnetic Resonance (NMR): energies of nuclei in magnetic fields. Chemical shift and the δ scale; resonance of different nuclei; shielding; spin-orbit coupling and coupling constants; molecular symmetry. ^{13}C NMR and ^1H NMR: integration, multiplicity, and chemical shift typical ranges. Introduction to molecular spectroscopy: spectroscopic transitions, absorbance, transmittance, and the Beer-Lambert Law; intensities of spectroscopic transitions.		
Unit: 3	Vibrational & Electronic Spectroscopy	06 L
Quantised vibration and simple harmonic oscillator model; wave functions. Molecular vibrational modes; vibrational spectroscopy – infrared (IR) and Raman spectroscopy; $3N-5$ and $3N-6$ vibrational degrees of freedom. Vibrational symmetry and IR/Raman activity; use of internal coordinates to get symmetry properties. Local mode approximation; characteristic IR absorptions (alkyl CH, alcohol, amine, carboxylic acid, amide, ester, ketone, aldehyde, nitrile, alkyne, alkene, aromatic); fingerprint regions; interpretation of IR spectra. Electronic spectroscopy: chromophores and excited states; UV-Vis spectroscopy; Franck-Condon principle and factors. Fates of excited states: fluorescence, phosphorescence, non-radiative transitions, internal conversion, and intersystem crossing. Applications – light-emitting polymers. Molecular orbital theory: HOMO and LUMO. Diatomic molecules, LCAO-MO, and symmetry of MOs. Photoelectron spectroscopy. Generalisation of MO approaches to polyatomic molecules. Hückel theory.		
Unit: 4	Aromatic Chemistry & Organometallic Chemistry	08 L
Aromatic and heterocyclic chemistry: benzene and aromaticity/antiaromaticity; electrophilic aromatic substitution; polycyclic aromatic compounds; heteroaromatic compounds – pyridine and pyrrole; non-C-based aromatic systems. Organometallic chemistry: types and applications of organometallic complexes and catalysts; ligand types. Group 1 (LiR) and Group 2 (Grignard) and p-block chemistries; EPR spectroscopy as a probe of electron distribution. Covalent interactions in coordination compounds – rationalization of the spectrochemical series. Binary metal carbonyl complexes: synergistic bonding and the 18-electron rule; IR and NMR spectroscopy. Substitution at metal carbonyl; other organometallic ligand types; alkyne and alkene complexes. Redox reactions in organometallic chemistry: oxidative addition; reductive elimination; insertions and migrations.		
Unit: 5	Catalysis & Applications	04 L

Catalysis involving transition metals: catalytic systems; water gas shift reaction; hydrogenations; acetic acid process; Monsanto process. Metallocene complexes and advanced polymerization catalysts. Applications of spectroscopy (IR, NMR, UV-Vis) in structural characterization and quality control. Integrated problem solving using spectroscopy and organometallic chemistry.

Suggested Reference Books:

1	S.H. Maron and C.F. Prutton; Principles of Physical Chemistry, 4th edition (1965), Collier Macmillan Ltd.
2	P. Atkins and J. de Paula; The Elements of Physical Chemistry, 5th edition (2009), W. H. Freeman Publication, USA.
3	C.N.R. Rao; University General Chemistry, 1st edition (2000), Macmillan Publishers, India.
4	P.S. Kalsi; Stereochemistry: Conformation and Mechanism, S. Chand Publication.
5	Jonathan Clayden, Nick Greeves and Stuart Warren; Organic Chemistry, Oxford University Press.
6	Samuel Glasstone; An Introduction to Electrochemistry, reprint edition (2011), BiblioBazaar, USA.
7	R. Chang; Physical Chemistry for Biological Sciences, 1st edition (2005), University Science Books, USA.
8	David Ball; Physical Chemistry, 1st edition (2003), Thomson Learning, USA.
9	B.S. Bahl, G.D. Tuli, Arun Bahl; Essentials of Physical Chemistry, 24th edition (2000), S. Chand Limited, India.
10	Robert Thornton Morrison; Organic Chemistry, 6th edition (1992), Pearson Publication, Dorling Kindersley (India Pvt. Ltd.).
11	Peter Sykes; Guide Book to Mechanism in Organic Chemistry, 6th edition (1996), Prentice Hall.
12	J.D. Lee; Concise Inorganic Chemistry, 5th edition (2008), John Wiley & Sons, USA.

CO vs K-Level Coverage Matrix

COs / K-Levels	K1	K2	K3	K4	K5	K6
CO1	✓	✓	-	-	-	-
CO2	-	✓	✓	-	-	-
CO3	-	-	✓	✓	-	-
CO4	-	-	-	✓	✓	-
CO5	-	-	-	✓	✓	✓

Course code	BIO 401	Genetics, Evolution and Ecology	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Developmental Biology / Evolutionary Biology	Syllabus Version	2026-27
Course Objectives 1. To understand the principles of Mendelian genetics and patterns of inheritance. 2. To explain genetic variation, linkage, recombination, and chromosomal basis of inheritance. 3. To analyze population genetics concepts including mutation, natural selection, gene flow, and genetic drift. 4. To understand population structure, growth dynamics, and demographic models. 5. To describe community interactions, biodiversity patterns, and ecological relationships. 6. To explain ecosystem structure, energy flow, trophic organization, and biogeochemical cycles.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom’s Level	Description	
CO1	Describe principles of Mendelian genetics, gene behaviour, chromosomal inheritance and genetic variation.	K1, K2	Remembering & Understanding	
CO2	Explain linkage, recombination, genetic mapping, sex determination and non-Mendelian inheritance patterns.	K2, K3	Understanding & Applying	
CO3	Apply population genetics concepts including mutation, genetic drift, natural selection, gene flow and inbreeding in population analysis.	K3, K4	Applying & Analyzing	
CO4	Analyze population biology and community ecology using demographic models, life tables and species interaction frameworks.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Evaluate ecosystem structure, energy flow, trophic dynamics and biogeochemical cycles for ecological interpretation and environmental assessment.	K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Transmission Genetics (Mendelian Genetics)			15 L
• Genetic variation and behaviour of genes • Linkage and recombination; Mapping genes (Chromosomal Basis of Inheritance, Pedigree Analysis and Human Genetics) • Chromosome maps and genetic markers, Sex linkage and sex determination, Complementation, Chromosomal mutations, Non-Mendelian inheritance, Extrachromosomal DNA, Quantitative genetics				
Unit: 2	Population Genetics			07 L

Genetic variation in populations, Mutation and Genetic drift, Natural selection, Mutation/Selection balance, Balanced polymorphism, Gene flow & inbreeding (Migration & random mating).		
Unit: 3	Population Biology	05 L
Nature of populations; numbers, mixing (dispersal), structure in age/stage, Density independent, density dependent growth (exponential and logistic growth equations), R & K selection, life-histories and links to population growth parameters, (annual vs perennial life-histories, clonality), Demography, Life tables, matrix models (requires simple matrix mathematics) and Epidemiology (simple functions).		
Unit: 4	Communities	02 L
Nature of communities; Community structure: how it is described, measured; what drives it; species composition, diversity (alpha, beta, gamma), Intracommunity (interspecific) interactions (bi-partite networks); Symbiosis, Predation, Competition, Host parasite interactions, Dynamics of communities (perturbation and succession), Biomes (communities on a global scale).		
Unit: 5	Ecosystems	04
Pond ecosystem (or other integrated example), Food chains and webs, Pyramids (numbers, biomass, energy), abstraction, defining trophic levels, the problem of omnivory (stable isotope tracers), Biogeochemical cycles (water, C, N, P) pools and fluxes, mass budget models. Rates of processes: productivity, decomposition, trophic transfer, turnover and Mean Residence Time.		

Suggested Text and Reference books:	
1	Anthony J. F. Griffiths, John Doebley, Catherine Peichel, David A. Wassarman – Introduction to Genetic Analysis. Edited by W.H. Freeman, [ISBN: 9781319114772]; 796 pages
2	Benjamin A. Pierce. Genetics: A Conceptual Approach; Edited by W H Freeman & Co; 6th edition; 978-1319050962: 976 pages
3	Daniel L. Hartl, Andrew G. Clark. Principles of Population Genetics. Sinauer Associates, USA; ISBN-13 978-0-87893-308-2: 672 pages
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.,]	
1	https://dth.ac.in/medical/course.php
2	https://onlinecourses.nptel.ac.in/noc22_bt07/preview
3	https://www.youtube.com/watch?v=NR3779ef9yQ
4	https://www.youtube.com/watch?v=IRBIEV8QR4A

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

Course code	PHY 402	PHYSICS PRACTICAL		2 Credits	
Core/Elective/SBS		RACTICAL PAPER			
Prerequisite Course		Basic Physics Laboratory		Syllabus Version	2026-27
Course Objectives 1. To understand the fundamental principles of experimental physics and measurement techniques. 2. To develop practical skills in electrical circuit analysis and inductive systems. 3. To perform optical experiments using laser and diffraction techniques. 4. To analyze experimental data and evaluate physical parameters using standard methods. 5. To enhance scientific observation, accuracy, and laboratory safety practices.					
Course Outcomes with K-Level Mapping					
CO Code	Course Outcome Statement		Bloom's Level	Description	
CO1	Demonstrate basic laboratory skills, measurements, and error analysis in physics experiments.		K1, K2	Remembering & Understanding	
CO2	Perform electrical experiments involving LR and LCR circuits and analyze circuit behavior.		K2, K3	Understanding & Applying	
CO3	Determine inductance and inductive reactance using bridge methods.		K3, K4	Applying & Analyzing	
CO4	Conduct optical experiments to measure wavelength using laser and diffraction gratings.		K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Interpret experimental results, compare theoretical and experimental values, and prepare laboratory reports.		K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create					
List of Experiments					
S. No	Title				
1.	Verification of Stefan's Law by Electrical method.				
2.	Study of LR circuit.				
3.	Study of LCR circuit				
4.	To determine the self-inductance of the coil using Anderson's bridge and calculate the Value of inductive reactance (XL) of the coil at a particular frequency.				
5.	Measurement of wavelength of Laser by Diffraction Grating.				
6.	To determine the Wavelength of main spectral line of mercury light using plane transmission grating.				
Text Book(s)					

1	A textbook of practical Physics, M.N. Srinivasan, S. Balasubramanian, R. Ranganathan, Sultan Chand & Sons (2017)
2	Practical Physics and Electronics, C.C. Ouseph, U.J.Rao, V. Vijayendran, S. Viswanathan Publishers (2007)
Reference	
1	https://nptel.ac.in/course.html/physics/experimentalphysicsI,IIandIII
2	https://nptel.ac.in/courses/115/105/115105110/
3	https://www.youtube.com/playlist?list=PLuiPz6iU5SQ8-rZn_LgLoRX7n8z4tHYK

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	–	✓	✓	✓

Course code	CHM 402	CHEMISTRY PRACTICAL	2 Credits	
Core/Elective/SBS		PRACTICAL PAPER		
Prerequisite Course			Syllabus Version	2026-27
Course Objectives 1. To provide advanced training in spectrophotometric, polarographic, and physicochemical analytical techniques. 2. To develop experimental skills in environmental chemical analysis such as COD and BOD determination. 3. To understand complex formation, stability constants, and instrumental analytical methods. 4. To perform multi-step organic synthesis and reaction sequence transformations. 5. To enhance analytical reasoning, accuracy, and research-oriented laboratory competence.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe principles of spectrophotometry, colorimetry, polarography, and physicochemical behaviour of chemical systems.	K1, K2	Remembering & Understanding	
CO2	Explain complex formation reactions, environmental analytical methods, and pH-metric analytical techniques.	K2, K3	Understanding & Applying	
CO3	Apply instrumental and analytical methods for determination of stability constants, COD, BOD, and quantitative chemical analysis.	K3, K4	Applying & Analyzing	
CO4	Analyze experimental observations to interpret reaction mechanisms, environmental parameters, and chemical equilibria.	K4, K5	Analyzing & Evaluating	
CO5	Design and execute multistep organic synthesis pathways and evaluate product formation using systematic laboratory procedures.	K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
List of Experiments				
S. No	Title			
List of Physical Chemistry experiments (Any 2)				
1.	Determination of the stability constant of a complex by spectrophotometry.			
2.	The reaction between potassium persulphate and potassium iodide by colorimetry.			
3.	Determine the formula and stability constant of a metal ion complex (Lead Oxalate) by polarography.			
4.	Analysis of copper oxide and copper dioxide to determine law of multiple proportions.			

5.	Behaviour of water at different temperatures
List of Inorganic Chemistry Experiments (Any 2)	
1.	Photometric Analysis - To study complex formation between Fe (III) and salicylic acid and find the formula and stability constant of the complex
2.	Simultaneous determination of Cr ⁺² and Cu ⁺²
3.	To determine the strength of given mixture of carbonate and bicarbonate in the given mixture by pH metric method.
4.	Determination of chemical oxygen demand (COD)
5.	Determination of Biological oxygen demand (BOD)
List of Organic Chemistry Experiments (Any 3 in Each Group)	
1.	Glycine – Hydantoic acid – Hydantoin
2.	Benzoin – Benzil - Benzilicacid
3.	P-cresol – 4,6-Dimethylcoumarin – 3-Bromo-4,6 Dimethyl Coumarin
4.	Benzophenone – Oxime –Benzanilide
5.	Acetanilide – p-Bromoacetanilide –p-Bromoaniline
6.	Hydroquinone – Quinoline – 1,2,4 –Triacetoxybenzene.
Text Book(s)	
1.	Basic Principles of Practical Chemistry, Kulandaivelu A.R., Veeraswamy R., Venkateswaran, Sultan Chand & Sons, 2017
2.	Practical Chemistry for B.Sc Chemistry, A.O. Thomas
3.	Practical Chemistry, Pandey D.N., Sultan Chand Publishers, 2018
4.	https://www.freebookcentre.net/chemistry-books-download/Chemistry-Laboratory-Manual-by-CSOS.html
Reference	
1.	Vogel's Text book of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Fifth Edition, Bath Press, Great Britan, 1989
2.	Vogel's Textbook of Quantitative Chemical Analysis, G H Jeffery, J Bassett, J Mendham, R C Denney, Fifth Edition, Bath Press, Great Britan, 1989
3.	ChemDraw 17.0 User Guide, PerkinElmer Informatics Inc, 1998-2017

CO vs K-Level Coverage Matrix

CO / K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	–	✓	✓	–
CO5	–	–	–	✓	✓	✓

Course code	BIO 402	BIOLOGY PRACTICAL		2 Credits	
Core/Elective/SBS		PRACTICAL PAPER			
Prerequisite Course		Developmental Biology / Evolutionary Biology		Syllabus Version	2026-27
Course Objectives 1. To understand ecosystem functioning by creating and monitoring artificial mesocosms and analyzing population growth and biomass changes. 2. To apply ecological field sampling techniques such as quadrat, line transect, and point count methods for estimation of biodiversity and population density. 3. To understand principles of Mendelian inheritance through genetic problem solving and analysis of inheritance patterns. 4. To analyze genetic linkage, crossing over, and sex-linked inheritance using genetic calculations and model organisms. 5. To interpret population genetics and chromosomal variations through human karyotype analysis and calculation of allele frequencies using ABO blood group data.					
Course Outcomes with K-Level Mapping					
CO Code	Course Outcome Statement		Bloom's Level	Description	
CO1	Describe ecological concepts including population structure, biodiversity assessment and ecosystem monitoring techniques.		K1, K2	Remembering & Understanding	
CO2	Apply ecological sampling methods for estimating population density, biomass and community structure.		K2, K3	Understanding & Applying	
CO3	Solve genetic problems involving Mendelian inheritance, linkage and sex-linked traits.		K3, K4	Applying & Analyzing	
CO4	Analyze chromosomal organization and genetic disorders using karyotype interpretation and population genetic data.		K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Evaluate allele frequencies and ecological datasets for population genetics and environmental assessment.		K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create					
List of Experiments					
S. No	Title (Any 6)				
1.	Create an artificial mesocosm (tub/tank of defined area), and inoculate with Lemna./Azolla sp. (brought from nearby habitats). Monitor growth, density and biomass over time.				
2.	Visit different types of water bodies (one river/stream and one quarry/pond/lake) and conduct sampling. Sampling methods (point count/line transect/quadrat) in field. Learn methods for estimating plant biomass (using GBH). (Field session)				

3.	Determination of population density in a natural community by quadrat method
4.	Solving Genetic problems which obey Mendelian laws.
5.	Determination of linkage and cross-over analysis – Problem solving.
6.	Sex linked Inheritance in drosophila – problem solving.
7.	Analyze the Human karyotype chart for different genetic disorders.
8.	Use of ABO blood group data to calculate allele frequencies. (Data can be gathered both by interviews and by actual blood group determination)

Text Book(s)

1	Krebs, C. J. (2014). <i>Ecology: The Experimental Analysis of Distribution and Abundance</i> . 6th Edition, Pearson Education.
2	Snustad, D. P. and Simmons, M. J. (2016). <i>Principles of Genetics</i> . 7th Edition, Wiley.
3	Strickberger, M. W. (2005). <i>Genetics</i> . 3rd Edition, Pearson Education
4	Southwood, T. R. E. & Henderson, P. A. (2009). <i>Ecological Methods</i> . Wiley-Blackwell.

Reference

1	Odum, E. P. and Barrett, G. W. (2005). <i>Fundamentals of Ecology</i> . Brooks/Cole Publishers.
2	Hartl, D. L. and Clark, A. G. (2007). <i>Principles of Population Genetics</i> . Sinauer Associates.
3	Klug, W. S., Cummings, M. R., Spencer, C. A. (2012). <i>Concepts of Genetics</i> . Pearson Education.
4	Stern, C. (2000). <i>Principles of Human Genetics</i> . Freeman & Company.
5	Krebs, C. J. (1999). <i>Ecological Methodology</i> . Addison-Wesley Educational Publishers.

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	–	✓

SEMESTER V

Course code	BIO 501	Biochemistry	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Basic Biochemistry / General Biology	Syllabus Version	2026-27
Course Objectives 1. To understand the structure and properties of major biological macromolecules. 2. To explain thermodynamic principles governing biological energy transformations. 3. To study enzyme mechanisms, kinetics and regulation. 4. To understand metabolic pathways of carbohydrates, lipids and proteins. 5. To introduce biochemical techniques used for purification and characterization of biomolecules.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe the structure, properties, and stabilizing interactions of biomolecules, including sugars, amino acids, fatty acids, and nucleic acids.	K1, K2	Remembering & Understanding	
CO2	Explain principles of biological thermodynamics, including free energy, energy-rich compounds, redox reactions, and biological energy cycles.	K2, K3	Understanding & Applying	
CO3	Analyze enzyme classification, mechanisms, kinetics, ligand binding, allostery, coenzymes, and isoenzyme functions.	K3, K4	Applying & analyzing	
CO4	Interpret and integrate metabolic pathways of carbohydrates, lipids and proteins and evaluate regulatory mechanisms of metabolism.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Apply biochemical techniques for purification and characterization of biomolecules using modern analytical methods.	K3, K4, K6	Applying, Analyzing & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Basic biomolecules and their properties		05 L	
• Sugars, • Amino acids, • fatty acids and nucleic acids, • Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc)				
Unit: 2	Biological thermodynamics		05 L	
• Concept of free energy, • energy-rich compounds, • Free energy and oxidation-reduction reactions. • Energy cycle				
Unit: 3	Enzymes		06 L	

• Definition, classification, properties, • Lock and key hypothesis, • factors affecting the activity of enzymes, Kinetics, • Coenzymes and their role in biological systems. • Isoenzymes and their role. Ligand Binding and Allostery		
Unit: 4	Metabolic pathways	12 L
• Carbohydrate metabolism- Glycolysis, fates of pyruvate: cori cycle fermentation, ED pathway, TCA cycle, Anapleurotic reactions, gluconeogenesis, glycogen breakdown and glycogen synthesis, Glyoxylate pathway, pentose phosphate pathway. Regulation of pathways. • Lipid metabolism: Action of lipases, β-oxidation of Fatty acids (Even No.), ketone bodies, synthesis of fatty acids, and an overview of cholesterol synthesis. And phospholipid synthesis • Protein metabolism Metabolic fates of amino acids, transamination, transfer of amino group by glutamate, urea cycle, Amino Acid Biosynthetic Families, Grouped by Metabolic Precursor		
Unit: 5	Techniques to purify and characterize biomolecules	08 L
• Cell Disruption & Extraction Methods Mechanical methods: homogenization, sonication, bead beating Chemical methods: detergents, enzymes (lysozyme) • Protein Purification Techniques Salting out (ammonium sulfate precipitation) - Dialysis and desalting - Chromatography principles - Ion exchange chromatography - Size exclusion (gel filtration) - Affinity chromatography (e.g., His-tag purification) • Nucleic Acid Isolation & Purification DNA vs RNA extraction methods - Phenol–chloroform extraction - Nucleic acid quantification (A260/A280 ratio) • Electrophoresis Techniques Principle of electrophoresis - SDS-PAGE for proteins - Native PAGE - Agarose gel electrophoresis for DNA/RNA - Visualization methods (staining, UV detection) - UV-Vis spectroscopy (Beer-Lambert law)		

Suggested Reference books:	
1	John Kuriyan, Boyana Konforti & David Wemmer; The Molecules of life: Physical and Chemical Principles, (2013), Garland Science
2	Lehninger Principles of Biochemistry David L. Nelson, Michael M. Cox. Publisher: W. H. Freeman, Fourth Edition
3	Jeremy M Berg; John Tymoczko; Lubert Stryer (2012), Biochemistry, 7 th /6 th edition (or older), Wiley.

