M.D. UNIVERSITY, ROHTAK

SCHEME OF EXAMINATION & SYLLABUS
(Under NEP-2020)

Bachelor of Technology 1st year
(Common to all the B.Tech. Programmes)

'H' Scheme (Under NEP-2020)
Effective from Academic Session 2025-26

1. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical (Lab) per week	1 credit

2. Structure of Undergraduate Engineering program:

Sr No	Category
1	Humanities and Social Sciences including Management courses
2	Basic Science Courses
3	Engineering Science courses
4	Program Core Courses (Branch specific)
5	Professional Elective courses relevant to chosen specialization/branch
6	Open Elective Courses (from Humanities, Technical Emerging or other Subjects)
7	Project work, Seminar and Internship in Industry or elsewhere
8	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition] etc. (non-credit)

3. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
HSMC	Humanities & Social Science Courses
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Program Core Courses
PEC	Program Elective Courses
OEC	Open Elective Courses
MC	Mandatory Courses
PROJ/SEM	Employment Enhancement Courses (Project/Summer Internship/Seminar)

PROGRAM OUTCOMES (PO)

Engineering Graduates will be able to:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

M.D. UNIVERSITY, ROHTAK

SCHEME OF EXAMINATION & SYLLABUS

Bachelor of Technology

H-Scheme (Under NEP-2020) effective from 2025-26

SEMESTER 1st (COMMON TO ALL THE BTECH PROGRAMMES)

Sr. No.	Category	Course Notation	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Scheme (Marks)				Duration of Exam (Hours)
					L	T	P			Mark of Class work	Theory	Practical	Total	
1	Basic Science Course	C	Refer to Table 1	Mathematics-I	3	1	0	4	4	30	70	0	100	3
2	Basic Science Course	A	Refer to Table 2	Physics	3	1	0	4	4	30	70	0	100	3
		B	25BSC-CH-101H	Chemistry	3	1	0	4	4	30	70	0	100	3
3	Engineering Science Course	A	25ESC-CSE101H	Programming for Problem Solving	3	0	0	3	3	25	50	0	75	3
		B	25ESC-EE-101H	Basics of Electrical & Electronics Engineering	3	0	0	3	3	25	50	0	75	3

4	Engineering Science Course	A	25ESC-ME-101H	Engineering Graphics and Design	0	0	4	4	2	15	0	35	50	3
	Engineering Science Course	B	25ESC-ME-102H	Workshop Technology	2	0	0	2	2	15	35	0	50	3
5	Engineering Science Course	A	Refer to Table 3	Refer to Table 3 (Basics of Engineering courses)*	3	0	0	3	3	25	50	0	75	3
		B	25LC-ME-101H	Workshop Technology Lab	0	0	4	4	2	15	0	35	50	3
6	Basic Science Course	A	Refer to Table 2	Physics Lab	0	0	2	2	1	5	0	20	25	3
		B	25LC-CH-101H	Chemistry Lab	0	0	2	2	1	5	0	20	25	3
7	Engineering Science Course	A	25LC-CSE101H	Programming for Problem Solving lab	0	0	2	2	1	5	0	20	25	3
		B	25LC-EE-101H	Basics of Electrical & Electronics Engineering lab	0	0	2	2	1	5	0	20	25	3
8	Humanities and Social science including Managemen	A	25HSMC-ENG-101H	English	2	0	0	2	2	15	35	0	50	3
		B	25HSMC-UHV-101H	Universal Human Values	3	0	0	3	3	25	50	0	75	3

	t courses													
9	Humanities and Social science including Management courses	A	25LC-ENG-101H	Language Lab	0	0	2	2	1	5	0	20	25	3
		B	25LC-ME-102 H	Design Thinking and Idea Lab	0	0	2	2	1	5	0	20	25	3
TOTAL CREDIT									**21/21**	**155/155**	**275/275**	**95/95**	**525/525**	

M.D. UNIVERSITY, ROHTAK

SCHEME OF EXAMINATION & SYLLABUS

Bachelor of Technology

H-Scheme (Under NEP-2020) effective from 2025-26

SEMESTER 2nd (COMMON TO ALL THE BTECH PROGRAMMES)

Sr. No.	Category	Course Notation	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Scheme (Marks)				Duration of Exam (Hours)
					L	T	P			Mark of Class work	Theory	Practical	Total	
1	Basic Science Course	C	Refer to Table 1	Mathematics-II	3	1	0	4	4	30	70	0	100	3
2	Basic Science Course	A	Refer to Table 2	Physics	3	1	0	4	4	30	70	0	100	3
		B	25BSC-CH-101H	Chemistry	3	1	0	4	4	30	70	0	100	3
3	Engineering Science Course	A	25ESC-CSE-101H	Programming for Problem Solving	3	0	0	3	3	25	50	0	75	3
		B	25ESC-EE-101H	Basics of Electrical & Electronics Engineering	3	0	0	3	3	25	50	0	75	3
4	Engineering Science Course	A	25ESC-ME-101H	Engineering Graphics and Design	0	0	4	4	2	15	0	35	50	3

	Engineering Science Course	B	25ESC-ME-102H	Workshop Technology	2	0	0	2	2	15	35	0	50	3
5	Engineering Science Course	A	Refer Table 3	Refer Table 3 (Basics of Engineering courses)*	3	0	0	3	3	25	50	0	75	3
		B	25LC-ME-101H	Workshop Technology Lab	0	0	4	4	2	15	0	35	50	3
6	Basic Science Course	A	Refer to Table 2	Physics Lab	0	0	2	2	1	5	0	20	25	3
		B	25LC-CH-101H	Chemistry Lab	0	0	2	2	1	5	0	20	25	3
7	Engineering Science Course	A	25LC-CSE-101H	Programming for Problem-Solving Lab	0	0	2	2	1	5	0	20	25	3
		B	25LC-EE-101H	Basics of Electrical & Electronics Engineering Lab	0	0	2	2	1	5	0	20	25	3
8	Humanities and Social science including Management courses	A	25HSMC-ENG-101H	English	2	0	0	2	2	15	35	0	50	3
		B	25HSMC-UHV-101H	Universal Human Values	3	0	0	3	3	25	50	0	75	3

9	Humanities and Social science including Management courses	A	25LC-ENG-101H	Language Lab	0	0	2	2	1	5	0	20	25	3
		B	25LC-ME-102 H	Design Thinking and Idea Lab	0	0	2	2	1	5	0	20	25	3
								TOTAL CREDIT	**21/21**	**155/155**	**275/275**	**95/95**	**525/525**	

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts each having equal marks from all units and remaining eight questions of equal marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Important Notes:

1. Significance of the Course Notations used in this scheme

C = These courses are common to both the groups (Group-A and Group –B).

A = Other compulsory courses for Group-A.

B = Other compulsory courses for Group-B

Course code for different branches

Table 1

Sr. No.	Course Name	Course Code	Branch
1.	Mathematics-I (Calculus and Matrices)	25BSC-MATH-101H	• Mechanical Engineering • Electronics and Communication Engineering • Civil Engineering • Electrical Engineering • Electronics and Electrical Engineering • Printing Technology • Automobile Engineering • Mechanical and Automation Engineering • Electronics and Computer Engineering • Fire Technology and Safety Engineering • Electronics and Telecommunication Engineering • Mining Engineering • Chemical Engineering
2.	Mathematics-I (Calculus and Linear Algebra)	25BSC-MATH-103H	• Computer Science Engineering • Computer Science and Technology • Information Technology • Computer Science and Information Technology • Other allied branches of Computer Science
3.	Mathematics-I (Series, Matrices and Calculus)	25BSC-MATH-105H	• Bio-Technology Engineering • Textile Technology • Textile Chemistry • Fashion and Apparel Engineering

			• Any other branch with eligibility for admission with physics, chemistry and biology
4.	Mathematics-II (Multivariable Calculus, Differential equations and Complex Analysis)	25BSC-MATH-102H	• Mechanical Engineering • Electronics and Communication Engineering • Civil Engineering • Electrical Engineering • Electronics and Electrical Engineering • Printing Technology • Automobile Engineering • Mechanical and Automation Engineering • Electronics and Computer Engineering • Fire Technology and Safety Engineering • Electronics and Telecommunication Engineering • Mining Engineering • Chemical Engineering
5.	Mathematics-II (Probability and Statistics)	25BSC-MATH-104H	• Computer Science Engineering • Computer Science and Technology • Information Technology • Computer Science and Information Technology • Other allied branches of Computer Science
6.	Mathematics-II (Vector Calculus, Differential equations and Laplace Transform)	25BSC-MATH-106H	• Bio-Technology Engineering • Textile Technology • Textile Chemistry • Fashion and Apparel Engineering • Any other branch with eligibility for admission with physics, chemistry and biology

Table 2

Sr. No.	Course Name	Course Code	Branch
1.	Introduction to Electromagnetic Theory (IEMT)	25BSC-PHY-101H	• Electronics and Communication Engineering • Electronics and Computer Engineering • Electronics and Telecommunication Engineering • Mechanical Engineering • Fire Technology and Safety Engineering • Mechanical and Automation Engineering • Automobile Engineering • Mining Engineering • Chemical Engineering
2.	Oscillations, Waves and Optics	25BSC-PHY-102H	• Electrical Engineering • Electronics and Electrical Engineering
3.	Semiconductor Physics	25BSC-PHY-103H	• Computer Science Engineering • Computer Science and Technology • Information Technology

			• Computer Science and Information Technology • Other allied branches of Computer Science
4.	Mechanics	25BSC-PHY-104H	• Civil Engineering • Printing Technology
5.	Optics and Quantum Mechanics	25BSC-PHY-105H	• Bio-Technology Engineering • Textile Technology • Textile Chemistry • Fashion and Apparel Engineering
6.	Introduction to Electromagnetic Theory (IEMT) Lab	25LC-PHY-101H	• Electronics and Communication Engineering • Electronics and Computer Engineering • Electronics and Telecommunication Engineering • Mechanical Engineering • Fire Technology and Safety Engineering • Mechanical and Automation Engineering • Automobile Engineering • Mining Engineering • Chemical Engineering
7.	Oscillations, Wave and Optics Lab	25LC-PHY-102H	• Electrical Engineering • Electronics and Electrical Engineering
8.	Semiconductor Physics Lab	25LC-PHY-103H	• Computer Science Engineering • Computer Science and Technology • Information Technology • Computer Science and Information Technology • Other allied branches of Computer Science
9.	Mechanics Lab	25LC-PHY-104H	• Civil Engineering • Printing Technology
10.	Optics and Quantum Mechanics Lab	25LC-PHY-105H	• Bio-Technology Engineering • Textile Technology • Textile Chemistry

			• Fashion and Apparel Engineering

Table 3

Sr. No.	**Course Name**	**Course Code**
1	Biotechnology for Human Welfare	25ESC-BT-101- H
2	Basics of Civil Engineering	25ESC-CE-101-H
3	Basics of Chemical Engineering	25ESC-CHE-101-H
4	Basics of Fashion Technology	25ESC-FAT-101-H
5	Basics of Fire Technology	25ESC-FT-101-H
6	Basics of Material science	25ESC-MS-101-H
7	Basics of Mechanical Engineering	25ESC-ME-103-H
8	Basics of Printing Technology	25ESC-PT-101-H
9	Basics of Textile Technology	25ESC-TT-101-H
10	Basics of Textile Chemistry	25ESC-TC-101-H
11	Basics of Fashion and Apparel Engineering	25ESC-FAE-101-H
12	Introduction to IoT	25ESC-IOT-101H

May be extended depending on Engineering Branches

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BACHELOR OF TECHNOLOGY
1ST YEAR SYLLABUS
(Common to all the B.Tech Programmes)

H-SCHEME (Under NEP-2020)
Effective from 2025-26

MATHEMATICS-I (CALCULUS AND MATRICES)

Coursecode	25BSC-MATH-101H				
Category	Basic Science Course				
Coursetitle	**Mathematics-I (Calculus and Matrices)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester I
	3	**1**	**0**	**4**	
Classwork	30 Marks				
Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

- To provide students with a clear understanding of calculus concepts, and their applications in solving engineering problems.
- To introduce students to the theory of sequences and series, including convergence tests and Fourier series.
- To help students grasp the fundamentals of multivariable differential calculus, including partial derivatives, extrema, and vector calculus concepts.
- To develop the ability to analyze and solve problems involving matrices, including determinants, rank, inverse, and systems of linear equations.
- To familiarize students with matrix concepts such as eigenvalues, eigenvectors and diagonalization.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: **Define** the concepts and terminology of calculus and matrices including maxima and minima, curvature, evolute and involutes, Beta and Gamma functions, sequence and series, Power series, Taylor series, Fourier series, partial derivatives, total derivative, determinants, rank of a matrix, normal form, eigenvalues and eigenvectors, etc.