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	–	✓

Course code	BIO 502	Molecular Biology	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Basic Molecular Biology / Cell Biology	Syllabus Version	2026-27
Course Objectives 1. To understand the central dogma and flow of genetic information in living systems. 2. To explain genome organization, DNA replication, mutation and DNA repair mechanisms. 3. To study transcription, translation and regulation of gene expression in prokaryotes and eukaryotes. 4. To introduce molecular cloning techniques and modern molecular biology tools. 5. To develop the ability to apply molecular biology concepts for analysis of gene function and expression.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom’s Level	Description	
CO1	Describe the central dogma of molecular biology and its historical development explaining the flow of genetic information.	K1, K2	Remembering & Understanding	
CO2	Explain genome organization, DNA replication, mutability, DNA repair mechanisms and homologous recombination processes.	K2, K3	Understanding & Applying	
CO3	Analyze transcription, transcriptional regulation, operon concept, RNA editing, translation and post-translational modifications in prokaryotes and eukaryotes.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO4	Apply molecular biology techniques including cloning strategies and molecular tools for studying gene expression and gene activity.	K3, K4, K6	Applying, Analyzing & Creating	
CO5	Evaluate molecular mechanisms governing genome maintenance and gene expression to solve biological problems and design experimental approaches.	K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Central Dogma in Biology		02 L	
• Central Dogma in Biology: A Historical Perspective				
Unit: 2	Maintenance of the genome		06 L	
• DNA, Chromosomes, and Genome • Replication of DNA • The Mutability and Repair of DNA • Homologous Recombination at the Molecular Level				

Unit: 3	Transcription and Gene Regulation	12 L
• Overview of Gene Expression – Transcription - Transcription Machinery - Transcription Regulation • Concept of Operon • Gene Regulation in Prokaryotes and Eukaryotes • RNA Processing and Editing		
Unit: 4	Translation and Post-Translational Events	08 L
• Translation - Mechanism of Translation • Regulation of Translation • Post-Translational Modifications (PTMs) - Protein Folding		
Unit: 5	Techniques in Molecular Biology	08 L
• Molecular Cloning methods • Molecular Tools for Studying Genes and Gene Activity		

Suggested Reference books:	
1	Molecular Biology of the Gene by Watson, Baker, Levine, Losick et al. [2007] 6 Ed. Benjamin Cummings.
2	Principles of Gene Manipulation by Primrose, Twyman, Old [2002] 6 Ed. Wiley-Blackwell.
3	Molecular Biology by Weaver [2011] 5 Ed. McGraw- Hill Science.
4	Molecular Biology and Genomics by Mulhardt [2006] 1 Ed. Elsevier.

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	✓	–
CO4	–	–	✓	✓	–	✓
CO5	–	–	–	✓	✓	✓

Course code	BIO 503	Animal Sciences	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Developmental Biology / Cell Biology	Syllabus Version	2026-27
Course Objectives 1. To understand fundamental processes involved in animal development from gametogenesis to organogenesis. 2. To explain stem cell biology, cell differentiation and genetic control of development. 3. To study mechanisms of cell communication and signal transduction pathways in animal systems. 4. To understand molecular mechanisms of gene expression including transcription, translation and post-translational modifications. 5. To develop analytical skills to interpret developmental and signaling processes in animal sciences.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe processes of animal development including gametogenesis, fertilization, cleavage, blastulation and gastrulation.	K1, K2	Remembering & Understanding	
CO2	Explain concepts of stem cells, cell lineage determination, differentiation, dedifferentiation and genetic control of development including pattern formation in <i>Drosophila</i> .	K2, K3	Understanding & Applying	
CO3	Analyze mechanisms of cell communication, signaling molecules, GPCR signaling, Ras-MAPK pathway and secondary messenger systems.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO4	Apply knowledge of transcription, gene regulation, RNA processing, translation and post-translational modifications in animal systems.	K3, K4, K6	Applying, Analyzing & Creating	
CO5	Evaluate molecular mechanisms underlying development and signaling to interpret experimental outcomes in animal sciences.	K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Early Embryonic Development		08 L	
• Gametogenesis (Spermatogenesis, Oogenesis and Structural and functional differences) • Fertilization (Mechanism of fertilization, Acrosome reaction and sperm entry, Prevention of polyspermy and Activation of egg metabolism) • Cleavage (Definition and characteristics, Types of cleavage (holoblastic, meroblastic) and Patterns of cleavage) • Blastulation (Formation of blastula/blastocyst and Structure and types) • Gastrulation (Formation of three germ layers (ectoderm, mesoderm, and endoderm)) • Gastrulation in: Amphioxus, Frog and Chick.				

Unit: 2	Advanced Developmental Processes and Regulation	07 L
• Organogenesis (Basic concept and stages and Overview in frog and chick) • Stem Cells and Cell Lineage (Stem cells: definition and types, Progenitor cells, Cell lineage and fate mapping) • Cellular Processes in Development (Determination, Commitment and Differentiation) • Cellular Plasticity (Dedifferentiation, Redifferentiation and Trans-differentiation) • Genetic Control of Development (Role of genes in body patterning, Axis formation and segmentation) • Developmental genetics using Drosophila as a model organism		
Unit:3	Fundamentals of Cell Communication and Signaling	07 L
• Introduction to Cell Communication • Importance of cell signaling in multicellular organisms • Types of cell communication: (Autocrine, Paracrine, Endocrine and Juxtacrine) • Signaling Molecules – (Types: Hormones, Neurotransmitters and Growth factors) • Ligand–receptor interactions (Specificity and affinity) • Receptors in Cell Signaling (Cell surface receptors, Intracellular receptors and Basic mechanisms of signal reception) • Overview of Major Signaling Pathways (Signal reception, Signal transduction, Cellular response and Concept of signal amplification)		
Unit:4	Signal Transduction Mechanisms and Pathways	08 L
• G Protein-Coupled Receptors (GPCRs) (Structure and components, Mechanism of activation) • Role of G-proteins (Gs, Gi, Gq) • Second Messengers in Signaling (cAMP, cGMP, IP₃ (Inositol triphosphate), DAG (Diacylglycerol), Calcium ions (Ca²⁺) and Role in signal amplification and regulation) • Ras-MAPK Pathway (Activation of Ras protein, Kinase cascade (MAPKKK → MAPKK → MAPK) and Role in cell growth and differentiation) • Integration and Regulation of Signaling (Cross-talk between pathways, Signal termination and desensitization and Biological significance and examples)		
Unit: 5	Techniques in animal sciences	06 L
• Histological and Cytological Techniques – (Tissue fixation and preservation, Embedding and sectioning (microtomy) and Staining methods (H&E staining) • Cell Culture Techniques (Primary vs cell lines, Culture media and conditions (CO₂ incubator, aseptic techniques) and Subculturing and maintenance) • Cytogenetic Techniques (Karyotyping, Chromosome banding techniques and Identification of chromosomal abnormalities)		

Suggested Reference books:	
1	Development Biology, 9th edition, (2010), Gilbert S.F.(Sinauer Associates, USA)
2	Principles of Development, 4th edition (2010), Wolpert L and Tickle C, Publisher: Oxford University Press, USA.
3	Cell Biology, 6th edition, (2010) Gerald Karp. John Wiley & Sons., USA
4	The Cell: A Molecular Approach, 6th edition (2013), Geoffrey M. Cooper, Robert E. Hausman, Sinauer Associates, Inc. USA

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	✓	–
CO4	–	–	✓	✓	–	✓
CO5	–	–	–	✓	✓	✓

Course code	BIO 504	Plant Sciences	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Botany / Plant Biology	Syllabus Version	2026-27
Course Objectives 1. To understand principles of plant taxonomy, classification and morphological characteristics of plants. 2. To study systematic position and economic importance of major plant families. 3. To explain plant metabolic processes including nitrogen metabolism and secondary metabolite biosynthesis. 4. To understand plant embryology, fertilization and developmental processes. 5. To introduce modern techniques used in plant sciences for studying plant structure, metabolism and development.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe principles of plant taxonomy, nomenclature, classification systems and morphological characters including phyllotaxy, inflorescence and fruit types.	K1, K2	Remembering & Understanding	
CO2	Explain characteristics, systematic position and economic importance of major plant families and concepts of plant systematics.	K2, K3	Understanding & Applying	
CO3	Analyze plant metabolic processes including nitrogen metabolism, secondary metabolites and plant cell signaling mechanisms.	K3, K4	Applying & Analyzing	
CO4	Interpret plant embryology, gametophyte development, fertilization and phases of vegetative and reproductive plant development.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Apply modern techniques in plant sciences to study plant structure, metabolism and developmental processes.	K3, K4, K6	Applying, Analyzing & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Plant Taxonomy and morphology			10 L
• Introduction to Plant Taxonomy • Definition, scope, objectives and importance • Identification, classification, nomenclature - Concept of Systematics • Study of Plant Families Study of the following families with reference to systematic position, salient features, floral formula, floral diagram, and any five examples with their economic importance – Malvaceae, Meliaceae, Rubiaceae, Solanaceae, Asclepiadaceae, Euphorbiaceae, and Liliaceae • Morphology- Phyllotaxy, Inflorescence, and fruit types.				

Unit: 2	Plant Metabolism and Biochemistry	07 L
• Nitrogen Metabolism: Biological nitrogen fixation and nitrogen cycle, ammonia assimilation, • Secondary Metabolites and their roles: Introduction to alkaloids, phenolics, plant terpenes, phytoalexins, sesquiterpenes, and sterols • Cell signaling in plants		
Unit: 3	Plant Embryology and Reproductive Structures	06 L
• Introduction to Plant Embryology (Definition and scope and Importance in plant biology) • Microsporangium and Male Gametophyte (Structure of microsporangium, Development of microspores, Structure and development of male gametophyte (pollen grain) • Megasporangium and Female Gametophyte (Structure of ovule (megasporangium), Types of ovules, Megasporogenesis and Structure and development of female gametophyte (embryo sac) • Fertilization in Plants (Pollination (brief overview), Double fertilization: Syngamy, Triple fusion and Significance of double fertilization.		
Unit: 4	Plant Development and Pattern Formation	07 L
• Major Phases of Plant Development (Vegetative development and Reproductive development) • Vegetative Development (Growth and differentiation in plants, Basic patterns in root and shoot development) • Transition to Reproductive Phase (Shift from vegetative to reproductive phase, Internal and external factors influencing flowering) • Pattern Formation in Plants (Concept of pattern formation, Positional information and morphogenesis) • Flowering and Reproductive Development (Floral induction and development and Overview of flowering mechanisms).		
Unit: 5	Techniques in plant sciences	06 L
• Plant Tissue Culture Techniques (Concept of totipotency, Types of cultures: callus culture, suspension culture, Micropropagation and its stages and Culture media (e.g., MS medium) and plant growth regulators) • Histological Techniques (Fixation and preservation of plant tissues, Microtomy and sectioning, Staining techniques (e.g., safranin and fast green) • Anatomical Techniques: Study of plant anatomy (root, stem, leaf) • Cytological Techniques (Preparation of slides (e.g., onion root tip squash), Study of mitosis and meiosis, Chromosome staining and observation) • Physiological Techniques (Measurement of photosynthesis (e.g., leaf disc method), Transpiration experiments (e.g., cobalt chloride method) and Estimation of chlorophyll content.		

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

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	–	✓

Course code	BIO 505	Methods in Biology	2 Credits	
Core/Elective/SBS		ELECTIVE PAPER		
Prerequisite Course		Basic Molecular Biology / Biochemistry	Syllabus Version	2026-27
Course Objectives 1. To introduce fundamental molecular biology and recombinant DNA technology methods 2. To explain histochemical and immunological techniques used for cellular and molecular detection. 3. To understand biophysical techniques for structural and functional analysis of biomolecules. 4. To study principles and applications of radiolabeling techniques in biological research. 5. To familiarize students with electrophysiological and advanced imaging techniques used in biological investigations.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe principles of molecular biology techniques including gene cloning, transformation, PCR, sequencing methods and genomic/cDNA library construction.	K1, K2	Remembering & Understanding	
CO2	Explain histochemical and immunological techniques such as FISH, GISH, immunofluorescence microscopy and flow cytometry for molecular detection.	K2, K3	Understanding & applying	
CO3	Analyze biophysical methods including X-ray crystallography, NMR, ESR, circular dichroism and mass spectrometry for molecular structure determination.	K3, K4	Applying & Analyzing	
CO4	Evaluate principles and applications of radiolabeling techniques, safety measures and autoradiographic detection in biological systems.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Apply electrophysiological and imaging techniques such as CAT, MRI, PET, ECG and patch clamp recording to interpret physiological and cellular functions.	K3, K4, K6	Applying, Analyzing & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Molecular Biology and recombinant DNA technology Methods			06 L
• Gene cloning and transformation of cells (Suitable example) • DNA and protein sequencing methods • Polymerase chain reaction and Genome sequencing: genomic and cDNA libraries.				
Unit: 2	Histochemical and Immunological techniques			04 L
• Detection of molecules in living cells: ▪ FISH and GISH <i>in situ</i> localization ▪ Immunofluorescence microscopy				

▪ Flow cytometry and cell sorting		
Unit: 3	Biophysical Methods	05 L
• Molecular structure determination by X-ray and NMR studies • ESR, Circular Dichroism and mass spectrometry		
Unit: 4	Radiolabeling Techniques	04 L
• Safety guidelines • Addition of radioisotopes in biological cells and tissues • Measurement and detection of radioisotopes in biological samples by autoradiography		
Unit: 5	Electrophysiological Methods	05 L
• CAT, MRI, PET, ECG, Brain activity recording • Patch clamp recording		

Suggested Reference books:	
1	Wilson K. and Walker J. Seventh Ed. Principles and Techniques of Biochemistry and Molecular Biology.
2	Ghatak 2011 Techniques and methods in Biology PHI learning Private Limited.
3	Jost J. 2014 Mathematical Methods in Biology and Neurobiology. Springer-Verlag London
4	Christina E. (Ed.) 2014 Histopathology: Methods and Protocol, Springer Protocols

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	–	✓

Course code	BIO 506	Genetic Engineering	2 Credits	
Core/Elective/SBS		ELECTIVE PAPER		
Prerequisite Course		Molecular Biology / Microbiology	Syllabus Version	2026-27
Course Objectives 1. To understand the principles and historical development of recombinant DNA technology. 2. To study molecular tools and cloning vectors used in genetic engineering. 3. To learn gene transfer methods and DNA isolation and characterization techniques. 4. To explain DNA sequencing, genome mapping and library construction strategies. 5. To understand applications of genetic engineering and biosafety guidelines for development of genetically modified organisms.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe historical development, principles and molecular tools of recombinant DNA technology including restriction enzymes and PCR.	K1, K2	Remembering & Understanding	
CO2	Explain different cloning and expression vectors including plasmids, bacteriophages, cosmids, BAC, YAC and Agrobacterium vectors.	K2, K3	Understanding & Applying	
CO3	Apply gene transfer methods, DNA isolation procedures and characterization techniques in bacterial, plant and animal systems.	K3, K4	Applying & Analyzing	
CO4	Analyze DNA sequencing methods, genome mapping strategies and construction of genomic and cDNA libraries.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Evaluate applications, biosafety guidelines and development of genetically modified organisms using recombinant DNA technology.	K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Introduction & Molecular Tools of Recombinant DNA Technology		05 L	
• Historical perspective • Overview of Recombinant DNA Technology • Different enzymes – Restriction enzymes, Ligases, Polymerases, Alkaline Phosphatases, Nucleases, Transferases • Introduction to PCR technology: Steps in PCR, Factors affecting PCR, Applications of PCR				

Unit: 2	Vectors used in Recombinant DNA Technology	04 L
• Plasmids • Bacteriophages: λ (Lambda) phage and M13 • Expression vectors: pET Vector • Agrobacterial Vectors – pTi plasmid • YAC, BAC • Chimeric Vectors - • Cosmids: Single Cos Cosmids and Dual Cos Cosmids • Phasmids: λZAP series • Phagemids: pGEMZf series, pEMBL8 • Fosmids: pFOS1		
Unit: 3	Gene Transfer & DNA Isolation Techniques	10 L
• Methods of introduction of DNA into: Bacterial cell, Animal cell, and Plant cell. • Selection and Characterization of transformants • Purification of Total cellular/chromosomal DNA and its characterization • Purification of Plasmid DNA – Plasmid Characterization • Purification of Bacteriophage DNA and its characterization		
Unit: 4	DNA Sequencing, Genome Mapping & Library Construction	06 L
• Maxam Gilbert's method • Sanger's Manual method • Automated DNA sequencing • Techniques of Genome mapping: Physical and Genetic • DNA Fingerprinting • Process of library construction • Comparison between Genomic and cDNA library		
Unit: 5	Applications of Recombinant DNA Technology and Guidelines to Create Genetically Modified Organisms	05L
• Application in Agriculture • Application in Food Industry • Application in healthcare and pharmaceutical industry		

Suggested Reference books:	
1	Gene Cloning and DNA Analysis –An Introduction. T.A. Brown. Eighth Edition (2020). Wiley Blackwell.
2	Genetic Engineering. By Smita Rastogi and Neelam Pathak. Oxford University Press (2009).
3	Principles of Gene Manipulation & Genomics, 7th Edition (2006), Primrose and Twyman, Blackwell Publishing, USA

4	Molecular Biology of the Gene, 7th Edition (2013), James D. Watson, Tania Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Lodwick, Pearson Education, Inc.
5	Genomes 3. T.A. Brown. Third Edition (2008). Garland Science Taylor and Francis Group, New York and London.

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

Course code	BIO 507	Biology Lab: I: Biochemistry and Molecular Biology Practicals	2 Credits	
Core/Elective/SBS		CORE PRACTICAL		
Prerequisite Course		Molecular Biology	Syllabus Version	2026-27

Course Objectives

1. To understand the fundamental principles and laboratory techniques used in biochemistry and molecular biology.
2. To develop practical skills in qualitative and quantitative biochemical analyses, enzyme assays, and chromatographic techniques.
3. To perform molecular biology techniques including DNA isolation, plasmid extraction, bacterial transformation, restriction digestion, and PCR.
4. To analyze and interpret experimental results related to biomolecules, enzymes, and nucleic acids using standard laboratory protocols.
5. To develop competency in laboratory safety, scientific documentation, and data interpretation for biochemical and molecular biological investigations.