CO2: **Understand** the significance and contribution of various concepts/ theorems/ methods such as Rolle's Theorem, Lagrange's mean value Theorem, Cauchy's mean value Theorem,Taylor's and Maclaurin's Theorem with remainder, convergence of sequence and series, Euler's Theorem, Lagrange's method of undetermined multipliers, gradient, directional derivatives, curl and divergence, Cayley Hamilton Theorem, etc.

CO3: **Apply** the concept of differential calculus to find evolute and involute, maxima and minima of functions and integral calculus to evaluate surface area and volume of solid of revolutions.

CO4: **Classify** and **justify** the nature of series.

CO5: **Analyze** the solution of system of linear equations and **evaluate** eigenvalues and

eigenvectors of a matrix.

Note:
Examiner will set 9 questions in all with two questions from each unit and one question covering all sections which will be Q.1. This Q1 is compulsory and of short answer type. Each question carries equal marks (14 marks). Examinee have to attempt 5 questions in total selecting at least one from each unit.

UNIT- I

Calculus: Indeterminate forms and L'Hospital's rule, Maxima and minima of a single variable function, Rolle's Theorem, Lagrange's mean Value Theorem, Cauchy's mean value Theorem, Taylor's and Maclaurin's Theorems with remainder, Taylor and Maclaurin series, Curvature, Evolutes and involutes, Beta and Gamma functions and their properties, Applications of definite integrals to evaluate surface areas and volumes of solid of revolutions.

UNIT-II

Sequences and Series: Convergence of sequence and series, Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test, Raabe's test, Logarithmic test, Gauss test, Cauchy's Integral test, Alternating series, Absolute and conditionally convergent series, Power series, Fourier series, Half range sine and cosine series.

UNIT-III

Multivariable Differential Calculus: Limit, continuity and partial derivatives, Homogeneous function, Euler's Theorem, Total derivative, Tangent plane and normal line, Maxima, minima and saddle points, Method of Lagrange's multipliers, Gradient, Directional derivatives, Curl and divergence.

UNIT-IV

Matrices: Determinants,Inverse and rank of a matrix, Normal form, Echelon form, System of linear equations, Symmetric, skew-symmetric and orthogonal matrices, Orthogonal transformation, Eigenvalues and eigenvectors, Cayley-Hamilton Theorem, Diagonalization of matrices.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		-	-	-	-	-	-	-	-	1
CO2	1	2		-	-	-	-	-	-	-	-	1

CO3	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**3**	**3**		**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO5	**3**	**3**			**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Reference/ Text Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Veera Rajan T., Engineering Mathematics for first year, Tata McGraw-Hill Publishing Company Limited.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.
5. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
6. P. Sivaramakrishna Das and C. Vijyakumari, Engineering Mathematics, Pearson Education.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

MATHEMATICS-I (CALCULUS AND LINEAR ALGEBRA)

Course code	25BSC-MATH-103H				
Category	Basic Science Course				
Course title	**Mathematics-I (Calculus and Linear Algebra)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I
	3	**1**	**0**	**4**	
Classwork	30Marks				
Examination	70 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

- To enable students to understand and apply mathematical tools from calculus and linear algebra that are essential for solving engineering problems.
- To introduce students to foundational calculus concepts such as mean value theorems, Taylor and Maclaurin series, curvature, and special functions.

- To build a strong understanding of matrix algebra, equipping students to handle systems of linear equations.
- To understand the structure of vector spaces, subspaces, basis, and dimension, and apply these concepts to analyze linear transformations and their matrix representations.
- To familiarize students with concepts such as eigenvalues, eigenvectors, and inner product spaces.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: **Define** the concepts and terminology of calculus and linear algebra including curvature, beta and gamma functions, matrices, rank of matrix, normal form, vector spaces, linear transformation, inner product spaces, eigenvalues, eigenvectors, etc.

CO2: **Understand** the significance and contribution of various theorems and methods such as Rolle's Theorem, Lagrange's mean value Theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's Theorems, Gauss elimination method, Rank-Nullity Theorem, Gram-Schmidt orthogonalization process, etc.

CO3: **Apply** the ideas of differential and integral calculus to notions of evolutes, maxima, minima, volume and surface area of solid of revolution.

CO4: **Analyze** and **evaluate** the solution of system of linear equations.

CO5: **Evaluate** eigenvalues, eigenvectors of matrix and basis and dimension of vector spaces, inner product spaces.

Note:

Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Calculus: Indeterminate forms and L' Hospital's rule, Maxima and Minima of single variable function, Rolle's Theorem, Lagrange's mean value Theorem, Cauchy's mean value Theorem, Taylor's and Maclaurin's Theorems with remainder, Taylor and Maclaurin series, Curvature, Evolutes and Involutes, Beta and Gamma functions and theirproperties, Applications of definite integrals to evaluate surface areas and volumes of solid of revolutions.

UNIT-II

Matrices: Matrices, Vectors: addition and scalar multiplication, Matrix multiplication, Determinants, Elementary transformations, Inverse of a matrix, Rank of a matrix, Normal form, Echelon form, Linear systems of equations, Linear Independence, Cramer's Rule, Gauss elimination and Gauss-Jordanelimination.

UNIT-III

Vector spaces I: Vector Space, Subspaces, Linear span of set, Linear dependence of vectors, Basis, Dimension, Linear transformations (maps), Range and kernel of a linear map, Rank and nullity, Inverse of a linear transformation, Rank nullity Theorem, Matrix associated with a linear map, Composition of linear maps.

UNIT-IV

Vector spaces II: Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric and Orthogonal Matrices, Eigen bases, Diagonalization, Inner product spaces, Orthogonal set, Orthogonal complement, Orthonormal set of vectors, Gram-Schmidt orthogonalization.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		-	-	-	-	-	-	-	-	1
CO2	1	2		-	-	-	-	-	-	-	-	1
CO3	3	3	3	-	-	-	-	-	-	-	-	1
CO4	3	3		3	-	-	-	-	-	-	-	1
CO5	3	3		3	-	-	-	-	-	-	-	1

Reference/Text Books:

1. Reena Garg, AICTE's Prescribed Textbook: Mathematics-I (Calculus and Linear Algebra), Khanna Book Publishing Co.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, PearsonEducation.
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley &Sons.
4. D. Poole, Linear Algebra: A Modern Introduction, BrooksCole.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
7. B.S. Grewal, Higher Engineering Mathematics, KhannaPublishers.
8. V. Krishnamurthy, V.P. Mainra and J. L. Arora, An introduction to Linear Algebra, Affiliated East– West Press Privatelimited.

MATHEMATICS -I (SERIES, MATRICES AND CALCULUS)

Coursecode	25BSC-MATH-105H				
Category	Basic Science Course				
Coursetitle	**Mathematics-I (Series, Matrices and Calculus)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I
	3	**1**	**0**	**4**	
Classwork	30 Marks				
Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

During the duration of the course, students will be made to learn to:

- To study the various test to find the convergence and divergence nature of infinite series (positive and alternative series, both) that is essential in engineering.
- Study the concept of rank of a matrix in details and various matrix methods to find the analytical solution of the linear system of equations, eigenvalue and eigenvectors problem of a Matrix. Also find the inverse of a matrix using Cayley Hamilton Theorem.
- The tools of differentiation and integration of functions of univariate and multivariate that are used in various techniques dealing engineering problems, like determine the maxima and minima of a function.
- To apply differential and integral calculus to find volume of solids and surface area of solids of revolution. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: **Define** the concepts and terminology of series, matrices and calculus including convergence and divergence of sequence and series, rank of a matrix, normal form, eigenvalues and eigenvectors, limit, continuity and differentiability of function, successive differentiation, Taylor's and Maclaurin's Series, partial derivatives, maxima and minima, double integral, triple integral, Beta and Gamma functions, etc.

CO2: **Understand** the significance and contribution of various concepts/ theorems/ methods including tests for convergence and divergence of series, Cayley Hamilton Theorem, Leibnitz Theorem, Euler's Theorem, Lagrange's method of undetermined multipliers, multiple integrals, Change of order of Integration, etc.

CO3: **Classify** and **justify** the nature of infinite series and alternating series.

CO4: **Analyze** the solution of system of linear equations and **evaluate** eigenvalues and eigenvectors of a matrix.

CO5: **Apply** the concept of differential calculus to find the maxima and minima of function of two variables.

Note:
Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Infinite series: Introduction of Arithmetic and Geometric Series**,** Convergence and divergence, Comparison Tests, D'Alembert's Ratio Test, Raabe's Test, Logarithmic and Cauchy root Tests, Alternating Series, Absolute and Conditional Convergence.

UNIT-II

Matrices & Its Application: Elementary Matrices, Elementary Transformations, Inverse using elementary transformations, Rank of a matrix, Normal form of a matrix, Linear dependence and independence of vectors, Consistency of linear system of equations, Linear and Orthogonal Transformations, Eigenvalues and Eigenvectors, Properties of eigenvalues, Cayley-Hamilton Theorem.

UNIT-III

Differential Calculus: Limit, Continuity and Differentiability of function of single variable, Successive Differentiation, Leibnitz Theorem, Taylor's and Maclaurin's Series for Single Variable function, Partial derivatives, Homogeneous functions, Euler's Theorem, Jacobian, Maxima-Minima of function of two variables, Lagrange's Method of undetermined multipliers.

UNIT-IV

Integral Calculus: Basic concepts of integration and properties of definite integrals, Applications of single integration to find surface area and volume of solids of revolution, Double integral, Change of order of integration, Double integral in Polar Co-ordinates, Triple integral, Beta and Gamma functions.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	-	-	-	-	-	-	-	3
CO2	3	3	2	1	-	-	-	-	-	-	-	3
CO3	3	3	2	2	-	-	-	-	-	-	-	3
CO4	3	3	3	1	-	-	-	-	-	-	-	3

CO5	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

Reference/Text Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill Publishing Company Limited.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.
5. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
6. P. Sivaramakrishna Das and C. Vijyakumari, Engineering Mathematics, Pearson Education.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

MATHEMATICS-II (MULTIVARIABLE CALCULUS, DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS)

Coursecode	25BSC-MATH-102H				
Category	Basic Science Course				
Coursetitle	**Mathematics-II (Multivariable Calculus, Differential equations and Complex Analysis)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester --II
	3	**1**	**0**	**4**	
Classwork	30 Marks				
Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

- To equip engineering students with methods in multivariable calculus, differential equations, and complex variables essential for analyzing and solving practical engineering problems.
- To develop a strong understanding of multiple integrals and their applications in calculating areas, volumes, and physical properties like center of mass and gravity.

- To introduce methods for solving ordinary differential equations, including special functions such as Legendre polynomials and Bessel functions, relevant in engineering contexts.
- To familiarize students with the fundamentals of complex variable differentiation, analytic functions, and conformal mappings.
- To build competence in complex variable integration techniques, including contour integrals and residue theory, for evaluating complex integrals.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: **Define** the concepts and terminology of vector calculus, multivariable calculus and differential equations including multiple integrals, ordinary differential equations of first and higher order, Centre of mass and gravity, line integrals and surface integrals, elementary complex functions, analytic function, harmonic function, Mobius transformations, contour integrals, singularities, residues, etc.

CO2: **Understand** the significance and contribution of various concepts/ theorems/ methods such as change of order, change of variables, theorems of Green, Gauss and Stokes, Method of variation of parameters, Legendre polynomials, Cauchy-Riemann equations, conformal mappings, Cauchy-Goursat Theorem, Liouville's Theorem and Maximum-Modulus Theorem, Cauchy's Residue Theorem, etc.

CO3: **Apply** the concept of multiple integrals to find area and volumes.