Course Outcomes with K-Level Mapping

CO No.	Course Outcome	Bloom's Level (K-Level)
CO1	Explain the principles underlying biochemical assays, enzyme activity, chromatography, and molecular biology techniques.	K2 – Understand
CO2	Perform qualitative and quantitative estimation of carbohydrates, proteins, amino acids, and enzyme activity using standard biochemical methods.	K3 – Apply
CO3	Carry out DNA isolation, plasmid extraction, bacterial transformation, restriction enzyme digestion, ligation, and PCR following standard laboratory protocols.	K3 – Apply
CO4	Analyze biochemical and molecular biology experimental data to evaluate the quality, quantity, and integrity of biomolecules.	K4 – Analyze
CO5	Interpret laboratory results and apply biochemical and molecular biology techniques to solve basic biological and biotechnological problems.	K5 – Evaluate

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Biochemistry Practicals (Any 3)

S. No	Title
1	Qualitative analysis of Sugar: To perform qualitative analysis of given sugar sample
2	Quantitative analysis of Sugar: To perform quantitative analysis of reducing sugars from given solution by DNSA method
3	Biuret method: To quantitatively estimate proteins by Biuret method

4	Lowry's method: To estimate the amount of proteins by Lowry's method
5	Paper chromatography: To separate free amino acids by paper chromatography
6	Enzyme assay: To carry out an enzyme assay of amylase using the DNSA method
7	Titration curve: To study the titration curve of Glycine
Molecular Biology Practicals (Any 3)	
S. No	Title
1	Isolation of plant DNA: To isolate total DNA from given plant tissue (Cauliflower inflorescence)
2	Isolation of bacterial DNA: To isolate chromosomal DNA from small scale <i>E. coli</i> culture
3	Plasmid isolation: To isolate plasmid DNA from <i>E. coli</i> by alkaline lysis method
4	Transformation of <i>E. coli</i> : To study the transformation experiment by preparing competent cells and learning the concept of alpha complementation
5	Restriction enzyme digestion and ligation of plasmid
6	Polymerase chain reaction (Demonstration)

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

Course code	BIO 508	Biology Lab: II: Plant and Animal Sciences Practicals	2 Credits	
Core/Elective/SBS		CORE PRACTICAL		
Prerequisite Course		Biology	Syllabus Version	2026-27
Course Objectives 1. To understand the principles of plant taxonomy, plant anatomy, tissue culture, and animal developmental biology through laboratory experiments. 2. To develop practical skills in plant identification, herbarium preparation, tissue culture techniques, and observation of animal developmental stages. 3. To perform laboratory procedures including media preparation, aseptic techniques, callus and anther culture, and regeneration studies. 4. To analyze the morphology, taxonomy, development, and regeneration of selected plant and animal models using microscopic and experimental approaches. 5. To develop scientific observation, experimental documentation, and data interpretation skills relevant to plant and animal biological sciences.				
Course Outcomes with K-Level Mapping				
CO No.	Course Outcome		Bloom's Level (K-Level)	
CO 1	Identify and classify selected plant families, placentation types, pollen morphology, and animal developmental stages using standard laboratory techniques.		K2 – Understand	
CO 2	Perform herbarium preparation, artificial key construction, media preparation, aseptic techniques, and plant tissue culture experiments.		K3 – Apply	
CO 3	Conduct laboratory studies on embryonic development, regeneration, primary cell culture, and developmental biology of selected animal models.		K3 – Apply	
CO 4	Analyze plant morphological characters, tissue culture responses, and developmental processes in plants and animals using experimental observations.		K4 – Analyze	
CO 5	Interpret experimental findings and laboratory data to explain biological principles related to plant taxonomy, tissue culture, developmental biology, and regeneration.		K5 – Evaluate	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Plant Sciences Practicals (Any 5)				
S. No	Title			
1	Preparation of artificial key: To prepare a dichotomous key for given set of species			
2	Herbarium File: To prepare plant specimen for scientific study			
3	Study of families: To study Malvaceae, Rubiaceae family			
4	To study Solanaceae, Asclepiadaceae family			

5	To study Euphorbiaceae, Liliaceae, Meliaceae family
6	Placentation types: To observe and study different placentation types
7	Germination of Pollen grains: To study germination of pollen grains of different flowers
8	Aseptic techniques in plant tissue culture: To study aseptic techniques in plant tissue culture practices
9	Stock solution and Media preparation: To prepare MS basal medium and special media (with growth hormones) for micro propagation
10	Callus culture: To initiate callus culture of Datura
11	Another culture: To initiate the anther culture of Datura
Exercises in Animal Sciences (Any 3)	
S. No	Title
1	Study of eggs: To study different types of eggs
2	Study of frog development: To study early developmental stages, life cycle of frog embryo (<i>Rana tigrina</i>)
3	Study of chick embryo development: To study whole mount of chick embryo and study staging and staining
4	Study of amphioxus development: To study amphioxus development, observe its embryo and different developmental stages
5	Study of external characteristics of <i>Drosophila melanogaster</i> : To study the external characteristics of <i>Drosophila melanogaster</i> with reference to external characters
6	Regeneration in Hydra: To demonstrate regeneration in Hydra
7	Primary cell culture from chick embryo: To initiate primary cell culture from chick embryo

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

BIO 509 – Project/Dissertation – 2 Credits

Project-based learning provides students with an opportunity to undertake independent research under the guidance of a faculty supervisor. Students will be assigned to on-campus faculty members or research scientists from leading national research institutes, universities, or biotechnology and life science research organizations working in various areas of biological sciences. Under their supervision, students will investigate a biological research problem aimed at developing critical thinking, identifying research problems and knowledge gaps, formulating research objectives and hypotheses, designing experimental methodologies, and solving scientific problems through laboratory and field-based investigations. The project enables students to acquire specialized skills in biological techniques, data collection, analysis, interpretation of results, and scientific reporting. It also fosters creativity, innovation, collaboration, teamwork, leadership, effective scientific communication, self-directed learning, and project management skills, thereby preparing students for higher studies and research careers in the biological sciences.

Assessment will be based on continuous evaluation of the student's progress through project presentations, seminars, discussions, maintenance of laboratory records, submission of a dissertation, and evaluation of the final research outcomes, ensuring adequate individual assessment.

SEMESTER VI

Course code	BIO 601	Evolutionary Development Biology	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Developmental Biology / Evolutionary Biology	Syllabus Version	2026-27
Course Objectives 1. To introduce principles of ontogeny, phylogeny and foundations of evolutionary developmental biology (Evo-Devo). 2. To understand concepts of recapitulation, epigenesis and evolutionary morphology. 3. To explain the Modern Synthesis and developmental mechanisms influencing evolutionary change. 4. To study developmental genetics including homeotic genes, HOX genes and deep homology. 5. To analyze evolutionary innovations through epigenetics, developmental constraints and variation in developmental toolkits.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe principles of ontogeny, phylogeny, and historical foundations of evolutionary developmental biology.	K1, K2	Remembering & Understanding	
CO2	Explain concepts of recapitulation, epigenesis, evolutionary morphology, and contributions of early evolutionary thinkers.	K2, K3	Understanding & Applying	
CO3	Analyze the Modern Synthesis, heterochrony, developmental timing, and gene–protein relationships influencing evolution.	K3, K4	Applying & Analyzing	
CO4	Evaluate developmental genetics, including homeotic genes, HOX genes, deep homology, and genetic regulation of body patterning in animals and plants.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Interpret evolutionary innovation through epigenetics, developmental constraints, pleiotropy, and variation in developmental toolkits using case studies.	K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Ontogeny and phylogeny and Concepts of Evolutionary developmental biology		05 L	
• Ontogeny of some animal and plant groups, as well as their organ systems, in a phylogenetic perspective • Steven J. Gould – Ontogeny and Phylogeny • Concepts of Evolutionary developmental biology Introduction to developmental biology from a historical and evolutionary perspective				
Unit: 2	Ontogeny, Recapitulation, Epigenesis and Evolutionary		07 L	

	morphology	
	• Haeckel, von Baer, the biogenetic law • Fritz Muller (using embryology to discover relationships) • Implications of similarity in early developmental stages (e.g., Barnacle larvae are arthropod-like, not molluscan; Tunicates are Chordates) • D'Arcy Thomson – On Growth and Form (minor changes in shape lead to major changes in morphology)	
Unit: 3	The Modern Synthesis (early 20th C) and Second Synthesis, and deep homology	04 L
	• Ronald Fischer: Integration of Darwin's Theory of Natural Selection with Mendel's laws of genetics • Gene-protein-structure; Gene mutation-change in biochemical pathway • Gavin deBeer: Changes in timing of developmental events - Heterochrony, neoteny	
Unit: 4	Radiolabeling Techniques	10 L
	• Steven J. Gould – Ontogeny and Phylogeny • Homeotic genes in Drosophila and the emergence of developmental genetics • Homeobox genes as a eukaryotic feature • The concept of Deep Homology • Highly conserved genes control dissimilar organs in different organisms; eg pax-6 in eyes of insects, cephalopods and vertebrates. • Regulation of transcription factors • HOX genes in animals – axis development and segmentation • MADS-box genes in plants and the ABC model of flower development • Hen's Teeth	
Unit: 5	Electrophysiological Methods	11 L
	• Pleiotropy • Origins of novelty are not mutations in genes, but variation in the toolkit • Case-studies (e.g. Distal-less affecting snake's legs, fruit fly antennae, butterfly wing spots, vertebrate mandibles) • Epigenetics • Variations in the toolkit • Consolidation of epigenetic changes • Developmental bias and constraint	

Suggested Reference books:	
1	Brian K. Hall Evo Edu Outreach (2012) 5:184–193 DOI 10.1007/s12052-012-0418-x Evolutionary Developmental Biology (Evo-Devo): Past, Present, and Future.
2	Arthur W. A theory of the evolution of development. Chichester: Wiley; 1988.
3	Gehring WJ. Master control genes in development and evolution: the homeobox story. New Haven: Yale University Press; 1998

4	Gilbert SF, Apel D. Ecological developmental biology: integrating epigenetics, medicine, and evolution. Sunderland: Sinauer Associates; 2008
5	Biémont C. From genotype to phenotype. What do epigenetics and epigenomics tell us? Heredity. 2010;105:1–3
6	Bowler PJ. Life's splendid drama. Evolutionary biology and the reconstruction of life's ancestry 1860–1940. Chicago: The University of Chicago Press; 1996.

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	–	✓	✓	✓

Course code	BIO 602	Systematics and Evolution	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Evolutionary Biology / Taxonomy	Syllabus Version	2026-27
Course Objectives 1. To understand principles of biological classification, species concepts and nomenclature rules. 2. To explain phylogenetic inference using morphological and molecular data. 3. To develop skills in analyzing phylogenetic datasets and interpreting evolutionary relationships. 4. To study systematic methodologies including biological collections, specimen documentation and databasing. 5. To evaluate evolutionary and biogeographic patterns with emphasis on speciation, extinction and Indian biogeography.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe principles of biological classification, species concepts, nomenclature rules and phylogenetic basis of taxonomy.	K1, K2	Remembering & Understanding	
CO2	Explain phylogenetic inference using morphological and molecular data including homology, molecular markers and evolutionary processes.	K2, K3, K4	Understanding, Applying & Analyzing	
CO3	Analyze phylogenetic datasets using computational approaches and interpret gene trees, species trees and evolutionary relationships.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO4	Apply systematic methods involving biological collections, specimen documentation, databasing and ancient DNA approaches.	K3, K4, K6	Applying, Analyzing & Creating	
CO5	Evaluate evolutionary and biogeographic patterns including speciation, extinction, phylogenetic diversity and Indian biogeographic regions.	K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Principles of classification of organisms at species rank		05 L	
• Ontogeny of some animal and plant groups, as well as their organ systems, in a phylogenetic purpose of classification, • monophyly/paraphyly/polyphyly, • species concepts, • practical approaches to species delimitation (molecular/morphological/behavioural), • rules of nomenclature				

Unit: 2	Method for phylogenetic inference from morphological and molecular data	08 L
• Homology/analogy, synapomorphy, • Parsimony v. likelihood and Bayesian methods • types of molecular markers, including sequencing/genotyping methods/technology (Sanger, high throughput etc.), • properties of nuclear and organellar genomes, • some processes of molecular evolution (transitions/transversions, gene duplications, indels, polyploidy)		
Unit: 3	Analysis of phylogenetic data, including the use of computer programs for assembling and analyzing morphological and molecular datasets	06 L
• Gene trees vs species trees: paralogy/orthology, incomplete lineage sorting • “capture” of organellar genomes through introgression, • concatenation vs concordance approaches to phylogenetic analysis		
Unit: 4	Importance of biological collections to the discipline of systematics and familiarity with common curatorial practices and use of specimen data	07 L
• collecting methods, • vouchers, • specimens as objects for classifying, • distribution mapping, • databasing of specimens and name information, • ancient DNA techniques		
Unit: 5	Inference of evolutionary and biogeographic patterns within and between species	11 L
• Use of phylogenies to infer rates of speciation and extinction • Historical biogeography: cf. ecological biogeography, vicariance/dispersal, molecular dating, patterns of diversity, endemism, phylogenetic diversity (focus on broad scale/higher-level patterns) • Phytogeography (focus on within-species patterns; could tie back to species delimitation, introgression etc.)		
Unit: 6	Biogeographic patterns in the Indian biota	06 L
• Biogeographic patterns in the Indian biota		

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

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	✓	–	–
CO3	–	–	✓	✓	✓	–
CO4	–	–	✓	✓	–	✓
CO5	–	–	–	✓	✓	✓

Course code	BIO 603	Microorganisms and Disease	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Microbiology / Immunology	Syllabus Version	2026-27
Course Objectives 1. To understand diversity, structure, growth and genetics of prokaryotic microorganisms including pathogenic forms. 2. To study diversity and pathogenic mechanisms of protists affecting animals and plants. 3. To explain fungal and helminth diversity, life cycles and disease mechanisms. 4. To understand evolution and functioning of animal immune responses and immunization strategies. 5. To analyze plant defense mechanisms and host–pathogen interactions in disease resistance.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom’s Level	Description	
CO1	Describe diversity, structure, growth and genetics of prokaryotes including pathogenic bacterial and archaeal examples.	K1, K2	Remembering & Understanding	
CO2	Explain diversity, evolution and pathogenic mechanisms of protists including parasitic adaptations in animal and plant systems.	K2, K3	Understanding & Applying	
CO3	Analyze fungal and helminth diversity, life cycles and disease-causing mechanisms in plants and animals.	K3, K4	Applying & Analyzing	
CO4	Evaluate animal immune responses, evolution of immunity and mechanisms of immunization against pathogens.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Interpret plant defense responses including MAMP-triggered immunity, hypersensitive response, SAR and ISR to understand host–pathogen interactions.	K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Prokaryotic diversity and biology		05 L	
• Bacteria and Archaea; Bacterial growth, reproduction, and genetics; Transformation • Pathogenic examples (selected examples as case studies)				
Unit: 2	Protist diversity and biology		06 L	
• Major groups of protists (emphasis on major pathogenic lineages) • Protist cell biology (eukaryotic); Evolution of protistan parasitism (from autotrophy); Obligate v. Facultative parasites • Pathogenic examples (selected examples as case studies): Animal Blood and tissue - <i>Plasmodium</i>, <i>Toxoplasma</i>, <i>Babesia</i> (Apicomplexans); <i>Trypanosoma</i>, <i>Leishmania</i> (Kinetoplastids); <i>Naegleria</i> (Amoebae); Dinoflagellates (in fish, crustacea, bivalves). Animal gut and digestive - <i>Entamoeba</i> (Amoebae); <i>Balantidium</i> (Ciliate); <i>Giardia</i> (Diplomonad); <i>Trichomonas</i> (Parabasalids); <i>Cryptosporidium</i>, <i>Cystoisospora</i>				

(Apicomplexa). Plants - <i>Phytophthora</i> (Kinetoplastid disease of coconuts and oil palms); <i>Phytophthora</i> (Oomycete – potato blight). Red alga on red alga (substitution of nuclei).		
Unit: 3	Fungal diversity and biology	05 L
- Fungal diversity and life cycles, major lineages - Pathogenic examples (selected examples as case studies): Microsporidians; Chytrids – <i>Batrachomyxium dendrobatidis</i> (Chytridiomycosis in amphibians), <i>Synchytrium endobioticum</i> (potato disease). Fungal Pathogens of animals - <i>Pneumocystis jirovecii</i>, other respiratory tract fungi; <i>Candida albicans</i>; Tinea. Fungal pathogens of plants		
Unit: 4	Helminth diversity and biology	04 L
Nematodes; Trematodes (flukes); Cestodes (tapeworms)		
Unit: 5	Animal responses (immunology)	10 L
Immune system and its evolution; Immunisation in mammals		
Unit: 6	Plant responses	06 L
- Inducible defense; Microbe-associated molecular pattern (MAMP)-triggered immunity; R-genes (resistance to intracellular effectors) - Hypersensitive response; Phytoalexins - Plant Systemic Immunity: Systemic Acquired Resistance (SAR): Induced Systemic Resistance (ISR)		

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

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

Course code	BIO 604	Computational Biology	4 Credits	
Core/Elective/SBS		CORE PAPER		
Prerequisite Course		Molecular Biology / Computer Applications in Biology	Syllabus Version	2026-27
Course Objectives 1. To introduce principles, scope and interdisciplinary applications of bioinformatics and computational biology. 2. To understand structure, classification and retrieval of biological databases. 3. To develop skills in using bioinformatics tools such as NCBI resources and BLAST for sequence analysis. 4. To explain sequence alignment methods, scoring matrices and molecular phylogenetic analysis. 5. To explore applications of computational biology in genomics, drug design, systems biology and disease modelling.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe principles, scope, research areas and interdisciplinary nature of bioinformatics and computational biology.	K1, K2	Remembering & Understanding	
CO2	Explain structure, classification and retrieval systems of biological databases used in bioinformatics research.	K2, K3	Understanding & Applying	
CO3	Apply bioinformatics tools including NCBI resources, BLAST and international sequence databases for biological data retrieval and submission.	K3, K4	Applying & Analyzing	
CO4	Analyze sequence alignment strategies, scoring matrices (PAM, BLOSUM) and molecular phylogenetic methods using computational tools.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Evaluate bioinformatics applications in drug design, genomics, transcriptomics, crop improvement, infectious disease modelling and systems biology.	K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Introduction to Bioinformatics and Computational Biology		05 L	
• Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics				
Unit: 2	Databases in Bioinformatics		05 L	
• Introduction, Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System.				
Unit: 3	Biological and Sequence Databases		06 L	
• National Center for Biotechnology Information (NCBI): Tools and Databases of NCBI, Database Retrieval Tool, Sequence Submission to NCBI, Basic local alignment search tool (BLAST)				

- Nucleotide Database, Protein Database, Gene Expression Database. EMBL Nucleotide Sequence Database (EMBL-Bank): Introduction, Sequence Retrieval, Sequence Submission to EMBL, Sequence analysis tools. DNA Data Bank of Japan Introduction, Resources at DDBJ, Data Submission at DDBJ. - Protein Information Resource (PIR): About PIR, Resources of PIR, Databases of PIR, Data Retrieval in PIR. Swiss-Prot: Introduction and Salient Features.		
Unit: 4	Sequence Alignments	08 L
- Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), MSA by CLUSTALW, Scoring Matrices, Percent Accepted Mutation (PAM), - Blocks of Amino Acid Substitution Matrix (BLOSUM).		
Unit: 5	Molecular Phylogeny	06 L
- Analyses Methods of Phylogeny, - Software for Phylogenetic Analyses, - Consistency of Molecular Phylogenetic Prediction.		
Unit: 6	Applications of Bioinformatics	06 L
- Inducible defense; Microbe-associated molecular pattern (MAMP)-triggered immunity; R-Drug Design, Microbial genome applications, Crop improvement, RNA-sequencing and transcriptomics, - Infectious disease modelling, - Analysis of complex ecological networks, Bayesian inference in systems biology		

Suggested Reference books:	
1	Robbe W. 2004 Computational Biology: Unix/Linux, Data Processing and Programming Springer-Verlag New York.
2	Fall C., Marland E., Wagner J., Tyson J. 2002 Computational cell biology Springer Verlag New York.
3	Voit E. 2000 Computational Analysis of Biochemical Systems: A Practical Guide for Biochemists and Molecular Biologists Cambridge University Press.
4	CloteP., Backofen R. 2000 Computational Molecular Biology: An Introduction, John Wiley and Sons.

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

Course code	BIO 605	Applied Biology	2 Credits	
Core/Elective/SBS		ELECTIVE PAPER		
Prerequisite Course		Biotechnology / Molecular Biology	Syllabus Version	2026-27
Course Objectives 1. To understand biodiversity resources, conservation strategies and traditional knowledge associated with bioresource utilization. 2. To explain principles of marker-assisted breeding and molecular marker applications in plant and animal improvement. 3. To study genomic applications in healthcare including genetic diagnosis, pharmacogenetics and personalized medicine. 4. To understand development and applications of transgenic plants and animals in agriculture and biomedical research. 5. To introduce biosensor technologies for biological detection, environmental monitoring and medical diagnostics.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe biodiversity resources, conservation strategies, gene banks and traditional knowledge associated with bioresource utilization.	K1, K2	Remembering & Understanding	
CO2	Explain principles of marker assisted breeding, molecular markers and QTL mapping in plant and animal improvement programs.	K2, K3	Understanding & Applying	
CO3	Apply genomics approaches in healthcare including genetic diagnosis, pharmacogenetics, gene therapy and personalized medicine.	K3, K4	Applying & Analyzing	
CO4	Evaluate development and applications of transgenic plants and animals for agriculture, nutrition, disease resistance and biomedical research.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Design and interpret biosensor applications for biological detection and environmental or biomedical monitoring.	K3, K4, K5, K6	Applying, Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Biodiversity uses and Bioresources			06 L
• Bioresources and bioresource conservation • Bioresources for food and nutrition • Ethnic knowledge in bioresource conservation • Gene bank and Bioprospecting traditional medicines				
Unit: 2	Marker Assisted breeding in Plants and Animals			05 L

	▪ Marker Assisted Selection ▪ Types of Markers ▪ QTL mapping, DNA markers in animal and plant breeding	
Unit: 3	Genomics applications in health	05 L
	• Identification and diagnosis of genetic disorders • Parental diagnosis and testing • Pharmacogenetics and gene therapy • Personalized medicines	
Unit: 4	Transgenic animals and plants	05 L
	• Transgenic animals in biomedical science • Transgenic animal in livestock maintenance • Transgenic plants in Nutrition improvement • Transgenic plants in high yield • Transgenic plants in disease resistance	
Unit: 5	Biosensors	03 L
	• Definition and concept of biosensors • Components of biosensors – bioreceptors (enzymes, antibodies, nucleic acids, whole cells), transducers (electrochemical, optical, piezoelectric, thermal) and signal processing systems. • Classification of biosensors – based on transducer type (amperometric, potentiometric, optical, piezoelectric, thermal) and based on bioreceptor type (enzyme biosensors, immunosensors, DNA biosensors, whole-cell biosensors). • Applications of biosensors – in medical diagnostics, environmental monitoring, food industry and agriculture.	

Suggested Reference books:	
1	Purohit and S.S. 2010 third edition Biotechnology: Fundamentals And Applications, Student edition.
2	Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India
3	Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edition. Agrobios, India.
4	Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
5	Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
6	John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi
7	Robbins S.L. (1974) Pathological basis of Disease. W B Saunders Company

8	Macleod J.: Davidson's Principles & Practice of Medicine: A textbook for students and doctors' 14th Edition. Churchill Livingstone.
9	Guyton A.C. and Hall J.E. (2006) Textbook of Medical Physiology 11th edn. Saunders
10	Hage D S and Carr J D, (2010) Analytical Chemistry & Quantitative Analysis, Prentice Hall

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	✓	✓

Course code	BIO 606	Scientific Writing	2 Credits	
Core/Elective/SBS		ELECTIVE PAPER		
Prerequisite Course		Research Methodology / Basic Computer Applications	Syllabus Version	2026-27
Course Objectives 1. To develop understanding of scientific data analysis, graphical representation and tabulation methods. 2. To introduce internet resources, databases and software tools for scientific information retrieval and citation. 3. To enhance scientific communication skills including academic writing, literature review preparation and presentations. 4. To understand structure, formatting and referencing styles used in scientific reports and research publications. 5. To train students in preparation of research reports, seminars and professional scientific presentations.				
Course Outcomes with K-Level Mapping				
CO Code	Course Outcome Statement	Bloom's Level	Description	
CO1	Describe methods of scientific data analysis, graphical presentation and tabulation techniques used in bioscience research.	K1, K2	Remembering & Understanding	
CO2	Apply internet resources, databases and computational tools for information retrieval, documentation and citation in biosciences.	K2, K3	Understanding & Applying	
CO3	Demonstrate scientific communication skills including essay writing, literature review preparation, poster design and oral presentation.	K3, K4	Applying & Analyzing	
CO4	Analyze structure, formatting and referencing styles used in research reports, scientific papers and theses.	K3, K4, K5	Applying, Analyzing & Evaluating	
CO5	Develop research reports and seminar presentations demonstrating professional scientific writing and presentation skills.	K4, K5, K6	Analyzing, Evaluating & Creating	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Unit: 1	Analysis and presentation data		04 L	
• Using graphs, presenting data in tables, Hints for solving numerical problems				
Unit: 2	The Internet and World Wide Web		08 L	
• internet resources for biosciences, using spreadsheets, word processors, databases and other packages, finding and citing information				
Unit: 3	Communicating information		08 L	
• General aspects of scientific writing, writing essays, reporting practical and project work,				

writing literature surveys and reviews, organizing a poster display, giving an oral presentation, examinations and preparation of scientific papers		
Unit: 4	Research Report	07 L
Format of the research report, style of writing the report, references and bibliography		
Unit: 5	Structure and Components of Research Report	02 L
Types of Report: research papers, thesis. Research Project Reports, Pictures and Graphs, citation styles,		
Unit: 6	Seminars and presentation skills	01 L
- Introduction to scientific seminars – purpose, types and importance in academic and research communication. - Planning a seminar – topic selection, literature survey, organizing content and time management. - Structure of a scientific presentation – title slide, introduction, objectives, methodology, results, discussion and conclusion. - Preparation of presentation materials – effective slide design, use of visuals (graphs, tables, images) and avoiding common errors. - Presentation skills – verbal and non-verbal communication, clarity, voice modulation, body language and audience engagement. - Handling questions and discussion – responding to queries, managing feedback and maintaining confidence.		

Suggested Reference books:	
1	Research Methodology. Methods and Techniques: C. R. Kothari
4	CloteP.,Backofen R. 2000 Computational Molecular Biology: An Introduction, John Wiley and Sons.

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	–	✓	✓	✓

Course code	BIO 607	Biology Lab III: Evolutionary Developmental Biology Practicals	2 Credits	
Core/Elective/SBS		CORE PRACTICAL		
Prerequisite Course		Molecular Biology	Syllabus Version	2026-27

Course Objectives

1. To understand the fundamental principles of evolutionary developmental biology through comparative studies of embryonic development in plants and animals.
2. To observe, identify, and document developmental stages using microscopy, dissections, and developmental models.
3. To apply morphometric, molecular, and bioinformatics tools to investigate developmental processes and evolutionary relationships.
4. To analyze the role of developmental genes, gene regulatory networks, heterochrony, and epigenetic mechanisms in shaping organismal diversity.
5. To develop scientific reasoning, data interpretation, and critical evaluation skills through laboratory experiments, case studies, and research-based learning.

Course Outcomes with K-Level Mapping

CO No.	Course Outcome	Bloom's Level (K-Level)
CO 1	Identify and compare embryonic developmental stages among vertebrates, plants, and model organisms to explain conserved developmental patterns.	K2 – Understand
CO 2	Perform laboratory observations, dissections, morphometric analyses, and developmental studies using appropriate experimental techniques.	K3 – Apply
CO 3	Analyze developmental patterns, homeotic mutations, heterochrony, and evolutionary changes using observational and computational approaches.	K4 – Analyze
CO 4	Interpret comparative genomic and bioinformatics data involving developmental genes (e.g., HOX, Pax-6) and relate them to evolutionary conservation and diversification.	K4 – Analyze
CO 5	Critically evaluate Evo-Devo theories, scientific literature, and experimental evidence to formulate logical scientific conclusions.	K5 – Evaluate

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Evolutionary Developmental Biology Practicals (Any 7)

S. No	Title
1	Comparative Study of Embryonic Stages Across Vertebrates
2	Frog Embryology — Live Observation of Developmental Stages
3	Chick Embryo Development — 24h, 33h, and 48h Stages

4	Plant Embryo and Seed Development — Dicot vs Monocot
5	D'Arcy Thompson Transformation Grids — Shape and Form
6	Morphometric Analysis of Leaf Shape Using ImageJ
7	Homeotic Mutants in <i>Drosophila</i> — Observation and Interpretation
8	ABC Model of Flower Development — Dissection and Mapping
9	Bioinformatics — Comparing HOX Gene Clusters Across Animals
10	Pax-6 Deep Homology — Sequence and Expression Comparison
11	Heterochrony Case Studies — Neoteny and Paedomorphosis
12	Epigenetics Demonstration — Environmental Effect on Development
13	Reading and Critique — Gould's Ontogeny and Phylogeny Chapter
14	Case Study Analysis — Distal-less and the Toolkit

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	–	✓

Course code	BIO 608	Biology Lab IV: Computational Biology Practicals	2 Credits	
Core/Elective/SBS		CORE PRACTICAL		
Prerequisite Course		Biology	Syllabus Version	2026-27
Course Objectives				
1. To understand the organization, retrieval, and management of biological information from public biological databases. 2. To develop practical skills in searching, retrieving, and interpreting biological sequence and structural data using online bioinformatics resources. 3. To apply computational tools for sequence similarity searching, multiple sequence alignment, and comparative sequence analysis. 4. To perform molecular phylogenetic analysis and interpret evolutionary relationships among biological sequences. 5. To develop competency in computational data analysis and scientific interpretation for solving biological research problems.				
Course Outcomes with K-Level Mapping				
CO No.	Course Outcome		Bloom's Level (K-Level)	
CO 1	Identify and retrieve biological information from major public databases such as PubMed, NCBI, DDBJ, EMBL, UniProt, and PDB.		K2 – Understand	
CO 2	Perform sequence retrieval and similarity searches using FASTA and BLAST for biological data analysis.		K3 – Apply	
CO 3	Conduct multiple sequence alignment using bioinformatics tools such as ClustalW, MUSCLE, and T-Coffee to compare biological sequences.		K3 – Apply	
CO 4	Analyze sequence conservation, evolutionary relationships, and construct phylogenetic trees using molecular phylogeny tools.		K4 – Analyze	
CO 5	Interpret computational biology results and apply bioinformatics approaches to support biological research and scientific decision-making.		K5 – Evaluate	
K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create				
Computational Biology Practicals				
S. No	Title			
1	Study of Publicly available biological database			
2	Study and searching of information from: 1) PubMed, 2) NCBI 3) DDBJ			

	4) EMBL 5) Uniport 6) PDB
3	Retrieval of sequences and sequence analysis by FASTA and BLAST
4	Multiple sequence analysis: Clustal W, MUSCLE, T-Coffee
5	Phylogenetic tree construction by molecular phylogeny

CO vs K-Level Coverage Matrix

CO \ K-Level	K1	K2	K3	K4	K5	K6
CO1	✓	✓	–	–	–	–
CO2	–	✓	✓	–	–	–
CO3	–	–	✓	✓	–	–
CO4	–	–	✓	✓	✓	–
CO5	–	–	✓	✓	–	✓

BIO 609 – Research Project Work – 2 Credits

The Research Project Work integrates both experimental and theoretical approaches to address a biological research problem. Students will design and perform experiments, collect and interpret biological data, and analyze the results using appropriate statistical methods, bioinformatics tools, and scientific software. Based on the findings, students will draw scientifically valid conclusions, whether positive or negative, and critically discuss their significance in the context of existing literature. The entire research work will be compiled and presented in the form of a dissertation during the VI semester, demonstrating the student's ability to conduct independent research, analyze scientific data, and communicate research outcomes effectively.

PART -1 Tamil

பொதுத்தமிழ்

அனைத்து இளங்கலை பட்டப்படிப்பு (சிறப்புத் தமிழ் அல்லாத) மாணவர்களுக்கானது
(தமிழ்நாடு மாநில உயர்கல்வி மன்றப் பாடத்திட்டம் 2022 - யை அடியொற்றியது)

Syllabus

AFFILIATED COLLEGES

Program Code: ***

2026-2027 கல்வியாண்டில்
சேர்வோர்க்கானது.



BHARATHIAR UNIVERSITY

(A State University, Accredited with "A++" Grade by NAAC,
Ranked 21st among Indian Universities by MHRD-NIRF)
Coimbatore - 641 046, Tamil Nadu, India

Instruction : PEOs are:**Program Educational Objectives (PEOs)
PART –I TAMIL program**

PEO1	இலக்கியப் பார்வை பெறுதல்.
PEO2	காலந்தோறுமான இலக்கிய வகைகளை அறிதல்.
PEO3	இலக்கியச் சுவை உணர்வுவழி மனநல மேம்பாடு பெறுதல்.
PEO4	மொழிப் பயிற்சி வழி மொழியாளுமையைப் பெறுதல்.
PEO5	சமூகக் கண்ணோட்டத்தைப் பெறுதல்
PEO6	படைப்பாளுமையை மேம்படுத்துதல்.
PEO7	வாழ்வியல் கோட்பாடுகளை உணர்தல்.
PEO8	இலக்கிய வரலாறு வழி பண்பாடுகளை அறிதல்.
PEO9	நிறை மனத்தினராதல்.
PEO10	நூல்களைத் தேர்ந்து படிக்கும் பழக்கம் பெறுதலும் போட்டித் தேர்வுகளுக்குத் திறனுடையோராதலும்.

Program Specific Outcomes (PSOs)

After the successful completion of PART-1 program, the students are expected to

PSO1	இலக்கியம் இன்னதென்பதை அறிதல். .
PSO2	இலக்கிய வடிவங்களை அறிதல்
PSO3	மொழிப் பயன்பாட்டு அறிவு பெறுதல்.
PSO4	நிகழ் சமூகச் சிந்தனை அறிவு பெறுதல்.
PSO5	படைப்பாளர்களாய் உருவாதல்.
PSO6	வாழ்வியல் மதிப்புகளைப் பெறுதல்
PSO7	பாரம்பரிய பண்பாட்டு உணர்வடைதலும் ,அறிவியல் வழி அற உணர்வடைதலும்.
PSO8	மனநல மேம்பாட்டுடன் மிளிர்ந்தல்
PSO9	நிறைவாழ்வு நடாத்துதல்.
PSO10	நூலின்பம் பெறுதலும்.பணிவாய்ப்பிற்கான தகுதி பெறுதலும்.

Program Outcomes (Pos)**On successful completion of the PART-I Tamil Program**

PO1	பாடப்பகுதியிலக்கியங்கள் வழி மானுட மதிப்புகளைப் பெறுதல்.
PO2	சமூகத்தின் பாற்பட்ட நல்லுணர்வு பெறுதல்.
PO3	மொழியாளுமைத் திறன் உடையோராதல்.
PO4	படைப்பாக்கத் திறன் பெற்றோராதல்.
PO5	இலக்கிய வரலாறு வழி போட்டித் தேர்வுகளை எதிர் கொள்ளும் திறன் பெறுதல்.



BHARATHIAR UNIVERSITY: COIMBATORE 641 046**PART- 1 TAMIL CURRICULUM OTHER THEN TAMIL MAJOR (AFFILIATED COLLEGES)****FOLLOWED BY TANSCHS SYLLABUS- AUGUST-2022****(For the students admitted during the academic year 2026-2027 onwards)**

SEMESTER	SUBJECT CODE	TITLE OF THE PAPER	INSTRUC TION HOURS	DURATI ON THE HOURS (EXAM)	MAXIMUM MARKS			CREDIT
					CIA	ESE	TOTAL	
I	11T	PART1 – TAMIL PAPER1I (Poetry, Short Story, Grammar, Translation and Communicative Skills, History of Tamil Literature)	6	3	50	50	100	4
II	21T	PART1 – TAMIL PAPER1I (Poetry, Prose, Grammar, Communicative Skills, History of Tamil Literature)	6	3	50	50	100	4
III	31T	PART1 – TAMIL PAPER1III (Poetry, Novel, Communicative Skills, History of Tamil Literature)	6	3	50	50	100	4
IV	41T	PART1 – TAMIL PAPER1IV (Poetry, Drama, Communicative Skills, History of Tamil Literature)	6	3	50	50	100	4

தாள்-1

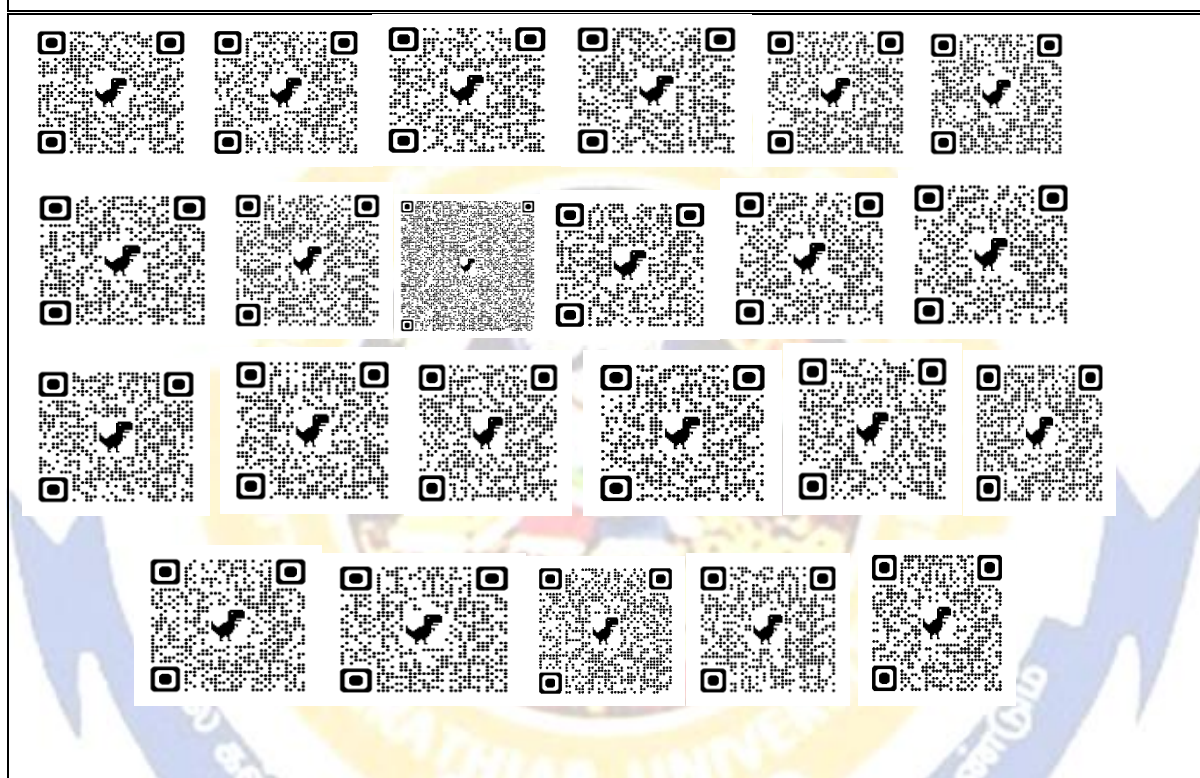
COURSE CODE	COURSE NAME	CATEGORY	L	T	P	S	INSTRUCTION HOURS	CREDITS	MARKS		
									CIA	EXTERNAL	TOTAL
11T	PART-1 TAMIL PAPER-1		Y	-	-	-	6	4	50	50	100
CORE/ELECTIVE/SUPPORTIVE			SUPPORTIVE								
PRE-REQUISITE		பன்னிரெண்டாம் வகுப்பில் தமிழை ஒரு பாடமாகப் பயின்றிருக்க வேண்டும்.									
LEARNING OBJECTIVES											
THE MAIN OBJECTIVES OF THIS COURSE ARE TO :											
- முதலாமாண்டுப் பட்ட வகுப்பு மாணவர்களுக்குத் தமிழ்மொழி இலக்கியங்களை அறிமுகம் செய்தல். - தற்கால இலக்கியப் போக்குகளையும் இலக்கண வளங்களையும் மாணவர் அறியுமாறு செய்து அவர்களின் படைப்பாற்றலைத் தூண்டுதல். - தமிழ் இலக்கியம் சார்ந்த போட்டித்தேர்வுகளுக்கு ஏற்ப கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்.											
EXPECTED COURSE OUTCOMES											
ON THE SUCCESSFUL COMPLETION OF THE COURSE, STUDENTS WILL BE ABLE TO											
இப்பாடத்தைக் கற்பதால் பின்வரும் பயன்களை மாணவர் அடைவர்.											
CO 1	பாரதியார் காலந்தொட்டு தற்காலப் புதுக்கவிதைகள் வரை கவிதை இலக்கியம் அறிமுகப்படுத்தப்படுவதால் படைப்பாற்றல் திறன்பெறுதலும்,சமூக சிந்தனை உணர்வு பெறுதலும் அடைவர்.								K1,K2		
CO 2	புதுக்கவிதை வரலாற்றினை அறிந்து கொள்வர்.								K2		
CO 3	சிறுகதை இலக்கியவகையினைக் கற்பதன் மூலம் படைப்பாக்கத் திறனைப் பெறுவர்.								K3,K6		
CO 4	மொழியறிவோடு சிந்தனைத்திறன் அதிகரித்தல்.								K3,K5		
CO 5	தமிழ்மொழியைப் பிழையின்றி எழுதவும், புதிய கலைச்சொற்களை உருவாக்கவும் அறிந்து கொள்ளுதல்.								K2,K6		
K1 - REMEMBER; K2 - UNDERSTAND; K3 - APPLY; K4 - ANALYZE; K5 - EVALUATE; K6 – CREATE											