CO4: **Solve** the different problems of exact, linear and Bernoulli's equations, second order linear differential equations with constant coefficients, method of variation of parameters, Cachy-Euler equation, power series solutions, Legendre polynomials, Bessel functions of the first kind and their properties

CO5: **Analyze and evaluate** thecomplex differentiation and complex integration problems.

Note:

Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Multivariable Integral Calculus: Multiple Integration: Double integrals (Cartesian), Triple integrals (Cartesian), Change of order of integration in double integrals, Change of variables, Applications of double and triple integral to find areas and volumes, Centre of mass and Gravity (constant and variable densities), Scalar line integrals, Vector line integrals, Scalar surface integrals, Vector surface integrals, Theorems of Green, Gauss and Stokes (without proof).

UNIT-II

Ordinary differential equations of first and higher orders: Exact, Linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, Second order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy-Euler equation, Power series solutions, Legendre polynomials, Bessel functions of the first kind and their properties.

UNIT-III

Complex Variable – Differentiation: Elementary complex functions (exponential, trigonometric, logarithm) and their properties, Limit, Continuity and Differentiability, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Finding harmonic conjugate, Conformal mappings, Mobius transformations and their properties.

UNIT-IV

Complex Variable – Integration: Contour integrals, Cauchy-Goursat Theorem (without proof), Cauchy's Integral formula (without proof), Liouville's Theorem and Maximum-Modulus Theorem (without proof), Taylor series, Zeros of analytic functions, Singularities, Laurent's series, Residues, Cauchy's Residue Theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		-	-	-	-	-	-	-	-	-
CO2	1	2		-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	1
CO4	3	3	3	-	-	-	-	-	-	-	-	1
CO5	3	3		3	-	-	-	-	-	-	-	1

Reference/Text Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, Wiley India.
4. S. L. Ross, Differential Equations, Wiley India.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India.
6. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.
7. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi

Publications.
8. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
9. P. Sivaramakrishna Das and C. Vijyakumari, Engineering Mathematics, Pearson Education.
10. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.

MATHEMATICS-II (PROBABILITY AND STATISTICS)

Course code	25BSC-MATH-104H				
Category	Basic Science Course				
Course title	**Mathematics-II (Probability and Statistics)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester -II
	3	**1**	**0**	**4**	
Classwork	30Marks				
Examination	70 Marks				
Total	100Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

- To equip engineering students with essential probability and statistics concepts that help them analyze uncertainty and make informed decisions in engineering problems.
- To introduce students to fundamental probability ideas including conditional probability, random variables and key discrete probability distributions.
- To develop understanding of continuous and bivariate probability distributions and their applications in real-world engineering scenarios.
- To familiarize students with key statistical measures like central tendency, moments, skewness, and kurtosis, and develop skills in analyzing data relationships through correlation and regression.
- To develop the ability to perform and interpret hypothesis tests for practical data.

Course Outcomes (CO):

By the end of the Course, Students will be able to:

CO1: **Define** the concepts and related terminology of probability and statistics including conditional probability, random variables, probability distributions, measures of central tendency, skewness, Kurtosis, correlation, regression, hypothesis testing, etc.

CO2: **Understand** the contribution and significance of random variables, probability

distributions, Chebyshev's inequality, moments, correlation, method of least square, tests of significance, etc.

CO3: **Solve** different problems involving the concept of random variables, probability distributions, expectation, variance, moments, skewness and kurtosis.

CO4: **Analyze** the strengths of relationship between variables and apply the method of least square in curve fitting and regression analysis.

CO5: **Formulate** null and alternative hypotheses and **apply** statistical methods for testing the hypothesis for small and large samples.

Note:

Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Random variables and discrete probability distributions: Probability spaces, Conditional probability, Bayes' rule, Discrete random variables, Independent random variables, Expectation of discrete random variables, Sums of independent random variables, Moments, Variance of a sum, Chebyshev's Inequality, Binomial distribution, The multinomial distribution, Poisson approximation to the binomial distribution, Infinite sequences of Bernoullitrials.

UNIT-II

Continuous and Bivariate probability distribution: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities, Bivariate distributions and their properties, Conditional densities, Distribution of sums and quotients.

UNIT-III

Basic Statistics: Measures of Central tendency: Moments, Skewness and Kurtosis, Evaluation of statistical parameters for three Probability distributions: Binomial, Poisson and Normal, Correlation: Correlation coefficient, Rank correlation; Regression, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more generalcurves.

UNIT-IV

Applied Statistics: Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations; Small samples: Test for single mean, difference ofmeans; Test for ratio of variances, Chi-square test for goodness of fit and independence ofattributes.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		-	-	-	-	-	-	-	-	1
CO2	1	2		-	-	-	-	-	-	-	-	1
CO3	3	3	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	2	-	-	-	-	-	-	-	1
CO5	3	3		3	-	-	-	-	-	-	-	1

Reference/Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley &Sons.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal BookStall.
3. S. Ross, A First Course in Probability, PearsonEducation.
4. W. Feller, An Introduction to Probability Theory and its Applications,Wiley.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications.
6. B.S. Grewal, Higher Engineering Mathematics, KhannaPublishers.
7. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill Publishing Company Limited.

MATHEMATICS-II (VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORM)

Coursecode	25BSC-MATH-106H				
Category	Basic Science Course				
Coursetitle	**Mathematics-II (Vector Calculus, Differential equations and Laplace Transform)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-II
	3	**1**	**0**	**4**	
Classwork	30 Marks				
Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

- To familiarize with the concept of the three fundamental quantities-Gradient, Divergence and Curl; and three integral quantities- Line Integral, surface and volume Integral along with their physical interpretation in vector calculus and their usage.
- Understanding the various analytical techniques to evaluate the exact solution of ODE (First and higher order, both) and some specific ODE used in Electric circuit and Thermodynamics.
- Learn the concept of Laplace transform and inverse Laplace transform of a function, Convolution of two function and application of Laplace Transform to solve ODE that is essential in most branches of engineering.
- Formulation, Classification and solution methodologies for first (linear and non-linear, both) and second order PDE with applications in engineering.

Course Outcomes (CO):

By the end of the Course, Students will be able to:

CO1: **Define** the concepts and terminology of vector calculus, differential equations of first and higher order, partial differential equations including gradient, directional derivatives, curl, divergence, line integrals and surface integrals, Laplace and inverse Laplace transform and Formulation and classification of PDE etc.

CO2: **Understand** the significance and contribution of various concepts/ theorems/ methods such as Green, Stoke's and Gauss Theorems, Method of variation of parameters, Convolution theorem, Charpit's method and method of separation of variables.

CO3: **Apply** the concept of Newton Law of cooling, Laplace transformation and Charpit's Method to find the solution of ordinary and partial differential equation.

CO4: **Solve** the different problems of exact, linear and Bernoulli's equations, second order linear differential equations with constant coefficients, Lagrange's linear partial differential equation and first order non-linear partial differential equation.

CO5: **Analyze and evaluate** theLaplace transformation of various mathematical functions.

Note:

Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Vector Calculus: Differentiation of vectors, Scalar and vector point functions, Gradient of a scalar field and Directional derivative, Divergence and Curl of a vector field and their physical interpretations, Integration of vectors, Line integral, Surface integral, Volume integral, Green, Stoke's and Gauss theorems (without proof) and their applications.

UNIT-II

Ordinary Differential Equations: Exact differential equations, Equations reducible to exact differential equations, Applications of differential equations of first order & first degree to simple electric circuits, Newton's law of cooling, Heat flow and Orthogonal trajectories,

Linear Differential equations of second and higher order, Complete solution, Complementary function and Particular integral, Method of variation of parameters to find particular integral.

UNIT-III

Laplace Transform and its Applications: Laplace transforms of elementary functions, Properties of Laplace transform, Existence conditions, Laplace Transform of derivatives, Laplace Transform of integrals, Multiplication by t^n, Division by t, Evaluation of integrals by Laplace transform, Laplace transform of unit step function, Unit impulse function and Periodic function, Inverse transform, Convolution theorem, Application to linear differential equations.

UNIT-IV

Partial Differential Equations: Formation of partial differential equations, Classification of second order PDE, Lagrange's linear partial differential equation, First order non-linear partial differential equation, Charpit's method, Method of separation of variables.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	-	-	-	-	-	-	-	3
CO2	3	3	2	1	-	-	-	-	-	-	-	3
CO3	3	3	2	2	-	-	-	-	-	-	-	3
CO4	3	3	3	1	-	-	-	-	-	-	-	3
CO5	3	3		3	-	-	-	-	-	-	-	1

Reference/Text Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Ramana B.V., Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
6. P. Sivaramakrishna Das and C. Vijyakumari, Engineering Mathematics, Pearson Education.
7. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, Wiley India.
8. S. L. Ross, Differential Equations, Wiley India.

9. R. K, Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publication House Private Limited.

INTRODUCTION TO ELECTROMAGNETIC THEORY (IEMT)

Course code	25BSC-PHY-101H				
Category	Basic Science Course				
Course title	**Introduction to Electromagnetic Theory (IEMT)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester I/II
	3	**1**	**0**	**4**	
Branches (B.Tech.)	ϒ Electronics and Communication Engineering ϒ Electronics and Computer Engineering ϒ Electronics and Telecommunication Engineering ϒ Mechanical Engineering ϒ Fire Technology and Safety Engineering ϒ Mechanical and Automation Engineering ϒ Automobile Engineering				
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

1. To provide knowledge of coordinate systems and electrostatics.
2. To provide good knowledge of magnetism and magnetic materials.
3. To introduce the students to Maxwell's equations and their significance.
4. To study the propagation of EM waves in different media.

COURSE OUTCOMES (CO):

After completing the course, students will be able to:

CO: 1 Understand the basic mathematical concepts related to electromagnetic vector fields. Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density.

CO: 2 Learn the concepts of magnetostatics, magnetic flux density, scalar and vector potential and their applications.

CO: 3 Understand the concepts related to Faraday's law, induced emf and Maxwell's equations.

CO: 4 Apply Maxwell's equations to solutions of problems relating to plane wave propagation in different media.

Note: Examiner will set 9 questions in all. Q.1 is compulsory and of short answers type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Students have to attempt 5 questions in total selecting at least one from each unit.

UNIT– I

Electrostatics in vacuum and linear dielectric medium

Introduction to co-ordinate systems – rectangular and spherical co-ordinate systems (Qualitative), gradient of a scalar field, divergence and curl of a vector field- their physical interpretation, Gauss's law and its applications to determine the electric field on axial and equatorial line of dipole, electric field and electrostatic potential for a charge distribution (discrete and continuous).

Electrostatic field: conditions for electrostatic field, divergence and curl of electrostatic field, Laplace and Poisson's equations, Boundary conditions of electric field and electrostatic potential, energy of a charge distribution (for discrete and continuous), electrostatic field and potential of a dipole (Multipole expansion (qualitative)), Field lines of pure and physical dipole (qualitative), Bound charges: surface bound charge and volume bound charge, Field of polarized object, electric displacement: Gauss Law in the presence of dielectrics.

UNIT-II

Magnetostatics

Bio-Savart's law and its application to determine magnetic field due to finite and infinite current carrying wire, conditions for magnetostatic fields, work done by magnetic field, divergence and curl of magnetostatic fields, current densities, Ampere's Law, Vector potential.

Magnetostatics in a linear magnetic medium: magnetization and associated bound currents, field of magnetized object, the auxiliary field **H**;Ampere's Law in magnetised materials, Effect of magnetic field on atomic orbits, boundary conditions on **B**, Magnetic susceptibility and permeability, (qualitative), domain theory of ferromagnetic materials, Hysteresis curve.

UNIT-III

Faraday's law and Maxwell's equations

Faraday's law in terms of EMF produced by changing magnetic flux, equivalence of Faraday's law and motional EMF, Lenz's law, battery method, Differential form of Faraday's law, energy stored in a magnetic field.

Electromagnetic braking and its applications, modified equation for the curl of magnetic field to satisfy continuity equation- displacement current and magnetic field arising from time-dependent electric field; Maxwell's equations in vacuum and matter, Poynting Theorem and Poynting vector.

UNIT-IV

Electromagnetic waves

Electromagnetic waves, characteristics of electromagnetic waves, the wave equation of plane electromagnetic waves in vacuum, their transverse nature, relation between electric and magnetic fields, Energy and momentum of electromagnetic waves; Resultant pressure, Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence, Reflection and transmission coefficients.