	மரபுக்கவிதை	
UNIT-I	1.பாவலரேறு பெருஞ்சித்திரனார்- தமிழ்த்தாய் வாழ்த்து!	18 CONTACT HOURS
	2.பாரதியார் – நாட்டு வணக்கம்	
	3.பாரதிதாசன் – நூலைப்படி	
	4.கவிமணி – புத்தரும் சிறுவனும்	
	5.பட்டுக்கோட்டை கல்யாணசுந்தரம்- விடுதலை	
	6.தமிழ்ஒளி- நெய்வேலி நாம் பெற்ற பேறு	
	7.உடுமலை நாராயணகவி- எதனாலே ?	
	8.மு.இளங்கோவன்- இணையத்தால் விளையும் பயன்கள் (இணைய ஆற்றுப்படை)	
	புதுக்கவிதை	
UNIT-II	1.அப்துல்ரகுமான் – ஒப்பிலாத சமுதாயம்	18 CONTACT HOURS
	2.ஈரோடுதமிழன்பன்- நகைத்துளிப்பா(சென்ரியூ) இயைபுத் துளிப்பா (லிமரைக்கூ)	
	3.சிற்பி பாலசுப்பிரமணியம் - டோடோ பறவை	
	4. புவியரசு - தந்தை மகற்காற்றும் உதவி	
	5.ஞானக்கூத்தன்- கீழ்வெண்மணி	
	6. ஆழியாள்- கொப்பித்தாளில் கிடந்த (பான் கீ மூனுக்கு விளங்காத) குறிப்பு யாருடையது?	
	7.வைரமுத்து – மழைக்காலப் பூக்கள்	
	8.கவிஞர் முஹத் வெம்பாயம்- அன்றங்கே ஒரு நாடிருந்ததே... (மொழிபெயர்ப்புக்கவிதை)	
	சிறுகதைகள்	
UNIT-III	1.சங்கு தேவனின் தர்மம் – புதுமைப்பித்தன்	18 CONTACT HOURS
	2.முள்முடி – தி.ஜானகிராமன்	
	3.காகிதஉறவு – சு.சமுத்திரம்	
	4.அது – உமாமகேஸ்வரி	
	5.வீட்டின் மூலையில் ஒரு சமையல் அறை – அம்பை	
	6.மாப்பளே இரயிலுப் பாக்கப் போலாமா... ? - பட்சி	

	(கொங்கு வட்டாரச் சிறுகதை)	
	7.ஒரு ஸ்கூல் கோயிலாகிறது-மாத்தளை சோமு	
	8.நூலகத்தில் ஒரு தளபதி-இடாலோ கால்வினா	
	(மொழிபெயர்ப்புக்கதை, தமிழில்- மாதவன்)	
	சிறுகதைக் கொத்து வெளியீடு அறிவுப் பதிப்பகம்(பி)லிட் சென்னை-14	
UNIT-IV	பாடம் சார்ந்த இலக்கிய வரலாறு	18 CONTACT HOURS
	1.இருபதாம் நூற்றாண்டு மரபுக்கவிதைகள்	
	2.புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும்	
	3.சிறுகதையின் தோற்றமும் வளர்ச்சியும்.;	
UNIT-V	இலக்கணம் /மொழித்திறன்	18 CONTACT HOURS
	• பொருள் பொதிந்த சொற்றொடர் அமைத்தல்	
	• ஓர் எழுத்து ஒரு மொழி	
	• வேற்றுமை உருபுகள்	
	• திணை, பால், எண், இடம்	
	2.மொழி பெயர்ப்பு-ஆங்கிலத்திலிருந்து தமிழ் அ.பொது நிலை ஆ.அலுவலக நிலை	
	TOTAL LECTURE HOURS	90
	REFERENCE BOOKS	
	தமிழ் இலக்கிய வரலாறு – சி.பாலசுப்பிரமணியன்	
	புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு-தமிழண்ணல்	
	வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு- எஃப்.பாக்கியமேரி	

WEB SOURCES
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• Project Madurai - www.projectmadurai.org.
• Chennai Library- www.chennailibrary.com .<http://www.chennailibrary.com>.

• Tamil Universal Digital Library- www.ulib.prg <http://www.ulib.prg>.
• Tamil E-Books Downloads- tamilebooksdownloads. blogspot.com
• Tamil Books on line- books.tamil cube.com
• Catalogue of the Tamil books in the Library of British Congress archive.org
• Tamil novels on line - books.tamilcube.com



Mapping with Programme Outcomes

COs	Po1	Po2	Po3	Po4	Po5
Co1	S	S	S	S	M
Co2	M	S	S	S	S
Co3	S	S	S	S	M
Co4	S	S	S	S	S
Co5	M	M	S	S	S

S-Strong; M-Medium; L-Low

தாள்-2

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	S	INSTRUCTION HOURS	CREDITS	MARKS		
									CIA	EXTERNAL	TOTAL
21T	PART-1 TAMIL PAPER-11		Y	-	-	-	6	4	50	50	100
CORE/ELECTIVE/SUPPORTIVE			SUPPORTIVE								
PRE-REQUISITE		பன்னிரெண்டாம் வகுப்பில் தமிழை ஒரு பாடமாகப் பயின்றிருக்க வேண்டும்.									
LEARNING OBJECTIVES											
THE MAIN OBJECTIVES OF THIS COURSE ARE TO :											
- வாழ்வியல் அறஉணர்வை மேம்படுத்துதல். - சமய இலக்கியங்களையும் சிற்றிலக்கியங்களையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல். - மொழித்திறனையும்,உரைநடை இலக்கிய வடிவம் வழியாக சமூகம் சார் சிந்தனை உணர்வையும் பெறுவர்.											
EXPECTED COURSE OUTCOMES											
ON THE SUCCESSFUL COMPLETION OF THE COURSE, STUDENTS WILL BE ABLE TO											
இப்பாடத்தைக் கற்பதால் பின்வரும் பயன்களை மாணவர் அடைவர்.											
CO 1	அற உணர்வின் பாற்பட்டு தமது வாழ்வை நடத்தும் திறம் பெறுவர்.								K2,K3		
CO 2	சிற்றிலக்கியங்களின் வழி இலக்கியச் சுவையினையும் பண்பாட்டு அறிவினையும் பெறுவர். பக்தி இலக்கியம் வழி பக்குவ மனப்பாங்கும், சித்தர் இலக்கியவழி சிந்தனைத் தெளிவும் பெறுவர்.								K1,K2,		
CO 3	உரைநடை இலக்கியங்கள் வழி சமூக உணர்வு, வாழ்வியல் அற விழிப்புணர்வு மற்றும் மொழியறிவுக் கருத்துக்களைப் பெறுவர்.								K2,k4		
CO 4	தமிழ்ச் சமூகப்பண்பாட்டு வரலாற்றினை இலக்கியங்கள் வாயிலாக அறிவர்.								K5.k4		
CO 5	போட்டித் தேர்வுகளில் வெற்றி பெறுவதற்கு ஏற்ப தமிழ்ப் பாடத்தினைப் பயன் கொள்ளும் வகையில் பயிற்சி பெறுவர்.விண்ணப்பங்கள் எழுதும் திறன் பெறுவர்.								K5,k6		
K1 - REMEMBER; K2 - UNDERSTAND; K3 - APPLY; K4 - ANALYZE; K5 - EVALUATE; K6 – CREATE											

	அற இலக்கியம்- பக்தி இலக்கியம்	
UNIT-I	1.திருக்குறள் – வான் சிறப்பு	18 CONTACT HOURS
	2.நாலடியார் - மெய்ம்மை	
	3.தேவாரம்- சுந்தரர்-திருத்தொண்டத்தொகை	
	4. பராபரக்கண்ணி- குணங்குடி மஸ்தான் சாகிபு பாடல்கள் 20 கண்ணிகள்	
	5. பிள்ளைச் சிறு விண்ணப்பம்- வள்ளலார் 1-5பாடல்கள்	
	சிறுநிலக்கியம்- சித்தர்பாடல்கள்- வித்தாரச் செய்யுட்கள்	
UNIT-II	1.திருக்குற்றாலக் குறவஞ்சி – குறத்தி மலைவளம் கூறுதல்.	18 CONTACT HOURS
	2.முக்கூடற்பள்ளு –பள்ளியர் ஏசல்	
	3.திருமந்திரம் – அன்புடைமை- (முதல் 5 பாடல்கள்).	
	4.சித்தர் பாடல்கள்-சிவவாக்கியம்-(3-7 ஐந்துபாடல்கள்)	
	5.வித்தாரச் செய்யுட்கள்- காளமேகப் புலவர் 1.ககர வருக்கப் பாட்டு 2.தகர வருக்கப் பாட்டு 3.தாதி தூதோ தீது	
	உரைநடை	
UNIT-III	1.தமிழ்நாடு-திரு.வி.க.	18 CONTACT HOURS
	2.வீரக்கல்-ரா.பி .சேதுப்பிள்ளை.	
	3.எளிமை ஓர் அறம் - மு.வ.	
	4.தமிழில் அறிவியல் - மணவை முஸ்தபா	
	5.தமிழ் கற்றல் கற்பித்தல்:சமுதாய மொழியியல் நோக்கில் --டாக்டர் கி.கருணாகரன்.	
	6. குழந்தைகளும் இலக்கியமும் - டாக்டர் - பூவண்ணன்	
	7. ஓதுவது ஒழியேல் - முனைவர் - சி.பாலசுப்ரமணியன்	
	8.தமிழ் வளர்ச்சியில் வலைப்பூக்கள்-வலைப் பதிவு - துரைமணிகண்டன்	
	உரைநடைத் திரட்டு வெளியீடு:தாமரை பப்ளிகேஷன்ஸ் சென்னை-50	

UNIT -IV	பாடம் சார்ந்த இலக்கிய வரலாறு	18 CONTACT HOURS
	1.பதினெண்கீழ்க்கணக்கு நூல்கள்.	
	2.பக்தி இலக்கியத்தின் தோற்றமும் வளர்ச்சியும்.	
	3.சிறுநிலக்கிய வகைகள்.	
	4.உரைநடையின் தோற்றமும் வளர்ச்சியும்.	
UNIT- V	இலக்கணம் /மொழித்திறன்	18 CONTACT HOURS
	இலக்கணம்/மொழித்திறன்/போட்டித்தேர்வுத்திறன் 1. தொடர்வகைகள் – (தொகைநிலை , தொகாநிலை) 2. மரபுத்தொடர், பழமொழிகள். 3. பிறமொழிச்சொற்களைக் களைதல். 4. வழச்சொற்களை நீக்குதல். 5.இலக்கணக்குறிப்பு அறிதல். 6.மடல்கள்,விண்ணப்பங்கள் எழுதுதல் - பயிற்சி.	
	TOTAL LECTURE HOURS	90
	REFERENCE BOOKS	
	தமிழ் இலக்கிய வரலாறு – சி.பாலசுப்பிரமணியன்	
	புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு-தமிழண்ணல்	
	வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு- எஃப்.பாக்கியமேரி	
	WEB SOURCES	
	• Tamil virtual University Library- www.tamilvu.org/	
	• Project Madurai - www.projectmadurai.org.	
	• Chennai Library- www.chennailibrary.com < http://www.chennailibrary.com >.	
	• Tamil Universal Digital Library- www.ulib.prg < http://www.ulib.prg >.	
	• Tamil E-Books Downloads- tamilebooksdownloads. blogspot.com	
	• Tamil Books on line- books.tamil cube.com	
	• Catalogue of the Tamil books in the Library of British Congress archive.org Tamil novels on line - books.tamilcube.com	

Mapping with Programme Outcome

COs	Po1	Po2	Po3	Po4	Po5
Co1	S	S	S	M	S
Co2	S	S	S	M	S
Co3	S	S	S	S	S
Co4	M	S	S	S	S
Co5	M	S	S	S	S

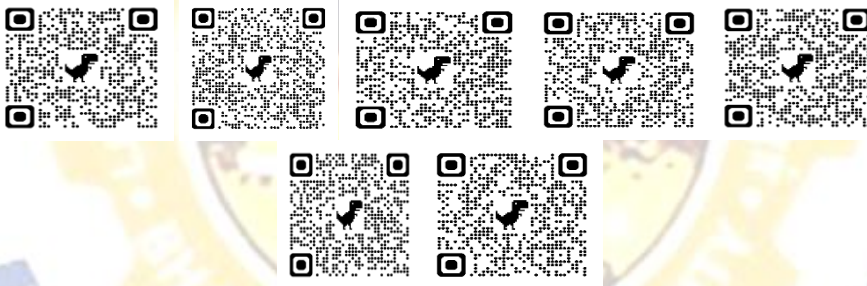
S-Strong; M-Medium; L-Low



தாள்-3

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	S	INSTRUCTION HOURS	CREDITS	MARKS		
									CIA	EXTERNAL	TOTAL
31T	PART-1 TAMIL PAPER-111		Y	-	-	-	6	4	50	50	100
CORE/ELECTIVE/SUPPORTIVE			SUPPORTIVE								
PRE-REQUISITE		பன்னிரெண்டாம் வகுப்பில் தமிழை ஒரு பாடமாகப் பயின்றிருக்க வேண்டும்.									
LEARNING OBJECTIVES											
THE MAIN OBJECTIVES OF THIS COURSE ARE TO :											
- இரண்டாமாண்டுப் பட்ட வகுப்பு மாணவர்களுக்குத் தமிழ்மொழி இலக்கியங்களை அறிமுகம் செய்தல்.இலக்கியங்களின்சிறப்பினைஉணர்த்துதல். - காலந்தோறும் எழுந்த காப்பியங்களின் போக்கையும், புதினத்தின் இலக்கிய வடிவத்தையும்,அறிவியல் வாயிலாக அறவியலை உணர்த்துதல். யாப்பு, அணி போன்ற இலக்கியவகைகளையும் மாணவர்கள் உணருமாறு செய்தல். - தமிழ் இலக்கியம் சார்ந்த போட்டித்தேர்வுகளுக்கு ஏற்ப கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்.											
EXPECTED COURSE OUTCOMES											
ON THE SUCCESSFUL COMPLETION OF THE COURSE, STUDENTS WILL BE ABLE TO											
இப்பாடத்தைக் கற்பதால் பின்வரும் பயன்களை மாணவர் அடைவர்.											
CO 1	காப்பியங்கள் அறிமுகப்படுத்தப்படுவதால் தமிழ்மொழியின் உயர்வையும் சிறப்பையும் உணர்தல்.								K1,K2		
CO 2	சமயக் காப்பியங்களின் வழி சமூக நல்லுணர்வுச் சிந்தனையைப் பெறுவர்.								K2,K4		
CO 3	தமிழ்ப் புதினங்களின் சமகாலப்படைப்புகள் காட்டும் அறிவியல் வழி அற வாழ்வியலை அறிந்து கொள்வர்.								K3,K6		
CO 4	நாவல் இலக்கியம், அறிவியல் வாயிலாக அறவியலை உணர்த்துதல் அறிமுகப்படுத்தப்படுவதால் புதுமை காணும் சிந்தனைஆற்றல், படைப்பாற்றல்,கற்பனைத்திறன் வளர்தல்.								K3,K5		
CO 5	யாப்பு, அணிஇலக்கணங்கள், கட்டுரை எழுதுதல் ஆகியவற்றைக் கற்பதன் மூலம் போட்டித்தேர்வுகளை எதிர் கொள்ளும் திறன் பெறுவர்.								K2,K6		
K1 - REMEMBER; K2 - UNDERSTAND; K3 - APPLY; K4 - ANALYZE; K5 - EVALUATE; K6 - CREATE											

	பெருங்காப்பியங்கள்	
UNIT-I	சிலப்பதிகாரம்- வரந்தரு காதை--இளங்கோவடிகள்	18 CONTACT HOURS
	மணிமேகலை -சிறைக் கோட்டம் அறக் கோட்டமாக்கிய காதை - சீத்தலைச்சாத்தனார்	
	சீவகசிந்தாமணி - நாமகள்இலம்பகம்- (பாடல் எண் 30- 70)திருத்தக்கதேவர்	
	சமய இலக்கியங்கள்	
UNIT-II	பெரியபுராணம்-திருநீலகண்டநாயனார்புராணம்- சேக்கிழார்	18 CONTACT HOURS
	கம்பராமாயணம் -கங்கைப் படலம் (1-27)-கம்பர்	
	தேம்பாவணி - மீட்சிப் படலம்-வீரமாமுனிவர் (பாடல் எண் 1-25)	
Unit -III	புதினம்	18 CONTACT HOURS
	கண்மணி சோபியா கவிஞர் புவியரசு நந்தினி பதிப்பகம்	
	பாடம் சார்ந்த இலக்கிய வரலாறு	
UNIT-IV	1.ஐம்பெருங்காப்பியங்கள்	18 CONTACT HOURS
	2.ஐஞ்சிறுங்காப்பியங்கள்	
	3.புதினத்தின்தோற்றமும்வளர்ச்சியும்	
UNIT-V	இலக்கணம் /மொழித்திறன்	18 CONTACT HOURS
	1.பாவகைகள் - வெண்பா, ஆசிரியப்பா	
	2.அணிகள் - உவமை, உருவகம்	
	3.கட்டுரை எழுதுதல் அ.இலக்கியக் கட்டுரைகள் ஆ.அறிவியல் கட்டுரைகள்	
	TOTAL LECTURE HOURS	90
	REFERENCE BOOKS	
	தமிழ் இலக்கிய வரலாறு - சி.பாலசுப்பிரமணியன்	
	புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு-தமிழண்ணல்	
	வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு- எஃப்.பாக்கியமேரி	

WEB SOURCES
• Tamil virtual University Library- www.tamilvu.org/
• Project Madurai - www.projectmadurai.org.
• Chennai Library- www.chennailibrary.com < http://www.chennailibrary.com >.
• Tamil Universal Digital Library- www.ulib.prg < http://www.ulib.prg >.
• Tamil E-Books Downloads- tamilebooksdownloads. blogspot.com
• Tamil Books on line- books.tamil cube.com
• Catalogue of the Tamil books in the Library of British Congress archive.org
• Tamil novels on line - books.tamilcube.com


Mapping with Programme Outcomes

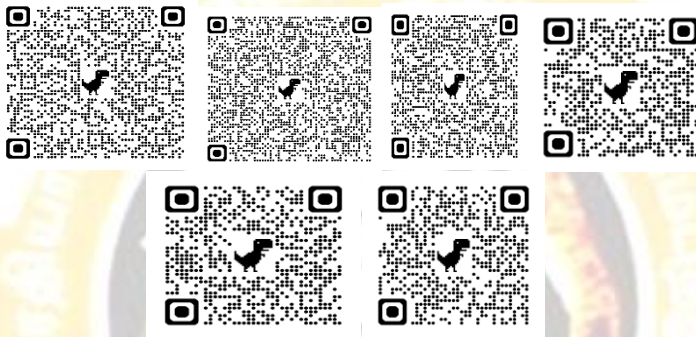
COs	Po1	Po2	Po3	Po4	Po5
Co1	S	S	S	M	S
Co2	S	S	S	M	S
Co3	S	S	S	S	S
Co4	M	S	S	S	S
Co5	M	S	S	S	S

S-Strong; M-Medium; L-Low

தாள்-4

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	S	INSTRUCTION HOURS	CREDITS	MARKS		
									CIA	EXTERNAL	TOTAL
41 T	PART-1 TAMIL PAPER-1V		Y	-	-	-	6	4	50	50	100
CORE/ELECTIVE/SUPPORTIVE			SUPPORTIVE								
PRE-REQUISITE		பன்னிரெண்டாம் வகுப்பில் தமிழை ஒரு பாடமாகப் பயின்றிருக்க வேண்டும்.									
LEARNING OBJECTIVES											
THE MAIN OBJECTIVES OF THIS COURSE ARE TO :											
- செவ்வியல் இலக்கியமாம் சங்க இலக்கியங்களின் சிறப்பினை உணர்த்துதல். - சங்க இலக்கியத்தின் சிறப்பையும், நாடகம் என்னும் இலக்கியவகையின் தன்மையையும் அகத்தினை, புறத்தினை இலக்கணங்களையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல். - தமிழ்இலக்கியம் சார்ந்த போட்டித்தேர்வுகளுக்கு ஏற்ப கற்பித்தல் நடைமுறைகளை மேற்கொள்ளுதல்.											
EXPECTED COURSE OUTCOMES											
ON THE SUCCESSFUL COMPLETION OF THE COURSE, STUDENTS WILL BE ABLE TO											
இப்பாடத்தைக் கற்பதால் பின்வரும் பயன்களை மாணவர் அடைவர்.											
CO 1	சங்க இலக்கியத்தில் காணப்பெறும் வாழ்வியல் சிந்தனைகளை அறிந்து கொள்வர்.								k2,K3		
CO 2	தமிழின் தொன்மையையும், செம்மொழித் தகுதியையும் அறிந்து கொள்ளுதல்.								K1,K2,		
CO 3	நாடக இலக்கியம் மூலம் நடிப்பாற்றலையும், கலைத் தன்மையையும், படைப்பாற்றலையும் வளர்த்தல்.								K2,k4		
CO 4	மானுட விழுமியங்களை உணர்த்துதல்.								K5.k4		
CO 5	மொழியறிவோடு வேலை வாய்ப்பினைப் பெறுதல்.								K5,k6		
K1 - REMEMBER; K2 - UNDERSTAND; K3 - APPLY; K4 - ANALYZE; K5 - EVALUATE; K6 - CREATE											

	எட்டுத்தொகை	
UNIT-I	நற்றிணை (பாடல்எண் :9, 14, 18)	18 CONTACT HOURS
	குறுந்தொகை (பாடல்எண் :16, 17, 19, 20, 25, 29, 38, 341)	
	கலித்தொகை (பாடல்எண் :38, 51)	
	அகநானூறு(பாடல்எண்(14, 33, 55)	
	புறநானூறு (பாடல்எண் : (37, 86, 112,)	
	பரிபாடல் - செவ்வேள் (5)	
UNIT-II	பத்துப்பாட்டு	18 CONTACT HOURS
	நெடுநல்வாடை-நக்கீரர் (முழுமையும்)	
	நாடகம்	
UNIT-III	ஆதி அத்தி ஆசிரியர்-ம.ப.பெரியசாமித் தூரன் (வரலாற்று நாடகம்)	18 CONTACT HOURS
	வெளியீடு: நியூசெஞ்சரிபுக்ஹவுஸ் (பி) லிட், சென்னை-50	
UNIT-IV	பாடம் சார்ந்த இலக்கிய வரலாறு	18 CONTACT HOURS
	1.எட்டுத்தொகைநூல்கள்	
	2.பத்துப்பாட்டுநூல்கள்	
	3.நாடகத்தின்தோற்றமும்வளர்ச்சியும்	
	இலக்கணம் /மொழித்திறன்	
UNIT-V	1. அகப்பொருள் (திணைகள்மட்டும்)	18 CONTACT HOURS
	2.புறப்பொருள் (திணைகள்மட்டும்)	
	3.படைப்பாக்கப் பயிற்சி (கவிதை,சிறுகதை)	
	TOTAL LECTURE HOURS	90
	REFERENCE BOOKS	
	தமிழ் இலக்கிய வரலாறு – சி.பாலசுப்பிரமணியன்	
	புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு-தமிழண்ணல்	
	வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு- எஃப்.பாக்கியமேரி	
WEB SOURCES		
• Tamil virtual University Library- www.tamilvu.org/		
• Project Madurai - www.projectmadurai.org.		