Alternative NPTEL/SWAYAM Course:

Sr. No.	NEPTEL course name	Instructor	Host Institute
1.	INTRODUCTION TO ELECTROMAGNETIC THEORY	PROF. MANOJ HARBOLA	IIT KANPUR

Course Articulation Matrix

COs	Programme Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2				1	1					2
CO2	3	2				2	1					2
CO3	3	2				2	1					2
CO4	3	2					1			1		2

Suggested Reference Books:

1. AICTE's prescribed textbook: Physics (Introduction to Electromagnetic Theory) with lab manual, Khanna Book Publishing Company.
2. David Griffiths, Introduction to Electrodynamics, Pearson Education.
3. ICFAI, Electricity and Magnetism, Pearson Education.
4. Halliday and Resnick, Physics.
5. W. Saslow: Electricity, magnetism and light.
6. S.K. Chatterjee, Fundamentals of Electricity and Magnetism- PHI.

7. A Mahajan, A Rangwala, Electricity and Magnetism

OSCILLATIONS, WAVES AND OPTICS

Coursecode	25BSC-PHY-102H				
Category	Basic Science Course				
Coursetitle	**Oscillations, WavesandOptics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**1**	**0**	**4**	
Branches (B. Tech.)	ϒ Electrical Engineering ϒ Electronics and Electrical Engineering				
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

1. To develop a basic understanding of different types of oscillations.
2. To acquaint the students with the fundamentals of wave propagation and its applications in day-to-day physical phenomena.
3. To have a basic understanding of the interference phenomenon and its applications.
4. To develop a basic understanding of lasers and optical fibres and their usage in communication, optoelectronic devices, medical, etc.

COURSE OUTCOMES (CO):

After completing the course, students will be able to:

CO: 1 Understand the concept of free, damped and forced oscillations and apply this knowledge to solve physical problems of oscillatory motions.

CO: 2 Understand travelling and standing waves in different media and their applications in the electrical transmission lines and musical instruments.

CO: 3. Understand interference as the superposition of waves from coherent sources derived from the same parent source. Analyse the interference by division of amplitude and wavefront.

CO: 4 Understand spontaneous and stimulated emission of radiation, optical pumping, population inversion, three-level and four-level lasers, Ruby, He-Ne laser in detail and their applications. Basics of optical fibre communication

Note: Examiner will set 9 questions in all. Q.1 is compulsory and of short answers type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Students have to attempt 5 questions in total selecting at least one from each unit.

UNIT- I
Oscillations

Simple Harmonic Motion: Basic characteristics of simple harmonic motion, oscillations of a spring-mass system; differential equation of SHM and its solution, examples of physical systems executing SHM: simple pendulum, LC circuit.

Damped Oscillations: Equation of motion, deadbeat motion, critically damped system, lightly damped system, energy, power, relaxation time, logarithmic decrement, quality factor, LCR circuit: differential equation and its solution.

Forced Oscillations and Resonance: Equation of motion, complete solution, steady state solution, resonance, sharpness of resonance, power dissipation, quality factor,Forced LCR circuit: differential equation and its solution.

UNIT – II
Waves

Wave Motion: Formation of a wave; Graphical representation of wave motion, relation between wave velocity, frequency and wavelength, phase, energy and intensity of wave, transported phase and phase difference, phase velocity, energy transported by progressive waves, intensity and the Inverse Square Law, one-dimensional wave equation.

Non-dispersivetransverseandlongitudinalwaves: Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching (by tapering and non-reflective layer), standing waves and their eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves.

UNIT – III
Interference

Interference of light waves: Huygens' principle, superposition of waves, interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, interference in thin films: parallel and wedge shaped, necessity of a broad source of light, Newton's rings experiment: determination of wavelength of light, refractive index of a medium and thickness of a thin transparent sheet, Michelson interferometer: determination of wavelength of light and resolution of spectral lines.

UNIT – IV
Laser and Optical Fibres

Laser: Einstein'stheory of matter radiation interaction: absorption, spontaneous and stimulated emission of radiation, relation between A and B coefficients, population inversion, pumping, two, three and four level laser systems, characteristics of laser beam, different types of lasers: gas laser (He-Ne), solid-state laser (Ruby), applications of lasers.

FibreOptics:Introduction,opticalfibreasadielectricwave guide: total internal reflection, numericalaperture and V-number,step and graded index fibres, applications of optical fibres.

Alternative NPTEL/SWAYAM Course:

Sr. No.	NEPTEL course name	Instructor	Host Institute
1.	WAVES AND OSCILLATIONS	PROF. M. S. SANTHANAM	IISER PUNE

Course Articulation Matrix

COs	Programme Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2										2
CO2	3	2	2			1	1					2
CO3	3	2										2
CO4	3	2					1					2

Reference books:

1. AICTE's Prescribed Textbook: Physics (Oscillations, Waves & Optics) with lab manual, Khanna Book Publishing Co., New Delhi.
2. Ghatak, "Optics", McGraw-Hill Education.
3. D. J. Griffiths, "Quantum mechanics", Pearson Education.
4. B.G. Streetman, "Solid State Electronic Devices", Pearson Education.
5. G. Main, "Vibrations and waves in physics", Cambridge University Press.
6. H. J. Pain, "The physics of vibrations and waves", Wiley.
7. E. Hecht, "Optics", Pearson Education.
8. O. Svelto, "Principles of Lasers", Springer Science & Business Media.

SEMICONDUCTOR PHYSICS

Course code	25BSC-PHY-103H				
Category	Basic Science Course				
Course title	**Semiconductor Physics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester I/II
	3	**1**	**0**	**4**	
Branches (B.Tech.)	ϒ Computer Science Engineering ϒ Information Technology ϒ Computer Science and Information Technology				
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

1. To give knowledge of shortcomings of classical mechanics and fundamentals of quantum mechanics.
2. To teach the origin of energy bands in solids and different types of electronic materials.
3. To introduce the students to semiconducting devices.
4. To develop a basic understanding of lasers and optical fibres and their usage in communication, optoelectronic devices, medical, etc.

COURSE OUTCOMES (CO):

After completing the course, students will be able to:

CO1: To analyse the difference between classical and quantum mechanical phenomena. Will have knowledge of the dual nature of matter and the fundamental equation of motion in quantum mechanics.

CO2: Understand the origin of energy bands in solids and analyse the differences between different types of electronic materials.

CO3: Understand the physics and applications of semiconducting materials. Knowledge of charge carrier flow mechanisms in semiconductors and optoelectronic devices.

CO4: Understand spontaneous and stimulated emission of radiation, optical pumping, population inversion, three-level and four-level lasers. Ruby, He-Ne laser in detail and its

applications.

Note: Examiner will set 9 questions in all. Q.1 is compulsory and of short answers type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Students have to attempt 5 questions in total selecting at least one from each unit.

UNIT - I
Introduction to Quantum Mechanics

Limitations of classical mechanics, Black body radiation phenomenon and Planck's radiation law, Photoelectric effect, Compton effect, Wave-particle duality, de- Broglie's hypothesis, Uncertainty principle,time-dependentandtime-independent Schrodinger wave equation, Physical significance of Wave function ψ, Particle in a 1-D box problem.

UNIT - II
Electronic Materials

Freeelectrontheory, Drude model, Kronig-Penny model (to introduce origin of band gap), Energy bandsinsolids,E-kdiagram,Directandindirect band gaps, typesofelectronicmaterials:metals,semiconductors and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

UNIT – III
Semiconductors

Intrinsic and extrinsic semiconductors, dependence of Fermi level on carrier-concentration andtemperature, carrier transport:diffusionanddrift,p-njunction, heterojunctions (Qualitative),metal-semiconductorjunction(Ohmic and Schottky), photoconductivity and photovoltaic effect, optoelectronics devices like photoconductive cell, photodiode, Solar cell and LED.

UNIT - IV
Lasers

Einstein'stheory of matter radiation interaction: absorption, spontaneous and stimulated emission of radiation, relation between A and B coefficients, population inversion, pumping, two, three and four level laser systems, characteristics of laser beam, different types of lasers: gas laser (He-Ne), solid-state laser (Ruby), semiconductor laser, applications of lasers.

Alternative NPTEL/SWAYAM Course:

Sr. No.	NEPTEL course name	Instructor	Host Institute
1.	FUNDAMENTALS OF SEMICONDUCTOR DEVICES	PROF. DIGBYJOY N. NATH	IISc BANGLORE

Course Articulation Matrix

COs	Programme Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2										2
CO2	3	2										2
CO3	3	2										2
CO4	3	2				2	1					2

Suggested Reference Books:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-HillInc. (1995).
2. B.E.A.SalehandM.C.Teich,FundamentalsofPhotonics,JohnWiley&Sons,Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A.YarivandP.Yeh,Photonics:OpticalElectronicsinModernCommunications,Oxford University Press, New York(2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL.
7. Onlinecourse:"OptoelectronicMaterialsandDevices"byMonicaKatiyarandDeepak Gupta on NPTEL

MECHANICS

Coursecode	25BSC-PHY-104H				
Category	Basic Science Course				
Coursetitle	**Mechanics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**1**	**0**	**4**	
Branches (B. Tech.)	ϒ Civil Engineering ϒ Printing Technology				
Classwork	30 Marks				
Exam	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

1. To develop a basic understanding of vector algebra, different coordinate systems and Newton's laws of motion.
2. To equip the students with the knowledge of equipotential surfaces, central forces, different types of orbits and simple harmonic motion.
3. To introduce the students to rigid body kinematics, determination of angular momentum and moment of inertia.
4. To teach students the condition of equilibrium in two and three dimensions, free body diagrams, deformations and then solve problems on axially loaded members like truss.

COURSE OUTCOMES (CO):

After completing the course, students will be able to:

CO1: Learn rectangular, spherical, cylindrical coordinate systems and transformations under rotation. Students will be able to apply Newton's equations of motion to solve problems including constraints and friction.

CO2: Analyse conservative and non conservative forces. Understand the mechanics of particles in motion and harmonic motion.

CO3: Acquire an understanding of rigid body mechanics. Analyse the torque, angular momentum and determine the moment of inertia.

CO4: Draw the free-bodydiagrams and solve the simple problems on axially loaded members like trusses.

Note: Examiner will set 9 questions in all. Q.1 is compulsory and of short answers type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Students have to attempt 5 questions in total selecting at least one from each unit.

UNIT-I
Vector Mechanics of Particles

Introduction to co-ordinate systems - rectangular, spherical and cylindrical (Qualitative), Divergence and curl of a vector - their physical interpretation, transformationofscalarsand vectors under rotational transformation, Newton's laws (Qualitative), Newton's equations of motion in spherical polar coordinates, Inertial and non-inertial frames of reference, Rotating coordinate system: five-term acceleration formula, Centripetal and Coriolis accelerations, Applications: weather systems.

UNIT-II
Mechanics of Particles in Motion and Harmonic Motion

Potentialenergyfunction:F=-GradV,equipotentialsurfacesand meaning of gradient,

Conservativeandnon-conservativeforces, curlofaforcefield,central forces, conservation of angular momentum, energy equation and energy diagrams, Elliptical, parabolic and hyperbolic orbits.
Simple Harmonic oscillator, dampedharmonicoscillator- lightly-damped, over-damped, critically damped, forced harmonic oscillator and resonance.

UNIT-III
Rigid Body Mechanics

Introduction to arigidbody, Center of gravity, Kinematicsin a coordinatesystem rotating and translating in the plane, Angular momentum about a point of a rigidbodyinplanar motion; Moment of inertia, Parallel and perpendicular axes theorems, Moment of inertia of disk, ring, solid sphere, hollow sphere, spherical shell and solid bar of rectangular cross-section.

UNIT-IV
Statics of Solids

Analysis of system of forces, condition of equilibrium of rigid body in two and threedimensions,Friction: limiting and non-limiting, Angle of response, Problems on constraintsand friction. Free body diagram, Types of beams: loads, supports, determination of support reactions, Lame's theorem, Structure of equilibrium: Trusses.