• Chennai Library- www.chennaiLibrary.com <http://www.chennaiLibrary.com>.
• Tamil Universal Digital Library- www.ulib.prg <http://www.ulib.prg>.
• Tamil E-Books Downloads- tamilebooksdownloads. blogspot.com
• Tamil Books on line- books.tamil cube.com
• Catalogue of the Tamil books in the Library of British Congress archive.org •
• Tamil novels on line - books.tamilcube.com


Mapping with Programme Outcomes

COs	Po1	Po2	Po3	Po4	Po5
Co1	S	S	S	S	M
Co2	M	S	S	S	S
Co3	S	S	S	S	M
Co4	S	S	S	S	S
Co5	M	M	S	S	S

S-Strong; M-Medium; L-Low

BHARATHIAR UNIVERSITY:: COIMBATORE-641 02
BOARD OF STUDIES IN TAMIL (UG) - PART-1 TAMIL
2026-2028

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BHARATHIAR UNIVERSITY, COIMBATORE – 641046. BOARD OF STUDIES PART II ENGLISH – MAY 2025

NAME OF THE BOARD: PART – II - ENGLISH

Part II English 2025-26 onwards - Affiliated Colleges - Annexure No.5 SCAA DATED: 09.07.2025

Program Educational Objectives (PEOs)	
The Part II English program will enable the students to	
PEO1	To develop the language skills of students by offering adequate practice in professional contexts
PEO2	Enhance the lexical, grammatical, socio-linguistic and communicative competence of students
PEO3	Develop strategic competence that will help to efficient communication
PEO4	Provide the most pedagogical inputs for the students
PEO5	Instill a comprehensive understanding through the study of various analytical skills and advances the level of writing.
PEO6	Inculcate effective use of English in creative expression and day to day life
PEO7	Enhance the ability to think and write critically and clearly.
PEO8	Prepare the students to use English proficiency in everyday life and to lay foundation for compete in respective careers.



Part II English 2025-26 onwards - Affiliated Colleges - Annexure No.5 SCAA DATED: 09.07.2025

Program Specific Outcomes (PSOs)	
After the successful completion of Part II English program, the students are expected	
PSO1	To create a life-long interest to improve their language and communicative skills
PSO2	To develop the language skills through LSRW
PSO3	To improve the effectiveness in day to day communication
PSO4	To analyse various oral and written communication and proper responses
PSO5	To present their ideas in a suitable way for the given situation
PSO6	To assess and improve their communicative competency
PSO7	To apply knowledge in analyzing the text and context
PSO8	To prove their knowledge and skills in language proficiency
PSO9	To imbibe self-confidence through their language proficiency
PSO10	To enhance their communicative skills in their career



Part II English 2025-26 onwards - Affiliated Colleges - Annexure No.5 SCAA DATED: 09.07.2025

Program Out comes (POs)	
On successful completion of the Part II English programme, students will be able to	
PO1	Prove their knowledge and skills in Language proficiency
PO2	Prove his proficiency in Listening Speaking Reading Writing.
PO3	Apply the knowledge in analyzing the text.
PO4	Develop good communicative skills
PO5	Demonstrate the competency in the domain area
PO6	Assess the communicative ideas
PO7	Establish a communicative competence in personal and social circumstances
PO8	Imbibe better understanding in various texts
PO9	Express thoughts, ideas and feelings appropriately in formal and informal communication
PO10	Evaluate every text and improve knowledge in various fields.



Part II English 2025-26 onwards - Affiliated Colleges - Annexure No.5 SCAA DATED: 09.07.2025

PART-II ENGLISH
Scheme of Examination (CBCS & OBE Pattern)
(Applicable to the students admitted from 2025- 2026 onwards)

Semester	Subject code	Title of the paper	Instruction	Duration of Exam (Hrs)	Max Marks			Credit
	Question paper cod		hours / cycle		CIA	ESE	TOTAL	
I	12 E	ENGLISH Paper - I	6	3	50	50	100	4
II	22E	ENGLISH Paper -II	4 + 2	3	50	50	100	4
III	33 E	ENGLISH Paper - III	6	3	50	50	100	4
IV	43E	ENGLISH Paper - IV	6	3	50	50	100	4

QUESTION PAPER PATTERN FOR THE STUDENTS ADMITTED FROM 2025-26 ONWARDS

Maximum - 75 marks			
SECTION A	Multiple choice questions with four options	10 x 1 = 10	10 Questions - 2 from each unit
SECTION A	Short answer questions of either / or type	5x5= 25	5 Questions - 1 from each unit
SECTION A	Essay-type questions of either /or type	5x8=40	5 Questions - 1 from each unit



Part II English 2025-26 onwards - Affiliated Colleges - Annexure No.5 SCAA DATED: 09.07.2025

BHARATHIAR UNIVERSITY, COIMBATORE – 641046.

BOARD OF STUDIES Part II English– MAY 2025

NAME OF THE BOARD: Part –II ENGLISH

DATE: 09.07.2025

FIRST YEAR - SEMESTER ENGLISH- I

Course code	12E	PART II - ENGLISH - I	L	T	P	C
PART II ENGLISH			4	0	0	4
Pre-requisite	Basic knowledge of English language		Syllabus Version		2025- 2026	
Course Objectives:						
The main objective of this course is to:						
1. Enable the students to communicate effectively and appropriate in day-to day conversations.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	To understand basic language skills through listening and reading				K1	
2	To understand basic English grammar and use effectively				K2, K3	
3	To enhance word power to speak and write effectively				K3	
4	To improve flawless writing and speaking in day-to-day situations				K4	
5	To communicate effectively				K5	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	SELF-AWARENESS(WHO)&POSITIVE THINKING(UNICEF) Life Story Chapter 1 from Malala Yousafzai, I am Malala An Autobiography or The Story of My Experiments with Truth (Chapters 1, 2 & 3) M.K.Gandhi Poem Where the Mind is Without Fear – Gitanjali 35 –	20

	Rabindranath Tagore	
	Love Cycle – Chinua Achebe	
II	EMPATHY Poem Nine Gold Medals – David Roth Alice Fell or poverty – William Wordsworth Short Story The School for Sympathy – E.V. Lucas Barn Burning – William Faulkner	20
III	CRITICAL & CREATIVE THINKING Poem The Things That Haven't Been Done Before –Edgar Guest Stopping by Woods on a Snowy Evening –Robert Frost Readers Theatre The Magic Brocade – A Tale of China Stories on Stage – Aaron Shepard (Three Sideway Stories from Wayside School” by Louis Sachar)	20
IV	Part of Speech Articles Noun Pronoun Verb Adverb Adjective Preposition	15
V	Paragraph and Essay Writing Descriptive Expository Persuasive Narrative Reading Comprehension	15

Total Number of Hours: 90 Hours

Book Prescribed: IMPACT – 1 - GENERAL ENGLISH – 1 (SEMESTER - I)

Publisher Name: Cambridge University Press and Assessment, New Delhi. Year of Publication 2024.

Course Outcomes		
Course Outcomes	On completion of this course, students will:	
CO1	Acquire self-awareness and positive thinking required in various life situations	PO1, PO7
CO2	Acquire the attribute of empathy.	PO1, PO2, PO10
CO3	Acquire creative and critical thinking abilities.	PO4, PO6, PO9
CO4	Learn basic grammar	PO4, PO5, PO6

CO5	Development and integrate the use of four language skills i.e., listening, speaking, reading and writing.	PO3, PO8
Text books for Reference (Latest Editions)		
1.	MalalaYousafzai. I am Malala, Little, Brown and Company, 2013.	
2.	M.K. Gandhi. An Autobiography or The Story of My Experiments with Truth (Chapter – I), Rupa Publications, 2011.	
3.	Rabindranath Tagore. "Gitanjali 35" from Gitanjali (Song Offerings): A Collection of Prose Translations Made by the Author from the Original Bengali. MacMillan, 1913.	
4.	N.Krishnasamy. Modern English: A Book of Grammar, Usage and Composition Macmillan, 1975.	
5.	Aaron Shepard. Stories on Stage, ShepardPublications, 2017.	
6.	J.C. Nesfield. English Grammar Composition and Usage, Macmillan, 2019.	

Web Resources	
1	MalalaYousafzai. I am Malala (Chapter 1) https://archive.org/details/i-am-malala
2	M.K Gandhi. An Autobiography or The Story of My Experiments with Truth(Chapter-1)- Rupa Publication, 2011 https://www.indiastudychannel.com/resources/146521-Book-Review-An-Autobiography-or-The-story-of-my-experiments-with-Truth.aspx
3	Rabindranath Tagore. "Gitanjali 35" from Gitanjali (Song Offerings) https://www.poetryfoundation.org/poems/45668/gita njali-35
4	Aaron Shepard.Stories on Stage, Shepard Publications, 2017 https://amzn.eu/d/9rVzlNv
5	J C Nesfield. Manual of English Grammar and Composition. https://archive.org/details/in.ernet.dli.2015.44179

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	M	M	L	L	M	S	M
CO2	L	S	S	S	M	M	M	M	L	M
CO3	M	S	S	M	S	S	M	L	M	M
CO4	M	M	S	S	S	S	S	L	M	S
CO5	S	S	M	S	S	S	S	L	S	M

* S - Strong; M - Medium; L - Low

Part II English 2025-26 onwards - Affiliated Colleges - Annexure No.5 SCAA DATED: 09.07.2025

FIRST YEAR – SEMESTER – II - ENGLISH- II

Course code	22E	PART II - ENGLISH - II	L	T	P	C
PART II - ENGLISH II			4	0	0	4
Pre-requisite	BASIC INTELLIGENCE ON WRITING		Syllabus Version		2025-2026	
Course Objectives:						
The main objective of this course is to:						
1.To train the students to develop the communication skills and inculcate language skills.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand basic grammar and enrich word power and language skill Enhance the writing skill of the students to write flawlessly Write paragraphs, emails, letters, opinion pieces and dramatic scripts Enhance understanding various formal and in formal, written and oral communications and respond to them Generate the own writing.				K1, K2	
2					K3	
3					K4	
4					K5	
5					K6	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						

FIRST YEAR - SEMESTER II - English-II

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	RESILIENCE	20
	Poem	
	Don't Quit – Edgar A. Guest	
	Still Here – Langston Hughes	
	Short Story	
	Engine Trouble – R.K. Narayan	
II	DECISION MAKING	20
	Short Story	
	The Scribe – Kristin Hunter	
	The Lady or the Tiger - Frank Stockton	
	Poem	
	The Road not Taken – Robert Frost	

III	PROBLEM SOLVING	20
	Prose life Story	
	How I taught My Grandmother to Read – Sudha Murthy	
	Autobiography	
	How frog Went to Heaven – A Tale of Angolo	
	Wings of Fire (Chapter- 1) by A.P.J Abdul Kalam	
IV	Tenses	15
	Present	
	Past	
	Future	
	Concord	
V	English in the Workplace	15
	E-mail – Invitation, Enquiry, Seeking Clarification	
	Circular	
	Minutes of the Meeting	
Total Lecture Hours		90

Book Prescribed: IMPACT – 2 - GENERAL ENGLISH – 2 (SEMESTER - II)

Publisher Name: Cambridge University Press and Assessment, New Delhi. Year of Publication 2024.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Realize the importarice of resilience	PO1, PO7
CO2	Become good decision-makers	PO1, PO2, PO10
CO3	Imbibe problem-solving skills	PO4, PO6, PO9
CO4	Use tenses appropriately	PO4, PO5, PO6
CO5	Use English effectively at the work place.	PO3, PO8

Textbooks for References (Latest Editions)	
Reference Books	
1	Martin Hewings. Advanced English Grammar. Cambridge University Press, 2000
2	SP Bakshi, Richa Sharma. Descriptive English. Arihant Publications (India) Ltd., 2019.

3.	Sheena Cameron, Louise Dempsey. The Reading Book: A Complete Guide to Teaching Reading. S & L. Publishing, 2019.
4	Barbara Sherman. Skimming and Scanning Techniques, Liberty University Press, 2014.
5.	Phil Chambers. Brilliant Speed Reading: Whatever you need to read, however. Pearson, 2013.
6.	Communication Skills: Practical Approach Ed. Shaikh Moula
	Ramendra Kumar. Stories of Resilience, Blue Rose Publications, 2020.

Web Sources

1	Langston Hughes. Still Here https://poetryace.com/im-still-here
2	R. K. Narayan. Engine Trouble http://www.sbioaschooltrichy.org/work/Work/images/new/8e.pdf
3	Washington Irving. Rip Van Winkle https://www.gutenberg.org/files/60976/60976-h/60976-h.htm
4	Frank Stockton. The Lady or the Tiger https://www.gutenberg.org/ebooks/396

Mapping with Programme Outcomes:

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	L	M	M	L	L	M	S	M
CO2	L	S	S	S	M	M	M	M	L	M
CO3	M	S	S	M	S	S	M	L	M	M
CO4	M	M	S	S	S	S	S	L	M	S
CO5	S	S	M	S	S	S	S	L	S	M

* S - Strong; M - Medium; L - Low



Part II English 2025-26 onwards - Affiliated Colleges - Annexure No.5 SCAA DATED: 09.07.2025**SECOND YEAR- SEMESTER III-ENGLISH - III**

Course code	32E	PART II - ENGLISH - III	L	T	P	C
PART II ENGLISH - III			4	0	0	4
Pre-requisite	Express Ideas in Simple English		Syllabus Version		2025- 2026	
Course Objectives:						
The main objective of this course is to:						
1. To evolve students intellectual, personal and professional abilities						
2. To develop interest in reading.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Enhance the reading skill of the students				K1	
2	Understand the essence of literature.				K2	
3	Improve the writing skills and present ideas appropriately				K3	
4	Comprehend and interpret the text.				K4	
5	Comment on the literary works efficiently				K5	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						

SECOND YEAR - SEMESTER III - English - III

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	ACTIVE LISTENING Short Story In a Grove – Akutagawa Ryunosuke Translated from Japanese by Takashi Kojima The Gift of the Magi – O’ Henry Prose Listening – Robin Sharma Nobel Prize Acceptance Speech – Wangari Maathai	20

II	INTERPERSONAL RELATIONSHIPS Prose Telephone Conversation – Wole Soyinka Of Friendship – Francis Bacon Song on (Motivational/ Narrative) Ulysses – Alfred Lord Tennyson And Still I Rise – Maya Angelou	20
III	COPING WITH STRESS Poem Leisure – W.H. Davies Anxiety Monster – RhonaMcFerran Readers Theatre The Forty Fortunes: A Tale of Iran Where there is a Will – Mahesh Dattani	20
IV	Grammar Phrasal Verbs & Idioms Modals and Auxiliaries Verb Phrases – Gerund, Participle, Infinitive	15
V	Composition / Writing Skills Official Correspondence – Leave Letter, Letter of Application, Permission Letter Drafting Invitations Brochures for Programmes and Events	15

Total Lecture Hours: 90 Hours

Book Prescribed: IMPACT – III GENERAL ENGLISH – 3 (SEMESTER - III)

Publisher Name: Cambridge University Press and Assessment, New Delhi. Year of Publication 2024.

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Listen actively	PO1,PO7
CO2	Develop interpersonal relationship skills	PO1,PO2,PO10
CO3	Acquire self-confidence to cope with stress	PO4,PO6,PO9
CO4	Master grammar skills	PO4,PO5,PO6
CO5	Carry out business communication effectively	PO3,PO8

Text Books for Reference (Latest Editions)

1	Wangari Maathai – Nobel Lecture. Nobel Prize Outreach AB 2023. Jul 2023.
2	Mahesh Dattani, Where there is a Will. Penguin, 2013.

3	Martin Hewings, Advanced English Grammar, Cambridge University Press, 2000
4	Essential English Grammar by Raymond Murphy

Web Resources

1	WangariMaathai – Nobel Lecture. Nobel Prize Outreach AB 2023. Mon. 17 Jul 2023. https://www.nobelprize.org/prizes/peace/2004/maathai/lecture/
2	Telephone Conversation - Wole Soyinka https://www.k-state.edu/english/westmank/spring_00/SOYINKA.html
3	Anxiety Monster- RhonaMcFerran- www.poetrysoup.com

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	S	S	S	S	L
CO2	L	S	S	S	S	S	S	S	S	S
CO3	M	S	S	S	S	S	S	S	S	S
CO4	M	M	S	S	S	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	S
* S - Strong; M - Medium; L - Low										



Part II English 2025-26 onwards - Affiliated Colleges - Annexure No.5 SCAA DATED: 09.07.2025**SECOND YEAR - SEMESTER IV – ENGLISH IV**

Course code	42E	PART II - ENGLISH - IV	L	T	P	C
PART II ENGLISH - IV			4	0	0	4
Pre-requisite	Knowledge on Basic English Skills		Syllabus Version		2025- 2026	
Course Objectives:						
The main objective of this course is to:						
1. Enable the students to incorporate the language skills (Listening, speaking, reading & writing) in day today conversations.						
Expected Course Outcomes:						
On the successful completion of the course, student will be able to:						
1	Understand the literary texts through listening and reading				K1, K2	
2	Enhance the language skills of the students.				K3	
3	Develop the verbal ability & reasoning or influence of language.				K3	
4	Analyse the texts and appreciate literature with literary competence.				K4	
5	To assess the view of the authors				K5	
K1-Remember; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6-Create						

Unit No.	Unit Title & Text	No. of Periods for the Unit
I	GOAL SETTING (UNICEF) Life Story From Chinese Cinderella – Adeline Yen Mah Why I Write - George Orwell Short Essay On Personal Mastery – Robin Sharma On the Love of Life – William Hazlitt	20

II	INTEGRITY Short Story The Taxi Driver – K.S. Duggal Kabuliwala - Rabindranath Tagore A Retrieved Reformation – O Henry Extract from a play The Quality of Mercy (Trial Scene from the Merchant of Venice - Shakespeare)	20
III	COPING WITH EMOTIONS Poem Pride – Dahlia Ravikovitch Phenomenal Woman – Maya Angelou Reader's Theatre The Giant's Wife: A Tall Tale of Ireland – William Carleton The Princess and the God: A Tale of Ancient India	20
IV	Grammar Simple Sentences Compound Sentences Complex Sentences Direct and Indirect Speech	15
V	Report Writing Narrative Report Newspaper Report Drafting Speeches Welcome Address Vote of Thanks	15

Total Hours: 90 Hours

Book Prescribed: IMPACT – 4 - GENERAL ENGLISH – 4 (SEMESTER - IV)

Publisher Name: Cambridge University Press and Assessment, New Delhi.

Year of Publication 2025.

Course Outcomes

Course Outcomes	On completion of this course, students will	
CO1	Determine their goals	PO1, PO7
CO2	Identify the value of integrity.	PO1, PO2, PO10
CO3	Deal with emotions.	PO4, PO6, PO9

CO4	Frame grammatically correct sentences	PO4, PO5, PO6
CO5	Write cohesive reports.	PO3, PO8

Text Books for Reference (Latest Editions)

1	Oxford Practice Grammar, John Eastwood, Oxford University Press
2	Cambridge Grammar of English, Ronald Carter and Michael Mc Carthy
3.	George Orwell Essays, Penguin Classics

Web Resources

1	http://www.gradesaver.com/George-orwell-essays/study/summary
2	O' Henry. A Retrieved Reformation. https://americanenglish.state.gov/files/ae/resource_files/a-retrieved-reformation.pdf
	Maya Angelou. Phenomenal Woman. https://www.poetryfoundation.org/poems/48985/phenomenal-woman
3	The Quality of Mercy, https://poemanalysis.com
4	https://www.oxfordscholarlyeditions.com/display/10.1093/actrade/9780199235742.book.1/actrade-9780199235742-div1-106 - William Hazlitt

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	M	M	S	S	S	S	S	S	L
CO2	L	S	S	S	S	S	S	S	S	S
CO3	M	S	S	S	S	S	S	S	S	S
CO4	M	M	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

* S - Strong; M - Medium; L - Low



First Semester– Paper I

Course: French I Course

Code: Credits: 4

Hours: 72

Course Objectives:

- Understand and use familiar everyday expressions and basic phrases aimed at the satisfaction of concrete needs.
- Recognize key aspects of Francophone cultures such as greetings, etiquette, daily life, and basic geography of French-speaking countries.
- Write short, simple texts such as postcards, emails, or short descriptions about themselves and their immediate environment.
- Construct simple sentences using correct word order and basic vocabulary.
- Develop sensitivity to cross-cultural differences in communication and social practices.
- Read and understand short, simple texts such as personal messages, advertisements, menus, and schedules.

Course Outcomes:

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

S.No	CourseOutcome	BloomsLevel
CO1	improve all the four French language skills (speaking, listening, reading, and writing) (Effective communicators)	K1
CO2	comprehend French and other Francophone nations' cultures and civilizations.	K2
CO3	comprehend the fundamentals of language structure, vocabulary, grammar, and phonetics (language skill).	K3
CO4	The French DELF-A1 Certification is appreciated.	K4

Syllabus:

Part1-French I	
Unit No.	Topics
1	BIENVENUE (pg 10-17) Grammaire: pg(122-124)
2	CONTACTS(pg 18-28) Grammaire: pg(125-128)
3	COMMUNICATION pg(29-33) Grammaire: pg(129-130)
4	QU'EST-CE QU'IL FONT pg(34-44) Grammaire: pg(131-136)
5	COMMUNICATION pg(45-49) Grammaire: pg(137-139)
Semester I Portions from Textbook « Nouvelle Génération A1» : UNITÉ 1, UNITÉ 2(Pg 10-49) Cahier d'exercices (Pg122-139)	

Text Book prescribed

S.No	Authors	Title	Publishers	Year & Edition
1	Luca Giachino, Carla Baracco, Romain Chrétien(DELF)	Nouvelle Génération A1	Didier FLE	2022 1 Ed.

Book Available at: GOYAL Publishers and Distributors Pvt Ltd, New Delhi (9810322459)

Books for Reference

S.No	Authors	Title	Publishers	Year & Edition
1.	Nathalie Hirschsprung, Tony Tricot	COSMOPOLITE	Hachette	2017 1 Ed.

Related Online Contents (MOOC, SWAYAM, NPTEL, Websites etc.,)

S.No	Related Online Contents
1	FUN MOOC Online course VIVRE EN France A1 Cours de français Alliance de français de Paris SWAYAM ONLINE COURSE BFLI -001- PARLER DE SOI/ BFLI-002 : FRENCH Échanger / Interactions (French) BY DR. DEEPANWITA SRIVATSAVA, IGNOU

Second Semester–Paper II

Course: French II

Course Code: Credits: 4

Hours: 72

Course Objectives:

- Understand and use familiar everyday expressions and basic phrases aimed at the satisfaction of concrete needs.
- Recognize key aspects of Francophone cultures such as greetings, etiquette, daily life, and basic geography of French-speaking countries.
- Write short, simple texts such as postcards, emails, or short descriptions about themselves and their immediate environment.
- Construct simple sentences using correct word order and basic vocabulary.
- Develop sensitivity to cross-cultural differences in communication and social practices.
- Read and understand short, simple texts such as personal messages, advertisements, menus, and schedules.

Course Outcomes:

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

S.No	Course Outcome	Knowledge Level
CO1	improve all the four French language skills (speaking, listening, reading, and writing) (Effective communicators)	K1
CO2	comprehend French and other Francophone nations' cultures and civilizations.	K2
CO3	comprehend the fundamentals of language structure, vocabulary, grammar, and phonetics (language skill).	K3
CO4	The French DELF-A1 Certification is appreciated.	K4

Syllabus:

Part I-French II	
Unit No.	Topics
1	PORTRAITS(pg 50-60) Grammaire: pg(140-144)
2	COMMUNICATION(pg 61-65) Grammaire: pg(145-146)
3	TEMPS LIBRE(pg 66-68) Grammaire: pg(147)
4	MOTS ET EXPRESSIONS((pg 69-76) Grammaire: pg(148-151)
5	COMMUNICATION(pg 77-81) Grammaire: pg(152-155)
Semester II Portions from Textbook « Nouvelle Génération A1» : UNITÉ 3, UNITÉ 4(Pg 50-81) Cahier d'exercices (Pg140-155)	

Text Book prescribed

S.No	Authors	Title	Publishers	Year & Edition
1	Luca Giachino, Carla Baracco, Romain Chrétien(DELF)	Nouvelle Génération A1	Didier FLE	2022 1 Ed.

Book Available at: GOYAL Publishers and Distributors Pvt Ltd, New Delhi (9810322459)

Books for Reference

S.No	Authors	Title	Publishers	Year & Edition
1.	Nathalie Hirschsprung, Tony Tricot	COSMOPOLITE	Hachette	2017 1 Ed.

Related Online Contents (MOOC, SWAYAM, NPTEL, Websites etc.,)

S.No	Related Online Contents
1	FUN MOOC Online course VIVRE EN France A1 Cours de français Alliance de français de Paris SWAYAM ONLINE COURSE BFLI -001- PARLER DE SOI/ BFLI-002 : FRENCH Échanger / Interactions (French) BY DR. DEEPANWITA SRIVATSAVA, IGNOU

Third Semester–Paper III

Course: French III

Course Code:

Credits: 4

Hours: 72

Course Objectives:

- Understand and use familiar everyday expressions and basic phrases aimed at the satisfaction of concrete needs.
- Recognize key aspects of Francophone cultures such as greetings, etiquette, daily life, and basic geography of French-speaking countries.
- Write short, simple texts such as postcards, emails, or short descriptions about themselves and their immediate environment.
- Construct simple sentences using correct word order and basic vocabulary.
- Develop sensitivity to cross-cultural differences in communication and social practices.
- Read and understand short, simple texts such as personal messages, advertisements, menus, and schedules.

Course Outcomes:

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

S.No	Course Outcome	Knowledge Level
CO1	improve all the four French language skills (speaking, listening, reading, and writing) (Effective communicators)	K1
CO2	comprehend French and other Francophone nations' cultures and civilizations.	K2
CO3	comprehend the fundamentals of language structure, vocabulary, grammar, and phonetics (language skill).	K3
CO4	The French DELF-A1 Certification is appreciated.	K4

Syllabus:

Part I-French III	
Unit No.	Topics
1	VENDRE ET ACHETER(pg 82-92) Grammaire: pg(156-160)
2	COMMUNICATION(pg 93-97) Grammaire: pg(161-162)
3	TOUT LE MONDE S'AMUSE(pg 98-100) Grammaire: pg(163)
4	MOTS ET EXPRESSIONS(pg 101-107) Grammaire: pg(164-167)
5	COMMUNICATION(pg 108-120) Grammaire: pg(168-171)
Semester III Portions from Textbook « Nouvelle Génération A1» : UNITÉ 5, UNITÉ 6(Pg 82-120) Cahier d'exercices (Pg156-171)	

Text Book prescribed

S.No	Authors	Title	Publishers	Year & Edition
1	Luca Giachino, Carla Baracco, Romain Chrétien(DELF)	Nouvelle Génération A1	Didier FLE	2022 1 Ed.

Book Available at: GOYAL Publishers and Distributors Pvt Ltd, New Delhi (9810322459)

Books for Reference

S.No	Authors	Title	Publishers	Year & Edition
1.	Nathalie Hirschsprung, Tony Tricot	COSMOPOLITE	Hachette	2017 1 Ed.

Related Online Contents (MOOC, SWAYAM, NPTEL, Websites etc.,)

S.No	Related Online Contents
1	FUN MOOC Online course VIVRE EN France A1 Cours de français Alliance de français de Paris SWAYAM ONLINE COURSE BFLI -001- PARLER DE SOI/ BFLI-002 : FRENCH Échanger / Interactions (French) BY DR. DEEPANWITA SRIVATSAVA, IGNOU

Fourth Semester–Paper IV

Course: French IV

Course Code:

Credits: 4

Hours: 72

Course Objectives:

- Understand and use familiar everyday expressions and basic phrases aimed at the satisfaction of concrete needs.
- Introduce themselves and others, and ask and answer questions about personal details such as name, age, nationality, family, and daily routines.
- Recognize key aspects of Francophone cultures such as greetings, etiquette, daily life, and basic geography of French-speaking countries.
- Write short, simple texts such as postcards, emails, or short descriptions about themselves and their immediate environment.
- Construct simple sentences using correct word order and basic vocabulary.
- Develop sensitivity to cross-cultural differences in communication and social practices.
- Read and understand short, simple texts such as personal messages, advertisements, menus, and schedules.

Course Outcomes:

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

S.No	Course Outcome	Knowledge Level
CO1	improve all the four French language skills (speaking, listening, reading, and writing) (Effective communicators)	K1
CO2	comprehend French and other Francophone nations' cultures and civilizations.	K2
CO3	comprehend the fundamentals of language structure, vocabulary, grammar, and phonetics (language skill).	K3
CO4	The French DELF-A1 Certification is appreciated.	K4

Syllabus:

Part I-French IV	
Unit No.	Topics
1	BIEN VENUE (pg 11-14) Grammaire: pg(121-122)
2	EN VILLE (pg 15-25) Grammaire: pg(123-127)
3	COMMUNICATION(pg 26-29) Grammaire: pg(128)
4	EN VOYAGE (pg 31-40) Grammaire: pg(129-133)
5	COMMUNICATION(pg 41-46) Grammaire: pg(134-137)
Semester IV Portions from Textbook « Nouvelle Génération A2» : UNITÉ 1, UNITÉ 2 (Pg 11- 46) Cahier d'exercices (Pg121-137)	

Text Book prescribed

S.No	Authors	Title	Publishers	Year & Edition
1	Luca Giachino, Carla Baracco, Romain Chrétien(DELFL)	Nouvelle Génération A2	Didier FLE	2022 1 Ed.

Book Available at: GOYAL Publishers and Distributors Pvt Ltd, New Delhi (9810322459)

Books for Reference

S.No	Authors	Title	Publishers	Year & Edition
1.	Nathalie Hirschsprung, Tony Tricot	COSMOPOLITE	Hachette	2017 1 Ed.

Related Online Contents (MOOC, SWAYAM, NPTEL, Websites etc.,)

S.No	Related Online Contents
1	FUN MOOC Online course VIVRE EN France A1 Cours de français Alliance de français de Paris SWAYAM ONLINE COURSE BFLI -001- PARLER DE SOI/ BFLI-002 : FRENCH Échanger / Interactions (French) BY DR. DEEPANWITA SRIVATSAVA, IGNOU

BHARATHIAR UNIVERSITY: COIMBATORE – 641 046
Part I – Hindi
For Under-graduate Degree Programme
(For the students admitted during 2025-2026 onwards)

Programme Educational Objectives (PEO)
Undergraduate Programme of Part I Hindi will be

PROGRAMME OUTCOME (PEO) :

- **PO1:** Basic knowledge of Hindi language will be improved.
- **PO2:** Knowledge of glossaries will increase.
- **PO3:** Hindi language expression will rise.
- **PO4:** Learners will enrich their grammar in Hindi.
- **PO5:** The desire to read literature, such as a story or a poem, develops.
- **PO6:** Knowledge such as reading, understanding and critique of literature will improve
- **PO7:** The knowledge of expressing one's opinion in Hindi will improve.
- **PO8:** Communication knowledge will increase.
- **PO9:** Develop a skill in translation.
- **PO10:** They will learn more about our Indian Culture and the values of Human being.

PROGRAM SPECIFIC OUTCOME (PSO):

PSO1: Develop an interest in the appreciation of literature.

PSO2: Discuss and respond to content of a reading passage.

PSO3: Learning the literary knowledge of Hindi specially reading and writing .

PSO4: Learning the literary knowledge specially reading and understanding of Hindi short Stories

PSO5: Learning the history of Hindi literature.

PSO6: The ability to translate from Hindi to English and from English to Hindi will be improved.

PSO7: Develop a skill in spoken Hindi.

Course code	HD1	PART I HINDI PAPER I	L	T	P	C
PART - I		PART I	3	-	-	3
Pre-requisite			Syllabus Version			2025-26

- **COURSE OBJECTIVE:**

- Improves grammatical knowledge
- Will continue to read and learn about articles and think about them
- It is possible to read and understand short stories and understand the thoughts and life of the people of this country
- Translation knowledge and the ability to read and analyze a message are also gained

Unit	PART I HINDI PAPER I	Hrs
I	PROSE : BHARTHI GADYA SANGRAH 1.Sanskurthi hai kya? (Lalith nibandh)- Ramdhari singh Dinkar 2. Voh cheeni Bhayi (Rekha chitra) – Mahadevi varma 3. Badthe shor ka gahratha sankat (pradoshan) - Rajendrakumr ray & Ravindra Varma 4. Ghar Loutthe huye – (Athma katha) – Harivamshraai Bacchan 5. Paramanu urja evam khadya padarth samrakshan (vaigyanik lek)- Parmaanuu urja vibhag (Bharth sarkar) 6. Cinema (film) – Manmohan Chdda	18
II	NON DETAILED TEXT SHORT STORIES: AAT KAHANIYAN 1. Vrath-bang – Jayashankar Prasad 2. Sath gathi - Premchand 3. parda - Yespal 4. Apna apna bhagya - Jaynendrakumar 5. Bhammarakshas ka shishya - Mukthibhodh 6. Dana-bhusa - Markandeya	18
III	GRAMMAR : SHABDHA VICAR ONLY (NOUN, PRONOUN, ADJECTIVE, VERB, TENSE, CASE ENDINGS) Theoretical & Applied.	14
IV	TRANSLATION : English – Hindi only. ANUVADH ABHYAS – III (1-15 lessons only)	12
V	COMPREHENSION: 1 Passage from ANUVADH ABHYAS–III (16-30)	10
	TOTAL	72

Teaching methods:

Lecturing, Assignment, Group Discussion, Quiz, Group Activity. PowerPoint Projection through LCD

Text Book:

Bharathi gadya sangrah, editor : Madhudhavan, publisher : Vani prakashan,
4697/5, Daryaganch, New Delhi – 110002.

Aatt Kahaniyan, Editor : Dr. H.R. Mihir, Publisher : Jaya bharthi prakashan, 267 B, Maya
press Road, Allahabad–211 003

Reference Books:

NAVEENHINDI Vyakaran, 2002, Dakshin Bharat Hindi Prachar Sabha, Chennai–600017

Web Link:

<https://hi.wikipedia.org/wiki/https://en.wikipedia.org/wiki/Premchandhttp://hindigrammar.in/>

S.No	COURSE OUTCOME
CO1	Understand the text styles and grammatical elements
CO2	Discuss the content of a reading passage
CO3	Develop an interest in the appreciation of short stories
CO4	Comprehend the grammatical structures and sentence making
CO5	Understand the language and developing English to Hindi translation skill

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO3	M	S	S	M	S	M	S	S	M	S
CO3	S	M	M	M	M	S	S	M	S	M
CO4	L	S	L	S	L	S	L	M	M	M
CO5	S	S	M	M	S	M	L	L	L	L

COURSE PREPARED	Dr.S.S.Resmi resmivijay6@gmail.com
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SECOND SEMESTER – HINDI - PAPER II

Course code	HD2	HINDI PAPER II	L	T	P	C
PART - I		PART I	3	-	-	3
Pre-requisite			Syllabus Version		2025-26	

● **COURSE OBJECTIVE:**

- A basic understanding of contemporary poetry can be gained and the nature of modern poetry can be realized.
- Realizing the nature of drama and its nature and improving the knowledge of reading and understanding the nature of contemporary plays.
- Understands the benefits of correspondence and can enhance the correspondence you need.
- Translation is especially useful for translating from Hindi to English

Unit No	PART I - HINDI II	Hours
I	MODERN POETRY : KAVYA PARASAR 1. Niyam – Kedarnath Singh 2. Ladki aur andha aadhmi – Manglesh Dablar 3. Daily Passenger – Arun kamal 4. Thodi si jagah – Rajesh joshi 5. Haddy Khopdi Khatra nishan – Veeren Dangvala 6. Bejghah – Anaamika	18
II	ONE ACT PLAY: SONE KI VARSHA 1. Sitha – Dvijendarlal rai 2. Parivartan - Ke Aiyanaar 3. Apoorva Thyag - Balashaur reddy 4. Sone ki varsha - Dayavathi Bhardhvaj 5. Sachcha Insaf - Avadh Nandan	18
III	LETTER WRITING (Leave Letter, Job Application, Ordering Books, Letter to Publisher, Personal Letter)	10
IV	CONVERSATION: (Doctor & Patient, Teacher & Student, Storekeeper & Buyer, Two Friends, Booking Clerk & Passenger at Railway Station, Auto rickshaw driver and Passenger)Ref : Bolchal Ki Hindi Aur Sanchar by Dr. Madhu Dhavan Vani Prakashan, New Delhi.	12
V	TRANSLATION: HINDI-ENGLISH ONLY Lessons – 1-15 only ANUVADH ABYAS-III	14
	TOTAL	72

Teaching methods:

Lecturing,Assignment,GroupDiscussion,Quiz,GroupActivity.PowerPointProjection through LCD

Text Book:

Kavya Parasar, Dr.Bolanath, Jawahar Pusthakalay, Sadar Bazaar,Mathura-U.P.281001.

Sone ki Varsha- Dakshin Bharat Hindi Prachar Sabha, Chennai – 600 017

Reference Books:

BolchalKiHindiAurSanchar,2015,Dr.MadhuDhavanVaniPrakashan, NewDelhi.

Web Link:

<https://hi.wikipedia.org/wiki/https://en.wikipedia.org/wiki/Premchandhttp://hindigrammar.in/>

S.No	PROGRAMME OUTCOME
CO1	Get a basic understanding of renewal poetry and the essence of the poem
CO2	It is possible to understand the genre of Drama
CO3	Translating skill improved specially from English to Hindi
CO4	Knowledge is gained by using phrases and idioms
CO5	Learners can express opinion in small sentences

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO3	M	S	S	M	S	S	S	S	M	S
CO3	S	M	M	M	M	S	S	M	S	M
CO4	L	S	L	S	L	S	L	M	M	M
CO5	S	S	M	S	L	S	S	S	S	S

COURSE PREPARED	Dr.S.S.Resmi resmivijay6@gmail.com
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THIRD SEMESTER - HINDI - PAPER III

Course code	HD3	HINDI - PAPER III	L	T	P	C
PART - I		PART I	3	-	-	3
Pre-requisite			Syllabus Version			2025-26

● **COURSE OBJECTIVE:**

- May have knowledge of the contents of primitive poetry
- Learn about contemporary poetry and its techniques.
- Interest in reading poetry and the ability to express social thoughts will improve
- This will help you to understand the basics of Hindi literature and to understand Hindi literature properly
- Knowledge of the elements of poetry and the knowledge of subtle translation will improve.