Alternative NPTEL/SWAYAM Course:

Sr. No.	NEPTEL course name	Instructor	Host Institute
1.	ENGINEERING MECHANICS	PROF. MANOJ HARBOLA	IIT KANPUR

Course Articulation Matrix

COs	Programme Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2								1		2
CO2	3	2								1		2
CO3	3	2										2
CO4	3	2								1		2

Suggested Reference Books

1. An Introduction to Mechanics — D Kleppner & R Kolenkow.
2. Principles of Mechanics — JL Synge & BA Griffiths.
3. Mechanics — JP Den Hartog.
4. Engineering Mechanics - Dynamics, 7th ed. - JL Meriam.
5. Elements of properties of matter-DS Mathur.
6. Physics for degree students – C L Arora.

OPTICS AND QUANTUM MECHANICS

	25BSC-PHY-105H				
Category	BasicScienceCourse				
Coursetitle	**Optics and Quantum Mechanics**				
SchemeandCredits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**1**	**0**	**4**	
Branches(B.Tech.)	ϒ Bio-TechnologyEngineering ϒ TextileTechnology ϒ TextileChemistry ϒ FashionandApparelEngineering				
Classwork	30Marks				
Exam	70Marks				
Total	100Marks				
Durationof Exam	03 Hours				

COURSE OBJECTIVES:

1. To have a basic understanding of the interference phenomenon and its applications
2. To introduce the students to elementary concepts of the polarization of light.
3. To develop a basic understanding of the working of lasers.
4. To give knowledge of shortcomings of classical mechanics and fundamentals of quantum mechanics.

COURSE OUTCOMES (CO):

After completing the course, students will be able to:

CO1: Understand interference as the superposition of waves from coherent sources derived from the same parent source. Analyze the interference by division of amplitude and wavefront.

CO2: To produce and analyze plane, circular and elliptically polarized lights.

CO3: Understand the physics behind the production of laser light and its applications in day-to-day life.

CO4: To analyze the difference between classical and quantum mechanical phenomena and will have knowledge of the dual nature of matter and the fundamental equation of motion in quantum mechanics.

Note: Examiner will set 9 questions in all. Q.1 is compulsory and of short answers type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Students have to attempt 5 questions in total selecting at least one from each unit.

UNIT – I
Interference

Huygens' principle, superposition of waves, interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Interference in thin films: parallel and wedge shaped, necessity of a broad source of light, Newton's rings experiment: determination of wavelength of light, refractive index of a medium and thickness of a thin transparent sheet, Michelson interferometer: determination of wavelength of light and resolution of spectral lines.

UNIT – II
Polarisation of light

Polarised and unpolarised light, Plane polarised light, Brewster's law, Double refraction, Uniaxial and biaxial crystals, Huygen's theory, Nicol prism, Theory of plane, circular and elliptically polarised lights, Quarter and half wave plates, Production and detection of plane, circular and elliptically polarised lights, Optical activity, Specific rotation, Polarimeter: Laurent's half shade and Biquartz Polarimeter.

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UNIT– III
Laser

Einstein'stheory of matter radiation interaction: absorption, spontaneous and stimulated emission of radiation, relation between A and B coefficients, population inversion, pumping, two, three and four level laser systems, characteristics of laser beam, different types of lasers: gas laser (He-Ne), solid-state laser (Ruby), applications of lasers.

UNIT– IV
Introduction to Quantum Mechanics

Limitations of classical Mechanics, Black body radiation phenomenon and Planck's radiation law, Photoelectric effect, Compton effect, wave-particle duality, de Broglie's hypothesis, Uncertainty principle,Time-dependentandtime-independent Schrodinger wave equation, Physical significance of wave function ψ, Particle in a 1-D box problem.

Alternative NPTEL/SWAYAM Course:

Sr. No.	NEPTEL course name	Instructor	Host Institute
1.	APPLIED OPTICS	PROF. AKHILESH KUMAR MISHRA	IIT ROORKEE

Course Articulation Matrix

COs	Programme Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2								1		2
CO2	3	2					1			1		2
CO3	3	2				1	1			1		2
CO4	3	2								1		2

Suggested Reference Books:

1. E.Hecht,"Optics",PearsonEducation,2008.
2. A.Ghatak,"Optics",McGraw-Hill Education,2012.
3. O.Svelto,"PrinciplesofLasers",Springer Science&BusinessMedia,2010.
4. S. P. Taneja, "Modern Physics for Engineers", R. Chand and Co.
5. V. Raghavan, Materials Science and Engineering, Prentice Hall of India Private Limited, New Delhi (2004).
6. Brij Lal & Subrahmanyam, "A textbook of Optics", S Chand and Co.

INTRODUCTION TO ELECTROMAGNETIC THEORY LAB (IEMT LAB)

Course code	25LC-PHY-101H
Category	Basic Science Course

Course title	**Introduction to Electromagnetic Theory Lab (IEMT Lab)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester I/II
	0	**0**	**2**	**1**	
Branches (B.Tech.)	ϒ Electronics and Communication Engineering ϒ Electronics and Computer Engineering ϒ Electronics and Telecommunication Engineering ϒ Mechanical Engineering ϒ Fire Technology and Safety Engineering ϒ Mechanical and Automation Engineering ϒ Automobile Engineering				
Internal Lab	05 Marks				
External Lab	20 Marks				
Total	25 Marks				
Duration of Exam	02 Hours				

COURSE OUTCOMES (CO):

CO1: Students will gain practical experience in setting up and conducting physics experiments. This includes using and handling a wide range of laboratory instruments and tools.

CO2: Understand the concept of errors in measurements and develop the ability to perform error analysis.

CO3: Connect theoretical physics principles with practical experimentation and real-world applications.

CO4: Students will be able to do measurements precisely, analyse experimental data and interpret results to draw meaningful conclusions.

Laboratory/ Virtual Laboratory work:

Note: Students have to perform at least eight experiments in total from sections A, B and C, by selecting at least three from group B. More experiments may be added from time to time as per requirement.

Section A (Basic experiments)

1. To determine the least count of the vernier caliper and measure the thickness of any object using it.
2. To determine the least count of screw gauge and measure the diameter of the wire.
3. To measure the least count of the Spherometer and calculate the radius of curvature of a convex surface using it.
4. To test and do measurements on various electronic devices using a multimeter.

Section B

1. To study the Hall effect in semiconductors and measure the Hall coefficient.
2. To find the frequency of the AC mains using a sonometer.
3. To study the magnetic properties of materials using the B-H curve.
4. To study the Curie temperature of materials using the Dielectric set-up.
5. To verify the inverse square law with the help of a photovoltaic cell.
6. To determine Planck's constant using a photocell.
7. To study the characteristics of a Solar cell and find out the fill factor.
8. To design and study Active and Passive filters.

9. To find impedance and Q factor using the LCR circuit.
10. To study resonance phenomena in the LCR circuit.
11. To measure the e/m of an electron using the helical method.
12. To find the temperature coefficient of platinum using the Griffith bridge.
13. To study the forward and reverse characteristics of the P-N junction diode.
14. To study the reverse characteristics of the Zener diode and voltage regulation using Zener Diode.
15. To determine the unknown resistance using a Post office box.
16. To study the variation of the magnetic field along the axis of a circular coil carrying current.
17. To determine the unknown capacitance using flashing and quenching of Ne/Ar bulb.

Section C (Virtual lab experiments)

Sr no.	Experiment name	Link
1	LC circuit and LCR circuit	**1.** http://vlab.amrita.edu/?sub=1&brch=75&sim=326&cnt=1 **2.** http://vlab.amrita.edu/?sub=1&brch=75&sim=330&cnt=1 **3.** http://vlab.amrita.edu/?sub=1&brch=75&sim=318&cnt=1 **4.** http://vlab.amrita.edu/?sub=1&brch=75&sim=325&cnt=1 **5.** http://vlabs.iitkgp.ernet.in/asnm/exp12/index.htm
2	Resonance phenomena in LCR circuits	http://vlab.amrita.edu/?sub=1&brch=75&sim=325&cnt=1
4	Photoelectric effect experiment.	http://mpv-au.vlabs.ac.in/modern-physics/Photo_Electric_Effect/

Course Articulation Matrix

COs	Programme Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	2	3	2				2	1		2
CO2	2	2		2	2				2			2
CO3	2		2		1	1			1			2
CO4	2			3					1			2

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H. T. Worshnop, 1971, Asia Publishing House.
2. Engineering Practical Physics, S. Panigrahi and B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. Practical Physics, G. L. Squires, 2015, 4/e, Cambridge University Press.
4. A Text Book of Practical Physics, Vol I, Prakash and Ramakrishna, 11/e, 2011, Kitab Mahal.

Note:

1. Each laboratory class/section shall not be more than about 20 students.
2. To allow a fair opportunity for practical hands-on experience to every student, each experiment may be either done by a student individually or in a group of not more than 3-4 students. Larger groups are strictly discouraged/disallowed.
3. Pre-experimental & post-experimental quizzes/questions may be offered for each lab experiment to reinforce &aid comprehension of the experiment.

OSCILLATIONS, WAVES AND OPTICS LAB

Coursecode	25LC-PHY-102H				
Category	Basic Science Course				
Coursetitle	**Oscillations, WavesandOptics Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester I/II
	0	**0**	**2**	**1**	
Branches (B. Tech.)	ϒ Electrical Engineering ϒ Electronics and Electrical Engineering				
Internal Lab	05 Marks				
External Lab	20 Marks				
Total	25 Marks				
Duration of Exam	02 Hours				

COURSE OUTCOMES (CO):

CO1: Students will gain practical experience in setting up and conducting physics experiments. This includes using and handling a wide range of laboratory instruments and tools.

CO2: Understand the concept of errors in measurements and develop the ability to perform error analysis.

CO3: Connect theoretical physics principles with practical experimentation and real-world applications.

CO4: Students will be able to do measurements precisely, analyse experimental data and interpret results to draw meaningful conclusions.

Laboratory/ Virtual Laboratory work:

Note: Students have to perform at least eight experiments in total from sections A, B and C, by selecting at least three from group B. More experiments may be added from time to time as per requirement.

Section A (Basic experiments)

1. To determine the least count of the vernier caliper and measure the thickness of any object using it.
2. To determine the least count of screw gauge and measure the diameter of the wire.
3. To measure the least count of the Spherometer and calculate the radius of curvature of a convex surface using it.
4. To test and do measurements on various electronic devices using a multimeter.

Section B

1. To find the frequency of the AC mains using a sonometer.
2. To study the magnetic properties of materials using the B-H curve.
3. To study the Curie temperature of materials using the Dielectric set-up.
4. To verify the inverse square law with the help of a photovoltaic cell.
5. To determine Planck's constant using a photocell.
6. To study the characteristics of a Solar cell and find out the fill factor.
7. To measure the e/m of an electron using the helical method.
8. To find the temperature coefficient of platinum using the Griffith bridge.
9. To study the forward and reverse characteristics of the P-N junction diode.
10. To determine the unknown resistance using a Post office box.
11. To study the variation of the magnetic field along the axis of a circular coil carrying current.
12. To determine the unknown capacitance using flashing and quenching of Ne/Ar bulb.
13. Tofind the wavelength of monochromatic light using Newton's ring experiment.
14. To find the wavelength of monochromatic light using a Diffraction grating.
15. To find the wavelength of monochromatic light using Fresnel's bi-prism
16. To study interference phenomena using Michelson's Interferometer and to find the wavelength of monochromatic light.
17. To find the specific rotation of sugar using a Polarimeter
18. To find the thickness of the wire using a He-Ne laser.

Section C (Virtual lab experiments)

Sr no.	Experiment name	Link
1	Photoelectric effect experiment.	http://mpv-au.vlabs.ac.in/modern-physics/Photo_Electric_Effect/
2	Diffraction and interference experiments (from ordinary light or laser pointers).	http://ov-au.vlabs.ac.in/optics/Diffraction_Grating/
3	Minimum	http://ov-au.vlabs.ac.in/optics/Spectrometer_i_d_Curve/

	deviation from a prism	
4	Angle of Prism	https://ov-au.vlabs.ac.in/optics/Angle_of_Prism

Course Articulation Matrix

COs	Programme Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	2	3	2				2	1		2
CO2	2	2		2	2				2			2
CO3	2		2		1	1			1			2
CO4	2			3					1			2

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H. T. Worshnop, 1971, Asia Publishing House.
2. Engineering Practical Physics, S. Panigrahi and B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. Practical Physics, G. L. Squires, 2015, 4/e, Cambridge University Press.
4. A Text Book of Practical Physics, Vol I, Prakash and Ramakrishna, 11/e, 2011, Kitab Mahal.