Unit No	PART I - HINDI III	Hours
I	POETRY:KAVYA THARANG – by Dr. NIRANJAN PRACHEEN KAVITHA 1. MAHATMA KABEER – Sakhi & Padh (2) 2. GOSWAMY TULSIDAS – Pad(4) 3. MAHATMA SOORDAS- Pad(3) 4. KAVIVAR RAHIM – DOHE(6)	18
II	MODERN POETRY : KAVYA THARANG- by Dr. NIRANJAN 1. Nirjar – Mythili sharan gupth 2. Parichay – Ramdhari singh Dinkar 3. Prethibimb – Sumithra nandan Panth 4. Kavi kaha ththa – Sooryakanth Tripathi Nirala 5. Kah de mam Kya ab dekhoon – Mahadevi varma 6. Kanu ke prathi – Darmveer Bharathi 7. Loha ka swad – Dhumil 8. Bhanth Kidikkiyon ki Takrahat – Gorakh pande	18
III	HISTORY OF HINDI LITERATURE :(TIPPANIYAN) 1. Bhakthi kal ka samanya parichaya (Kabeer, Jaysi, Soor, Thulsi, Meera, Raskhan, Rahim)	10
IV	Ras Chad & ALANKAR: 1. Srungar & veer Ras 2. ANUPRAS & Upama 3. Dhoha & Rola	12
V	TRANSLATION : ENGLISH-HINDI only ANUVADH ABHYAS – III (16-30 Lessons only)	14
	TOTAL	72

Teaching methods:

Lecturing, Assignment, Group Discussion, Quiz, Group Activity. Power Point Projection through LCD

Text Book:

Kavya Tharang – by Dr. NIRANJAN, Jawahar Pusthakalay, Sadar Bazaar, Mathura-
U.P.281001.

Anuvadh abyas-III, Dakshin Bharath Hindi Prachar Sabha Chennai – 17.

Reference Books:

Hindi sahithya ka saral ithihaas, by Rajnath sharma, vinod pustak mandir, agra-282

Kavya Pradeep Rambadri Shukla, Hindi Bhavan, 36, Tagore Town, Allahabad – 211 002.

Web Link:

<https://hi.wikipedia.org/wiki/https://en.wikipedia.org/wiki/Premchand>

S.No	COURSE OUTCOME
CO1	Get a basic knowledge of the history of Hindi literature.
CO2	Enhances the art and taste of Hindi literary works
CO3	Literary genres can be learned
CO4	Create an interest to read and enjoy Hindi poetry
CO5	Get the basic Knowledge of poetry techniques like Anlankar.

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	M	S	S	M	S	S	S	S	M	S
CO3	S	S	M	S	L	S	S	S	S	S
CO4	M	S	S	M	S	S	S	S	M	S
CO5	S	M	M	M	M	S	S	L	S	L

COURSE PREPARED	Dr.S.S.Resmi resmivijay6@gmail.com
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FOURTH SEMESTER-HINDI –PAPER-IV

Course code	HD4	HINDI PAPER IV	L	T	P	C
PART - I		PART I	3	-	-	3
Pre-requisite			Syllabus Version			2025-26

- **COURSE OBJECTIVE:**
- Knowledge of contemporary drama contents of Hindi literature
- Learn novels and its techniques. The ability to read novels and express criticism about it and the ability to express social thoughts will improve
- There will also be litigation messages in Hindi and news on speech techniques
- Able to write articles on their own and improve their translation skills.

Unit No.	PART I - HINDI IV	Hours
I	DRAMA: Aashad ka ek din By Mohan Rakesh	18
II	NOVEL : GABAN – Premchand	18
III	LOKKOTHI & MUHAVARE - NAVEEN HINDI VYAKARAN (Selected Lokkokthi -10 & Muhavare-10)	10
IV	GENERAL ESSAY : AADARSH NIBANDH	12
V	TRANSLATION : HINDI-ENGLISH only ANUVADH ABHYAS – III (16-30 Lessons only)	14
	TOTAL	72

Teaching methods:

Lecturing, Assignment, Group Discussion, Quiz, Group Activity. Power Point Projection through LCD

Text Book:

Aashad ka ek din –Drama- Mohan Rakesh, Publisher : Rajpal & sons Kashmeeri gate Delhi– 110006.

Gaban –Novel- Premchand, 2015, Rajkamal Prakashan, 1B Nethaji Subash Marg, New Delhi.

Reference Books:

Hindi sahithya ka saral ithihaas,by rajnath sharma, vinod pustak mandir,Agra-282
Kavya Pradeep Rambadri Shukla, Hindi Bhavan, 36, Tagore Town, Allahabad – 211 002.

Web Link:

https://hi.wikipedia.org/wiki/https://en.wikipedia.org/wiki/Premchand http://www.hindisamay.com/content/259 https://www.hindisamay.com/content/1050/2
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S.No	COURSE OUTCOME
CO1	Get a basic knowledge of drama
CO2	Can read and critique novels
CO3	Creat the interested in art literature courses
CO4	The hope of writing an essay in genaral topic
CO5	The idea of creating new works and critique knoledge will improve

Mapping with Programme Outcomes										
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	S	S	S
CO2	M	S	S	M	S	S	S	S	M	S
CO3	S	S	M	S	L	S	S	S	S	S
CO4	M	S	S	M	S	S	S	S	M	S
CO5	S	M	M	M	M	S	S	L	S	L

COURSE PREPARED	Dr.S.S.RESMI resmivijay6@gmail.com
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BHARATHIAR UNIVERSITY : COIMBATORE – 641 046
(For the students admitted during 2020-2021 onwards)
QUESTION PAPER PATTERN
FIRST SEMESTER HINDI -PAPER-I
(Maximum Marks 75)

SECTION – A (10 x 1 = 10)
Multiple Choice Questions

Multiple Choice Questions :

5 Questions from Prose Text

5 Questions from non-detailed text (Multiple Choice Questions)

SECTION – B (5 x 5 = 25)
(either / or pattern)

Two annotations from Prose text only. (Either / or Pattern)

Two Short note from non-detailed (Either / or Pattern)

Applied Grammar – 5 Questions (Sentences)

(Gender, Number, Tense, Verb, Error Corrections)

SECTION – C (5 x 8 = 40)
(Either or pattern)

1. One Essay from Prose

2. One Essay from non-detailed text.

3. One Essay from Grammar (Theoretical)

4. Comprehension passage with 4 Questions

5. One passage – English to Hindi Translation

SECOND SEMESTER - HINDI-PAPER-II
(Maximum Marks 75)

SECTION – A (10 x 1 = 10)
Multiple Choice Questions

5 Questions from Modern Poetry

5 Questions from One Act Play

SECTION – B
(5 x 5 = 25)
(either / or
pattern)

Two annotations from Poetry

Three Short answers from One Act Play

SECTION – C (5 x 8 = 40)
(Either or pattern)

One Essay from Poetry

One Essay from One Act Play

One Letter writing

One Conversation

One passage – Hindi to English Translation

QUESTION PAPER PATTERN
THIRD SEMESTER - HINDI-PAPER-III
(Maximum Marks 75)

SECTION – A (10 x 1 = 10)
Multiple Choice Questions

- 5 Questions from Old Poetry
- 5 Questions from History of Hindi Literature

SECTION – B (5 x 5 = 25)
(either / or pattern)

- 1 Annotation from Ancient Poetry.
- 1 Annotation from Modern & Contemporary Poetry
- 1 Short note from Ras
- 1 Short note from Chand
- 1 Short note from Alankar

SECTION – C (5 x 8 = 40)
(Either or pattern)

- One essay from Ancient Poetry
 - One Essay from Modern Poetry
 - One Essay from History of Hindi Literature
 - One short note (poet and literature)
 - One passage – English to Hindi Translation
-

FORTH SEMESTER PAPER-IV
(Maximum Marks 75)

SECTION – A (10 x 1 = 10)
Multiple Choice Questions

- 5 Questions from Drama
- 5 Questions from Novel

SECTION – B (5 x 5 = 25)
(either / or pattern)

- TWO Short Notes from Drama.
- ONE short notes from Novel.
- ONE short notes Lokokthi
- ONE short notes Muhavre

SECTION – C (5 x 8 = 40)
(Either or pattern)

- One essay from drama.
- Two essays from novel
- One General essay.
- One passage – Hindi to English Translation

Programme:	B.A./B.Sc./B.COMM/BBA, Degree Courses
Duration:	Only in Four Semesters
Programme Outcomes:	1. To produce competent students, academicians, and writers in the field of Kannada Language and Literature. 2. To provide the brief vision of the historical development and the evolution of the sensibility in Kannada 3. To understand the compositional analysis in Kannada writings. 4. To attract more students in Kannada Literature study.



	5. To enable them to write for media PSO 1 (PSE =PROGRAMME SPECIFIC OUTCOMES) The students are to ensure the up-to-date level of understanding the concepts of basics in Kannada Language and Literature. PSO 2 The Students are to ensure the competence and performance in Kannada Language. PSO 3 The Students are to ensure the style variations and new trends in Kannada Literature. PSO 4 An overview of world Literature from the perceptive of Kannada Literature. PSO 5 To generalize social mobility in terms of literary sensibility.
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KANNADA – UG - Syllabus

Programme Specific Outcomes:	After the successful completion of the course the students are expected to do the following: • To implement the grammatical and linguistic competence in accordance with the context and text. • To be more curious about study the further development in Kannada Language and Literature. • To do higher studies in Kannada Language and Literature. • To enrich the students in the various field of the literary as well as the linguistic level in Kannada. • To bring out reference books and other materials for future generation.
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Semester	Course Code	Title of the Course	Core/ Elective/ Soft Skill	Credits
I	KAN	Paper-I, Ancient and Medieval Poetry		3
II	KAN	Paper-II, Modern poetry and General Essay		3
III	KAN	Paper-III, Modern Kannada Prose		3
IV	KAN	Paper-IV, Kannada Drama and Translation		3

Course Objectives	
Recall (K1) - List, Identify, Enumerate, Define Understand/Comprehend (K2) - Describe, Explain, Outline, Briefly Summarise Apply Knowledge (K3) - Interpret, Calculate, Select, Employ, Generalise Analyze and Evaluate (K4 and K5) - Compare and Contrast, Differentiate, Evaluate, Critically Assess, Review an Idea Create(K6) - Conceive, Theorise, Conceptualiseetc	1. Students are capable of evaluating different literary sensibilities. 2. Enable them to understand the history of Literature in Kannada 3. Enable them to differentiate new trends in literary genres. 4. Enable them to identify the nature of development of Kannada Literature. 5. Enable them to translate Kannada Literature into another Language.



Semester - I

Course I	Core/Elective/Soft Skill
Title of the Course:	Paper-I, Ancient and Medieval Poetry
Credits:	3
Pre-requisites, if any:	To expose students to the Ancient and Medieval Kannada Literature. They learn about the Literary Heritage, Culture, Religic developments etc. Also to make them to understand and appreciate Old Literature a representative collection of Ancient and Medieval poetry of about 100 pages is prescribed. General understanding, appreciation of poetry, poetical beauty, the language of the poetry etc., are to be taught.
Course Outcomes (Use verbs like interpret, calculate,employ,generalise, evaluate, differentiate, critically assess, review, enumerate, identify, state, describe, explain, outline, select, recall, understand, compare and contrast, evaluate, critique, revise, summarise, demonstrate, draft, report, explain, obtain, recognise, respond, display)	1. To understand ancient literary text & Medieval Poetry in Kannada 2. To describe text and context of ancient literature and Medieval Texts in Kannada 3. To evaluate the difference between the ancient style of writing. 4. To describe about the style of the authors. 5. To narrate the poetry and improve in understanding the poetry
UNITS	
I	Introduction to Ancient Kannada Literature
II	Prescribed text Lessons 1,2,3,4
III	Prescribed text Lessons 5,6,7,8
IV	Prescribed text Lessons 9,10,11 and 12
V	Critical appreciation of Ancient and Medieval Poetry-their contents and expression
Reading List (Print and Online)	1. Parakrama dhalavana Parakramam –Pampa 2. Bheema Dhuryodhaniyam-Ranna 3. Vachanagalu 4. Bedara Kannappana ragale-Harihara 5. Sudugadu Hageyayte-Raghavankha 6. Haydudu tale nabha stalake-Kumaravyasa 7. Maaniniyariche-Kumaravyasa 8. Maye meredalu baala leeleyali-Chamarasa. 9. Ragi vreehi samvada-Kanakadaasa 10.Karubariddoorinde kaadollithu-Lakshmisha 11.Garathiya Haadugalu-Jaanapad geethegalu 12. Govina haadu

Recommended Texts	Pracheena Kavya Marga-3 , H. Nagarajaih & Others (Ed), 1995, Prasaraanga, Bangalore University, Bangalore-56
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Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	2	3	2	3	2	3	1	2
CO 2	3	3	1	3	3	2	3	2
CO 3	3	2	3	3	3	2	1	3
CO 4	3	3	3	3	3	3	2	3
CO 5	3	3	3	2	2	1	3	1

Level of Correlation between PSO's and CLO's

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CLO 1	3	3	3	3	2
CLO 2	3	3	3	3	2
CLO 3	3	2	3	2	3
CLO 4	3	3	3	2	3
CLO 5	2	2	2	3	3
Weightage	14	13	14	13	13
Weighted percentage of Course Contribution to PSOs	2.8	2.6	2.8	2.6	2.6

Strong- 3 Medium – 2 Low - 1

Semester – II

Course - 2	Core/Elective/Soft Skill
Title of the Course :	Paper-II, Modern poetry and General Essay
Credits :	03
Pre- requisites, if any:	To expose the students to the Modern Kannada poetry and train them to write essays. For this an anthology of about 100 pages of Modern Poems covering different general trends, forms and contents is prescribed. Essay on given topics relating to Literature, Culture, Art, Education, Communication, Sports, Environment, Current Affairs etc., are to be given.
Course Outcomes	1. To understand the Contemporary literary text in Kannada 2. To Explain the Contemporary author style of writings 3. To evaluate the difference between the ancient and Contemporary Literature. 4. To brief the content of the techniques of General Essay Writing 5. To use grammatical styles in writing.
Units	
I	Beginning of modern Kannada Poetry-trends-themes-contents-Poetry-in a birds eye view
II	Text Poems from Part I -1,2,9, Part II - 2,4,6
III	Text Poems from Part III - 1,3, 14, 16
IV	Text Poems from Part IV - 6,8,11, Part V - 2,6,8
V	Poems reading-appreciation-general-acquaintance of the writers of the prescribed poems
Reading List (Print and Online)	Part -I :1. Belagu-Bendre 2. Devaru ruju maadidanu-Kuvempu 9. Sharade-G.S.Shivarudrappa Part-II :2.Mane tumbisuvudu-V.Seetaramaiah 4. Nalli taav nam malli-G.P.Rajaratnam 6.Tungabhadre - K.S.Narasimhaswamy Part-III :1.Kurudu kanchaana-Bendre 3. O! Nanna Janave!-GopalaKrishna adiga 14.Samadhaana-G.P.Rajaratnam 16.Amma Aachara Naanu-K.S.Nisar Ahmad. Part-IV :6.Mabbininda Mabbige-G.S.Shivarudrappa 8. Kaala Nilluvudilla-Channaveera Kanavi 11.Maneyinda manege- K.S.Narasimhaswamy Part-V :2.Vishva kutumbiya kashta-Pu.thi.na.

	6.Atithigalu- GopalaKrishna adiga 8.Angula Huluvina parakaaya pravesha-A.K. Ramanujam
Recommended Texts	Samakaaleena Kannada Kavithe-I , Ed. G.S. Shivarudrappa, 2000, Prasaranga, Bangalore University, Bangalore-560 001

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	2	3	2	3	2	3	1	2
CO 2	3	3	1	3	3	2	3	2
CO 3	3	2	3	3	3	2	1	3
CO 4	3	3	3	3	3	3	2	3
CO 5	3	3	3	2	2	1	3	1

Level of Correlation between PSO's and CLO's

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CLO 1	3	3	3	3	2
CLO 2	3	3	3	3	2
CLO 3	3	2	3	2	3
CLO 4	3	3	3	2	3
CLO 5	2	2	2	3	3
Weightage	14	13	14	13	13
Weighted percentage of Course Contribution to PSOs	2.8	2.6	2.8	2.6	2.6

Strong- 3 Medium – 2 Low - 1

Semester - III

Course - 3	
Title of the Course	Paper-III, Modern Kannada Prose
Credits :	03
Pre- requisites, if any:	To expose the students for Modern Kannada Prosais Literature and teach them to understand the literature and enjoy. A novel of about 200 pages are prescribed. The general appreciation and evaluation of the theme, development and the techniques of the prescribed text are to be learnt.
Course Outcomes	1. To understand the significance of the current phase of Prose 2. To Explain the nature of modern Novels in Kannada 3. To evaluate the culture of the society through Novels 4. Understand the Critical outlook of the Texts 5. To interpret the various styles of Novels.
Units	
I	Development of Modernism in Kannada Literature - the trends-Fiction prose writers-introduction about the author and texts.
II	The Novel - Alida mele (Novel Story and Theme)
III	The Novel-Alida mele (First half)
IV	The Novel- Alida mele (Second half)
V	The critical appreciation of the texts
Reading List (Print and Online)	L.S. Sheshagiri Rao, Hosagannada Sahitya charitre, Ankita Pustaka, No.53, Shamsingh Complex, Gandhi bazaar Road, Bagsavanagudi, Bangalore-560 004
Recommended Texts	Dr. Shivarama Karanatha , 1996, Alida Mele, SBS Publishers & Distributers, Bangalore-01

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	2	3	2	3	2	3	1	2
CO 2	3	3	1	3	3	2	3	2
CO 3	3	2	3	3	3	2	1	3
CO 4	3	3	3	3	3	3	2	3
CO 5	3	3	3	2	2	1	3	1

Level of Correlation between PSO's and CLO's

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CLO 1	3	3	3	3	2
CLO 2	3	3	3	3	2
CLO 3	3	2	3	2	3
CLO 4	3	3	3	2	3
CLO 5	2	2	2	3	3
Weightage	14	13	14	13	13
Weighted percentage of Course Contribution to PSOs	2.8	2.6	2.8	2.6	2.6

Strong- 3 Medium – 2 Low - 1



Semester - IV

Course - 4	
Title of the Course :	Paper-IV, Kannada Drama and Translation
Credits :	03
Pre- requisites, if any:	Kannada Drama Literature is to be studied and enjoy. Learn to understand and appreciate the theme, characters, techniques and style of the Kannada Drama. A traditional or Modern drama either original or translation of about 100 pages to be learnt. A passage of about 100 words from English to be given for translation in to Kannada thus translation skill of the student also to be developed.
Course Outcomes	1. To understand the rich tradion of Kannada Drama 2. To Explain nature of Drama of Kannada 3. To describe the nature of understandings the Drama 4. To evaluate the culture of the society through Drama. 5. To know the techniques of the Translation in Kannada
Units	
I	Drama Literature in Kannada-Translation Dramas from Sanskrit and English-Development of Kannada Drama through many trends of 20 th Century. Elements of Drama-theme-characters-techniques and style etc., are to be described.
II	Prescribed Drama-Abhijnana Shakuntalam Act-1
III	Prescribed Drama-Abhijnana Shakuntalam Act-2
IV	Prescribed Drama-Abhijnana Shakuntalam Act-3
V	Techniques of Translation for Translation English to Kannada and Kannada to English.
Reading List (Print and Online)	Avalokana , Ed. Basavappa Sahstri virachita shakuntala naatakam, HM. Shankaranarayana Rao, Sharada mandir, Mysore.
Recommended Texts	Karnataka Abhijnana shakuntala Natakam , by Basavappa shastry, Sharada Mandira, 1973, Mysore-04.

Method of Evaluation:

Internal Assessment	End Semester Examination	Total	Grade
25	75	100	

Methods of Assessment:

Recall (K1) - Simple definitions, MCQ, Recall steps, Concept definitions

Understand/ Comprehend (K2) - MCQ, True/False, Short essays, Concept explanations, Short summary or overview

Application (K3) - Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain

Analyse (K4) - Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge

Evaluate (K5) - Longer essay/ Evaluation essay, Critique or justify with pros and cons

Create (K6) - Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

****[Follow the same pattern for all Courses/Papers]- **Course means Paper**

Mapping with Programme Outcomes:

Map **Course Outcomes (CO)** for each Course with **Programme Specific Outcomes (PSO)** in the 3-Point scale of 1, 2, 3 (Strong, Medium and Low)

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	2	3	2	3	2	3	1	2
CO 2	3	3	1	3	3	2	3	2
CO 3	3	2	3	3	3	2	1	3
CO 4	3	3	3	3	3	3	2	3
CO 5	3	3	3	2	2	1	3	1