Note:

1. Each laboratory class/section shall not be more than about 20 students.
2. To allow a fair opportunity for practical hands-on experience to every student, each experiment may be either done by a student individually or in a group of not more than 3-4 students. Larger groups are strictly discouraged/disallowed.
3. Pre-experimental & post-experimental quizzes/questions may be offered for each lab experiment to reinforce &aid comprehension of the experiment.

SEMICONDUCTOR PHYSICS LAB

Coursecode	25LC-PHY-103H				
Category	Basic Science Course				
Coursetitle	**Semiconductor Physics Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester I/II

	0	**0**	**2**	**1**
Branches (B. Tech.)	ϒ Computer Science Engineering ϒ Information Technology ϒ Computer Science and Information Technology			
Internal Lab	05 Marks			
External Lab	20 Marks			
Total	25 Marks			
Duration of Exam	02 Hours			

COURSE OUTCOMES (CO):

CO1: Students will gain practical experience in setting up and conducting physics experiments. This includes using and handling a wide range of laboratory instruments and tools.

CO2: Understand the concept of errors in measurements and develop the ability to perform error analysis.

CO3: Connect theoretical physics principles with practical experimentation and real-world applications.

CO4: Students will be able to do measurements precisely, analyse experimental data and interpret results to draw meaningful conclusions.

Laboratory/ Virtual Laboratory work:

Note: Students have to perform at least eight experiments in total from sections A, B and C, by selecting at least three from group B. More experiments may be added from time to time as per requirement.

Section A (Basic experiments)

1. To determine the least count of the vernier caliper and measure the thickness of any object using it.
2. To determine the least count of screw gauge and measure the diameter of the wire.
3. To measure the least count of the Spherometer and calculate the radius of curvature of a convex surface using it.
4. To test and do measurements on various electronic devices using a multimeter.

Section B

1. To study the Hall effect in semiconductors and measure the Hall coefficient.
2. To find the frequency of the AC mains using a sonometer.
3. To study the magnetic properties of materials using the B-H curve.
4. To study the Curie temperature of materials using the Dielectric set-up.
5. To verify the inverse square law with the help of a photovoltaic cell.
6. To determine Planck's constant using a photocell.
7. To study the characteristics of a Solar cell and find out the fill factor.
8. To measure the e/m of an electron using the helical method.
9. To find the temperature coefficient of platinum using the Griffith bridge.
10. To study the forward and reverse characteristics of the P-N junction diode.
11. To study the reverse characteristics of the Zener diode and voltage regulation using the Zener Diode
12. To determine the unknown resistance using a Post office box.

13. To study the variation of the magnetic field along the axis of a circular coil carrying current.
14. To determine the unknown capacitance using flashing and quenching of Ne/Ar bulb.
15. To compare the capacitance of two capacitors using De Sauty's Bridge.

Section C (Virtual lab experiments)

Sr no.	Experiment name	Link
1	Photoelectric effect experiment.	**http://mpv-au.vlabs.ac.in/modern-physics/Photo_Electric_Effect/**
2	Hall effect experiment: Determination of charge carrier density	**https://mpv-au.vlabs.ac.in/modern-physics/Hall_Effect_Experiment**
3	Resistivity by Four Probe Method	**https://mpv-au.vlabs.ac.in/modern-physics/Resistivity_by_Four_Probe_Method**

Course Articulation Matrix

COs	Programme Outcomes											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	2	3	2				2	1		2
CO2	2	2		2	2				2			2
CO3	2		2		1	1			1			2
CO4	2			3					1			2

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H. T. Worshnop, 1971, Asia Publishing House.
2. Engineering Practical Physics, S. Panigrahi and B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. Practical Physics, G. L. Squires, 2015, 4/e, Cambridge University Press.
4. A Text Book of Practical Physics, Vol I, Prakash and Ramakrishna, 11/e, 2011, Kitab Mahal.

Note:

1. Each laboratory class/section shall not be more than about 20 students.

2. To allow a fair opportunity for practical hands-on experience to every student, each experiment may be either done by a student individually or in a group of not more than 3-4 students. Larger groups are strictly discouraged/disallowed.
3. Pre-experimental & post-experimental quizzes/questions may be offered for each lab experiment to reinforce &aid comprehension of the experiment.

MECHANICS LAB

Coursecode	25LC-PHY-104H				
Category	Basic Science Course				
Coursetitle	**Mechanics Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester I/II
	0	**0**	**2**	**1**	
Branches (B. Tech.)	ϒ Civil Engineering ϒ Printing Technology				
Internal Lab	05 Marks				
External Lab	20 Marks				
Total	25 Marks				
Duration of Exam	02 Hours				

COURSE OUTCOMES (CO):

CO1: Students will gain practical experience in setting up and conducting physics experiments. This includes using and handling a wide range of laboratory instruments and tools.

CO2: Understand the concept of errors in measurements and develop the ability to perform error analysis.

CO3: Connect theoretical physics principles with practical experimentation and real-world applications.

CO4: Students will be able to do measurements precisely, analyse experimental data and interpret results to draw meaningful conclusions.

Laboratory/ Virtual Laboratory work:

Note: Students have to perform at least eight experiments in total from sections A, B and C, by selecting at least three from group B. More experiments may be added from time to time as per requirement.

Section A (Basic experiments)

1. To determine the least count of the vernier caliper and measure the thickness of any object using it.
2. To determine the least count of screw gauge and measure the diameter of the wire.
3. To measure the least count of the Spherometer and calculate the radius of curvature of a convex surface using it.

4. To test and do measurements on various electronic devices using a multimeter.

Section B

1. To find the moment of inertia measurement of a fly wheel.
2. To find acceleration due to gravity using bar pendulum.
3. To study resonance phenomena in mechanical oscillators.
4. To examine the behaviour of coupled pendulum.
5. To examine air track experiment and to study collisions between objects governed by the laws of momentum and energy.
6. To find the modulus of rigidity of a wire using Maxwell's needle.
7. To determine the moment of inertia of the given disc using Torsion pendulum.
8. To perform experiment on rotation and Gyroscopic precession.
9. To measure spring constant using Hook's Law.
10. To measure height of a distant object using sextant.
11. To find the frequency of the AC mains using a sonometer.
12. To verify the inverse square law with the help of a photovoltaic cell.
13. To determine Planck's constant using a photocell.
14. To study the characteristics of a Solar cell and find out the fill factor.
15. To study the forward and reverse characteristics of the P-N junction diode.
16. To determine the unknown resistance using a Post office box.
17. To study the variation of the magnetic field along the axis of a circular coil carrying current.
18. To determine the unknown capacitance using flashing and quenching of Ne/Ar bulb.

Section C (Virtual lab experiments)

Sr no.	Experiment name	Link
1	Experiment on moment of inertia measurement.	**https://vlab.amrita.edu/?sub=1&brch=74&sim=571&cnt=1**
2	Photoelectric effect experiment.	**http://mpv-au.vlabs.ac.in/modern-physics/Photo_Electric_Effect/**
3	Torque and angular acceleration of a flywheels	**https://vlab.amrita.edu/index.php?sub=1&brch=74&sim=1517&cnt=1**
4	Newton's Second Law of Motion	**https://vlab.amrita.edu/index.php?sub=1&brch=74&sim=207&cnt=1**

Course Articulation Matrix

Cos	Programme Outcomes

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

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H. T. Worshnop, 1971, Asia Publishing House.
2. Engineering Practical Physics, S. Panigrahi and B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. Practical Physics, G. L. Squires, 2015, 4/e, Cambridge University Press.
4. A Text Book of Practical Physics, Vol I, Prakash and Ramakrishna, 11/e, 2011, Kitab Mahal.

Note:

1. Each laboratory class/section shall not be more than about 20 students.
2. To allow a fair opportunity for practical hands-on experience to every student, each experiment may be either done by a student individually or in a group of not more than 3-4 students. Larger groups are strictly discouraged/disallowed.
3. Pre-experimental & post-experimental quizzes/questions may be offered for each lab experiment to reinforce &aid comprehension of the experiment.

OPTICS AND QUANTUM MECHANICS LAB

Coursecode	25LC-PHY-105H				
Category	Basic Science Course				
Coursetitle	**Optics and Quantum Mechanics Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester I/II
	0	**0**	**2**	**1**	
Branches (B. Tech.)	ϒ Computer Science Engineering ϒ Information Technology ϒ Computer Science and Information Technology				
Internal Lab	05 Marks				
External Lab	20 Marks				
Total	25 Marks				
Duration of Exam	02 Hours				

COURSE OUTCOMES (CO):

CO1: Students will gain practical experience in setting up and conducting physics experiments. This includes using and handling a wide range of laboratory instruments and tools.

CO2: Understand the concept of errors in measurements and develop the ability to perform error analysis.

CO3: Connect theoretical physics principles with practical experimentation and real-world applications.

CO4: Students will be able to do measurements precisely, analyse experimental data and interpret results to draw meaningful conclusions.

Laboratory/ Virtual Laboratory work:

Note: Students have to perform at least eight experiments in total from sections A, B and C, by selecting at least three from group B. More experiments may be added from time to time as per requirement.

Section A (Basic experiments)

1. To determine the least count of the vernier caliper and measure the thickness of any object using it.
2. To determine the least count of screw gauge and measure the diameter of the wire.
3. To measure the least count of the Spherometer and calculate the radius of curvature of a convex surface using it.
4. To test and do measurements on various electronic devices using a multimeter.

Section B

1. To find the frequency of the AC mains using a sonometer.
2. To study the magnetic properties of materials using the B-H curve.
3. To study the Curie temperature of materials using the Dielectric set-up.
4. To verify the inverse square law with the help of a photovoltaic cell.
5. To determine Planck's constant using a photocell.
6. To study the characteristics of a Solar cell and find out the fill factor.
7. To measure the e/m of an electron using the helical method.
8. To find the temperature coefficient of platinum using the Griffith bridge.
9. To study the forward and reverse characteristics of the P-N junction diode.
10. To determine the unknown resistance using a Post office box.
11. To study the variation of the magnetic field along the axis of a circular coil carrying current.
12. To determine the unknown capacitance using flashing and quenching of Ne/Ar bulb.
13. Tofind the wavelength of monochromatic light using Newton's ring experiment.
14. To find the wavelength of monochromatic light using a Diffraction grating.
15. To find the wavelength of monochromatic light using Fresnel’s bi-prism
16. To study interference phenomena using Michelson’s Interferometer and to find the wavelength of monochromatic light.
17. To find the specific rotation of sugar using a Polarimeter.
18. To find the thickness of the wire using a He-Ne laser.

Section C (Virtual lab experiments)

Sr no.	Experiment name	Link

1	Photoelectric effect experiment.	**http://mpv-au.vlabs.ac.in/modern-physics/Photo_Electric_Effect/**
2	Diffraction and interference experiments (from ordinary light or laser pointers).	**http://ov-au.vlabs.ac.in/optics/Diffraction_Grating/**
3	Minimum deviation from a prism	**http://ov-au.vlabs.ac.in/optics/Spectrometer_i_d_Curve/**
4	Angle of Prism	**https://ov-au.vlabs.ac.in/optics/Angle_of_Prism**

Course Articulation Matrix

COs	Programme Outcomes											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	2	2	3	2				2	1		2
CO2	2	2		2	2				2			2
CO3	2		2		1	1			1			2
CO4	2			3					1			2

Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H. T. Worshnop, 1971, Asia Publishing House.
2. Engineering Practical Physics, S. Panigrahi and B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. Practical Physics, G. L. Squires, 2015, 4/e, Cambridge University Press.
4. A Text Book of Practical Physics, Vol I, Prakash and Ramakrishna, 11/e, 2011, Kitab Mahal.

Note:

1. Each laboratory class/section shall not be more than about 20 students.
2. To allow a fair opportunity for practical hands-on experience to every student, each experiment may be either done by a student individually or in a group of not more than 3-4 students. Larger groups are strictly discouraged/disallowed.
3. Pre-experimental & post-experimental quizzes/questions may be offered for each lab experiment to reinforce &aid comprehension of the experiment.

CHEMISTRY

B.Tech. Semester –I/II (Common to all the B.Tech Programmes)

Course code	25BSC-CH- 101H				
Category	Basic Science Course				
Course title	**Chemistry (Theory)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**1**	**0**	**4**	
Classwork	30 Marks				
Examination	70 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

- To acquaint the students with the basic phenomenon/concepts of chemistry that student faces during course of their study in the industry and Engineering field.
- To understand and explain scientifically the various chemistry related problems in the industry/engineering field.
- To rationalise periodic properties such as ionisation potential, electronegativity, oxidation states and electronegativity.
- To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques and apply this knowledge to identify the materials.
- To list major chemical reactions which are used in the synthesis of materials.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: **Define** point defects,periodic properties, stereochemistry, organic reactions including synthesis of drugs, intermolecular forces of attraction, water chemistry, corrosion and spectroscopic techniques.

CO2: **Understand** the concepts of molecular orbital, crystal field and band theory, point defects in solids, periodic properties, stereochemistry, organic reactions and synthesis of drugs, intermolecular forces of attraction, water chemistry, corrosion and spectroscopic techniques.

CO3: **Apply** the knowledge & ideas of electronic configuration for study of atomic &

molecular Structure and periodic properties, stereochemistry and study of organic reactions including synthesis of organic compounds, water chemistry, corrosion and spectroscopic techniques to solutions of complex engineering problems in similar situations.

CO4: **Analyze** MO diagrams, periodic properties, stereochemistry, organic reactions including synthesis of drugs, water chemistry, corrosion and spectroscopic techniques involving various ranges of electromagnetic spectrum.

Note:
Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Atomic and molecular structure: Molecular orbital energy level diagrams of diatomic molecules: homo nuclear and heteronuclear (NO, HF, HCl & CO) Pi-molecular orbitals of butadiene and benzene. Crystal field theory and the energy level diagrams for transition metal ions. Band theory of solids and the role of doping on band structures. Point defects in solids.

Periodic properties: Effective nuclear charge, calculation of effective nuclear charge, penetration of orbitals, Quantum Numbers, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states.

UNIT-II

Stereochemistry: Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations, symmetry and chirality, enantiomers, Diastereomers, optical activity, absolute configurations and conformational analysis of Ethane, Propane and Butane.

Organic reactions and synthesis of drugs: Introduction to reactions involving substitution, addition, elimination (General mechanism of these reactions), oxidation, reduction, cyclization. Synthesis of commonly used drug molecules (Asprin & Paracetamol).

UNIT-III

Intermolecular forces: Ionic, dipolar and Van der Waals interactions, H-Bonding, Equations of state of real gases and critical phenomena.

Water Chemistry and Corrosion: Hardness of water- Introduction, Types, Measurement of hardness by EDTA method, Methods of water softening (Lime soda process, Zeolite Process,

Demineralisation process). Corrosion: Introduction, Types, Factor affecting corrosion and methods of prevention.

UNIT-IV

Spectroscopic techniques and applications: Basic concept of spectroscopy, Principle and Applications of different spectroscopic techniques (UV-Visible and IR spectroscopy). Nuclear magnetic resonance and magnetic resonance imaging, Elementary discussion on Flame photometry.

Alternative NPTEL/SWAYAM Course:

SNo	NPTEL course name	Instructor	Host Institute
1.	Chemistry - I	Prof. Mangala Sunder Krishnan	IITM

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	2	-	-	-	-	-	-	2
CO2	3	3	2	2	2	1	-	-	2	1	-	2
CO3	3	3	2	1	2	1	-	-	2	1	-	2
CO4	3	3	1	3	2	1	-	-	2	1	-	2

Suggested Text Books:

(i) University chemistry, by B. H. Mahan

(ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane

(iii)Fundamentals of Molecular Spectroscopy, by C. N. Banwell

(iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

(v) Physical Chemistry, by P. W. Atkins

(vi) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition. http://bcs.whfreeman.com/vollhardtschore5e/default.asp

CHEMISTRY (LAB)

(Common to all the B.Tech Programmes)

Course code	25LC-CH-101H				
Category	Basic Science Course				
Course title	**Chemistry I (Practical)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-I/II
	0	**0**	**2**	**1**	
Internal Lab	05 Marks				
External lab	20 Marks				
Total	25 Marks				
Duration of Exam	02 Hours				

Credit: 1
Max. Marks: 05+20
Duration of Exam: 02Hrs.

LIST OF EXPERIMENTS:-

1. Determination of surface tension of given liquid by drop number method.
2. Determine the viscosity of given liquid by using Ostwald's viscometer / Redwood viscometer.
3. Calculate the Rf value of given sample using Thin layer chromatography / Paper chromatography.
4. Removal of Ca^{2+} and Mg^{2+} hardness from given water sample using ion exchange column.
5. Determination of chloride content in given water sample.
6. Calculate the strength of strong acid by titrating it with strong base using conductometer.
7. Calculate the emf value of given cell.
8. To prepare the urea formaldehyde and phenol formaldehyde resin.
9. To determine the rate constant of a reaction.
10. To synthesize iodoform / aspirin
11. Calculate the saponification value / acid value of given oil sample.
12. To determine the alkalinity of given water sample.
13. Determination of the partition coefficient of a substance between two immiscible liquids.

14. To determine the total hardness of given water sample by EDTA method.

15. Study the adsorption phenomena using acetic acid and charcoal.

16. Study of Lattice structures and packing of spheres.

Course Outcomes:

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will be able to:

CO1 - Learn and understand the various lab skills.

CO2 - Apply the knowledge of the important lab experiments in solving complex Engineering problems.

CO3 - Determine alkalinity, hardness of water sample, saponification/acid value of oil andrate constants of reactions.

CO4 - Synthesize Urea formaldehyde, Phenol formaldehyde, Iodoform and Aspirin.

CO5 - Study the molecular/system properties such as surface tension, adsorption phenomenon, viscosity, conductance of solutions, redox potentials, chloride content of water, Lattice structure etc.

Note: At least 8-10 experiments are to be performed by the students.

1). Each laboratory class/section shall not be more than about 20 students.

2). To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups are strictly discouraged/disallowed.

3). Pre-experimental &post experimental quiz /questions may be offered for each lab experiment to reinforce &aid comprehension of the experiment.

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. N	Experiment Name	Experiment Link(s)
1.	Determination of surface tension and viscosity.	http://pcv-au.vlabs.ac.in/physical-chemistry/Determination_of_Viscosity_of_Organic_Solvents/
2.	Determination of chloride content of water.	http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental_Engineering_1/experiments/determination-of-chloride-nitk/simulation.html
3.	Determination of the rate constant of a reaction.	http://pcv-au.vlabs.ac.in/physical-chemistry/EMF_Measurement/

4.	Saponification/acid value of an oil.	http://biotech01.vlabs.ac.in/bio-chemistry/Estimation_of_Saponification_Value_of_Fats_or_Oils/
5.	Potentiometry - determination of redox potentials and EMFs.	http://pcv-au.vlabs.ac.in/physical-chemistry/EMF_Measurement/
6.	Lattice structures and packing of spheres.	https://vlab.amrita.edu/?sub=1&brch=282&sim=370&cnt=1

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	-	1	-	-	-	-	-	2
CO2	3	2	1	2	-	1	-	-	-	-	-	2
CO3	3	2	1	2	-	1	-	-	-	-	-	2
CO4	3	2	1	2	-	1	-	-	-	-	-	2
CO5	3	2	1	2	-	1	-	-	-	-		2

Suggested Books:

1. A Text book on Experiments and Calculation –Engineering Chemistry by S.S.Dara, S.Chand & Company Ltd.
2. Essential of Experimental Engineering chemistry, Shashi Chawla, Dhanpat Rai Publishing Co.
3. Theory & Practice Applied Chemistry – O.P.Virmani, A.K. Narula (New Age).

BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING

B.Tech.Semester –I/II (Common to all the B.Tech Programmes)

Course code	25ESC-EE- 101H				
Category	EngineeringScience Course				
Course title	Basics of Electrical & Electronics Engineering**(Theory)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**0**	**0**	**3**	
Classwork	25 Marks				

Examination	50 Marks
Total	75 Marks
Duration of Exam	03 Hours

COURSE OBJECTIVES:

- To introduce the basic concepts of electrical and electronics engineering.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: Apply various networks laws and theorems to solve dc circuits.
CO2: Compute different ac quantities with phasor representation of electric circuits, Computation of Boolean expression and Implementation with logic gates.
CO3: Understand the construction and working of electrical Machines, diode, transistor . and their applications.
CO4: Understand the fundamental concepts and techniques used in digital electronics.

Note:
Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Electric Circuits
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, Three phase balanced circuits, voltage and current relations in star and delta connections

UNIT-II

Transformers
Ideal and practical transformer with phasor diagrams, equivalent circuit, losses in transformers, transformer tests and efficiency.

UNIT-III

Electronic Devices and Circuits: p-n junction diode: VI characteristics of diode, LED, Operation of BJT, CB, CE and CC configuration, Transistor as a switch, MOSFET: Operation MOSFET

UNIT-IV

Digital Electronics: Number system: conversion, binary arithmetic, subtraction using 2's complement, theorems of Boolean algebra, algebraic simplification, SOP and POS forms, Logic Gates and Universal Gates.

Alternative NPTEL/SWAYAM Course:

SNo	NPTEL course name	Instructor	Host Institute
1	Basic Electric Circuits Prof.	Ankush Sharma	IIT Kanpur
2	Basic Electrical Circuits	Prof. Nagendra Krishnapura	IITM
3	Fundamentals Of Electrical Engineering	Prof. Debapriya Das	IIT KGP

CO – PO mapping

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

Suggested Text Books:

(i) B.L Theraja, "Electrical Technology-1", S Chand.
(ii) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(iii) Boylestad, R.L. and Nashelsky, L., Electronic Devices & Circuit Theory, Perason (2009).
(iv) Mano M. M. and Ciletti, M.D., Digital Design, Pearson, Prentice Hall, (2013).

BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB

B.Tech 1st / 2nd Sem.(Common to all the B.Tech Programmes)

Course code	25LC-EE-101H				
Category	Engineering Science Course				
Course title	**Basics of Electrical and Electronics Engineering(Practical)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-I/II
	0	**0**	**2**	**1**	
Internal Lab	05 Marks				
External lab	20 Marks				
Total	25 Marks				
Duration of Exam	02 Hours				

Credit:1
Max. Marks: 05+20
Duration of Exam: 02Hrs.

LIST OF EXPERIMENTS:-

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Practical resistors, capacitors and inductors.
2. To verify KCL and KVL.
3. To verify Thevenin's and Norton theorems.
4. To verify Superposition theorems.
5. To perform O.C. and S.C. tests of a transformer.
6. Measuring the response of R-L, R-C, and R-L-C circuits to a step change in voltage. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification.
7. Observation of phase differences between current and voltage.
8. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor)
9. To verify the truth table of basic gates.
10. To verify truth table of universal gates.
11. To verify the truth table of boolean expression using basic gates
12. To implement the basic gates using transistor
13. To verify diode characteristics.
14. To verify BJT Common Emitter characteristics.
15. To verify BJT Common base characteristics.
16. To study the MOSFET characteristics.

Course Outcomes:

The electrical and electronics engineering laboratory course will consist of experiments illustrating the principles of electrical and electronics relevant to the study of engineering.

The students will be able to:

CO1 Get an exposure to common electrical and electronics components and their ratings.
CO2 Make electrical connections by wires of appropriate ratings.
CO3 Understand the usage of common electrical and electronic measuring instruments.
CO4 Understand the basic characteristics of transformers, electrical machines, diode and BJT.

Note: At least 10 experiments are to be performed by the students.

1).Each laboratory class/section shall not be more than about 20 students.

2).To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups are strictly discouraged/disallowed.

3).Pre-experimental &post experimental quiz/questions may be offered for each lab experiment to reinforce &aid comprehension of the experiment.

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S.N	Experiment Name	Experiment Link(s)
1.	Familiarization with the Electrical Equipments	https://bes-iitr.vlabs.ac.in/exp/electrical-equipments/
2.	To verify kirchhoff's voltage law.	https://bes-iitr.vlabs.ac.in/exp/kirchhoff-law/
3.	To study and verify the network theorems	https://bes-iitr.vlabs.ac.in/exp/network-theorem/
4.	To Study the efficiency of single phase transformer by load test.	https://bes-iitr.vlabs.ac.in/exp/single-phase-transformer/
5.	VI characteristics of a Diode	https://be-iitkgp.vlabs.ac.in/exp/characteristics-diode/
6.	BJT Common Emitter Characteristics	https://be-iitkgp.vlabs.ac.in/exp/common-emitter-characteristics/
7.	BJT Common Base Characteristics	https://be-iitkgp.vlabs.ac.in/exp/common-base-characteristics/

CO – PO mapping

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

Suggested Books:

4. A Text book on Experiments and Calculation –Engineering Chemistryby S.S.Dara, S.Chand&
   Company Ltd.
5. Essential of Experimental Engineering chemistry, ShashiChawla, DhanpatRai Publishing Co.
6. Theory & Practice Applied Chemistry – O.P.Virmani, A.K. Narula(New Age).

PROGRAMMING FOR PROBLEM SOLVING

B.Tech.Semester –I/II (Common to all the B.Tech Programmes)

Course code	25ESC-CSE101H				
Category	Engineering Science Course				
Course title	**Programming For Problem Solving (Theory)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**0**	**0**	**3**	
Classwork	25 Marks				
Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

- This course develops basic knowledge of computers and programming, enhances problem-solving skills, and enables students to design simple solutions using C language and modern tools while encouraging continuous learning.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: Describe the basic components, functions, classifications, and limitations of computers, including memory hierarchy and number systems.

CO2: Apply structured problem-solving techniques such as algorithms, flowcharts, and pseudo-codes to solve simple logical and numerical problems.

CO3: Develop programs in C using fundamental programming constructs like control statements, arrays, strings, functions, and recursion to solve real-world problems.

CO4: Implement advanced programming concepts like pointers, structures, unions, file handling, and dynamic memory management in C to create efficient programs.

Note:
Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

Unit I

The computer: Block diagram of functional units of the computer, Data and information, Classification of computers, Computer characteristics, Advantages of the computer, Limitations of computer, Applications of computers, The CPU and the Memory, Primary memory, Secondary memory, Memory hierarchy, Measuring the memory, Examples based on the inter-conversion of memory units, The Computer Software, Classifications of software, Operating system, The Number Systems (Binary Octal, Decimal, Hexadecimal and their conversion to one another, Operations on binary numbers, Other popular codes (ASCII, BCD, EBCDIC, Excess-3 and Gray code)

Unit II

Problem-solving Techniques: Steps for logical and numerical problem-solving, Solving a logical problem, Solving a numerical problem, Algorithm, Flowcharts, Pseudo codes, Programming language, Language translator, Interpreter, Assembler, Compiler, Compiling and executing process, Syntax and logical errors in the compilation, Files generated in the C program lifecycle, C Program compilation process

Unit III

Fundamentals of C: History of C language, Why C?, characters set, Whitespace characters or escape sequences, Format specifiers, Tokens in C, Keywords, Variables, Constant, Identifiers, Special symbols, Header files, Data types, Type casting, Operators and Expressions, Precedence and associativity of operators in C, Decision-making Statements: Conditional and Unconditional decision-making statements, Roots of a quadratic equation, Loops, Arrays, Single, Multidimensional array, String, Standard inbuilt string functions, Linear searching, Binary search, Bubble sort

Unit IV

Function, Need of the function, Types of function, Call by value, Call by reference, The Console Input-output Functions, Preprocessor, Storage classes in C, Recursion, use recursion for finding the factorial of a number, Fibonacci series, Ackermann function, Structure and

Union, Passing structure in a function, Pointers, Generic pointer, Self-referential structure, Linked list, File Handling in C, Operations on file through the inbuilt functions, Dynamic memory allocate: malloc(), calloc(), free(). Realloc(), Basic of Time and Space Complexity of an algorithm.

Alternative NPTEL/SWAYAM Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Introduction to Programming in C	Prof. Satyadev Nandakumar	IIT Kanpur
2.	Problem solving through Programming in C	Prof. Anupam Basu	IIT Kharagpur

CO – PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	-	1	-	-	1	-	-	2
CO2	3	3	2	3	-	1	-	-	1	1	-	3
CO3	3	3	2	3	-	1	1	-	1	1	-	3
CO4	3	3	2	3	1	1	-	-	1	1	-	3

TEXT/REFERENCE BOOKS:

1. Dr. Kamaldeep, Programming for Problem-solving with C, BPB Publication.
2. Yashavant Kanetkar, Let Us C, BPB Publication.
3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
4. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
5. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

PROGRAMMING FOR PROBLEM SOLVING LAB

B.Tech 1st / 2nd Sem.(Common to all the B.Tech Programmes)

Course code	25LC-CSE101H				
Category	Engineering Science Course				
Course title	**Programming For Problem Solving Lab (Practical)**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-I/II
	0	**0**	**2**	**1**	

Internal Lab	05 Marks
External lab	20 Marks
Total	25 Marks
Duration of Exam	03 Hours

Credit:1
Max. Marks: 05+20
Duration of Exam: 02Hrs.

COURSE OBJECTIVES:

- This laboratory course enables students to apply basic programming skills to solve simple computational problems using C language. It enhances problem-solving abilities, promotes the practical application of programming tools and techniques, and strengthens understanding of computer systems and memory management while fostering teamwork, communication, and a mindset of continuous learning.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: Identify and demonstrate understanding of computer components, programming environments, and basic syntax of C language.

CO2: Apply fundamental programming concepts including operators, loops, arrays, strings, and functions to solve basic computational problems.

CO3: Develop and implement modular solutions using advanced C programming features like pointers, structures, file handling, and dynamic memory management.

CO4: Analyze and construct well-structured programs to solve real-time computational problems using iterative, conditional, and recursive logic.

LIST OF EXPERIMENTS

1. To learn the components of computers physically.
2. To formulate simple algorithms for arithmetic and logical problems.
3. Familiarization with programming environment
4. Simple computational problems using operators
5. Problems involving loops and conditional statements
6. Roots of a quadratic equation
7. Iterative problems e.g., sum of series
8. 1D and Multi-D Array manipulation

9. Matrix problems, String operations
10. Simple functions and Recursive problems
11. Pointers and structures
12. File operations
13. File handling in C, Operations on file through the inbuilt functions,
14. Dynamic memory allocate: malloc(), calloc(), free(). Realloc(),

Note: At least 10 experiments are to be performed by the students.

1). Each laboratory class/section shall not be more than about 20 students.

2). To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups are strictly discouraged/disallowed.

3). Pre-experimental and post experimental quiz/questions may be offered for each lab experiment to reinforce and aid comprehension of the experiment.

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S.N	Experiment Name	Experiment Link(s)
1.	Expression Evaluation	https://cse02-iiith.vlabs.ac.in/exp/cp-expression-evaluation/
2.	Basic Control Flow	https://cse02-iiith.vlabs.ac.in/exp/basic-control-flow/
3.	Advanced Control Flow	https://cse02-iiith.vlabs.ac.in/exp/advanced-control-flow/
4.	Numerical Approximation	https://cse02-iiith.vlabs.ac.in/exp/numerical-approximation/
5.	Functions	https://cse02-iiith.vlabs.ac.in/exp/functions/
6.	Pointers	https://cse02-iiith.vlabs.ac.in/exp/pointers/
7.	Arrays	https://cse02-iiith.vlabs.ac.in/exp/arrays/
8.	Structures	https://cse02-iiith.vlabs.ac.in/exp/structures/
9.	Recursion	https://cse02-iiith.vlabs.ac.in/exp/cp-recursion/
10.	Problem Solving Lab	https://ps-iiith.vlabs.ac.in/List%20of%20experiments.html

CO – PO mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	3	2	2	3	-	-	-	1	1	-	2
CO2	3	3	3	3	3	-	-	-	1	1	-	3

CO3	3	3	3	3	3	-	-	-	1	1	-	3
CO4	3	3	3	3	3	-	-	-	1	1	-	3

Suggested Books:

1. Dr. Kamaldeep, Programming for Problem-solving with C, BPB Publication.
2. Yashavant Kanetkar, Let Us C, BPB Publication.
3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
4. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
5. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

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B.Tech 1st/ 2nd Sem.(Common to all the B.Tech Programmes)

Coursecode:	**25HSMC-ENG-101H**					
Category:	**Humanities and Social Sciences including Management courses**					
CourseTitle:	**English**					
Schemeandcredits:	**L**	**T**	**P**	**Credits**	Semester I/II	
	2	**0**	**0**	**2**		
InternalAssessments:	**15 Marks**					
ExternalAssessments:	**35 Marks**					
Totalmarks:	**50**					
DurationofExam:	**03 hours**					

COURSE OBJECTIVES:

- EffectivelycommunicateinspokenandwrittenEnglishinvariousreal-lifesituations.
- DevelopconfidenceinusingEnglishforglobalinteractions.
- Applylearningtoreal-worldscenariosandproblem-solvingsituations.
- Understandthetotalcontentandunderlyingmeaningofthetexts.

COURSEOUTCOMES (CO): Bytheend,studentswill beableto:

CO1:**Define**thepracticalknowledgeofusingactionwordsinsentence construction.
CO2:**Understand**theconceptofaccurateEnglishwhilewritingandbecomingequallyatea seinusing good vocabulary and language skills.
CO3:**Apply**therightkindoffpronunciationwithregardstospeech,soundsandbeingableto get different types of pronunciation.
CO4:**Analyze:**Astudentisrequiredtounderstandthegivenquestionsonthebasisofcomparison.

Note - Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

COURSE CONTENT:

UNIT-1

Basic Writing skills& identifying Common Errors in Writings: - Subject Verb Agreement, Noun Pronoun Agreement, Governance of Nouns through Prepositions, Basic Verb Patterns (V, SV, SVO, SVOO, SVC, SVOC, SVOA)

UNIT-2

VocabularyBuilding&CreatingGrammatical Cohesion

One word substitution, commonly used Idioms, Referring Time in Language (Tenses), Use of Active and Passive Voice

UNIT-3

Oral Communication (Phonetics Basic concept)–Vowels, Consonants, Phonemes, Syllable, Transcription ofwords Pronunciation.

UNIT-4

ReadingandWriting Practices

(a) LiteraryTexts:

i. "TheSecret of Work"bySwami Vivekanand
ii. "PatriotismbeyondPolitics and ReligionbyAbdulKalamAzad

(b) WritingofficialLetters-IssuesConcerningStudents'academicandsociallife

Text/Reference Books:

1. AICTE's Prescribed Textbook: English (with Lab Manual), Kulbhushan Kumar, Khanna Book Publishing Co., 2023.

2. EffectiveCommunicationSkills.KulBhushan Kumar,KhannaBookPublishing, 2022.

3. PracticalEnglishUsage.MichaelSwan. OUP.1995.
4. RemedialEnglishGrammar.F.T.Wood.Macmillan.2007
5. OnWritingWell.WilliamZinsser.HarperResourceBook.2001
6. StudyWriting.Liz Hamp-Lyons andBenHeasly. Cambridge UniversityPress.2006.
7. CommunicationSkills.SanjayKumar andPushpLata. OxfordUniversityPress. 2011.
8. "KarmaYoga" bySwamiVivekananda,Vivekananda-RomainRolland (English)
9. "Ignited minds"byAbdul Kalam Azad

Alternative NPTEL/SAWAYAM Course:

S. No	NPTEL	Course Name	Instructor	Host/Ins
1		English Language for Competitive Exam	Prof. Aysha Iqbal	IIT Madras

CO-PO Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	3	-	2
CO2	3	2	-	-	-	-	-	-	-	2	-	1
CO3	3	2	-	-	-	-	-	-	-	2	-	1
CO4	2	3	-	-	-	-	-	-	-	2	-	3

LANGUAGELAB

B.Tech 1st/ 2nd Sem. (Common to all the B.Tech Programmes)

Course Code:	25LC-ENG-101H				
Category:	Humanities and Social Sciences including Management courses				
Course Title:	**LANGUAGELAB**				
Credit/ Internal:	L	T	P	Credit	Semester I/II
	0	0	2	1	

	SEM 1st / 2ndSem
External Assessment:	20 Marks
InternalAssessment:	5 Marks
Total:	25 Marks
Duration:	02 Hours

COURSEOBJECTIVES:

ThecourseaimsatdevelopingthedesiredEnglishlanguageskillsofstudents of Engineering and Technology so that they become proficient in communication to excel in their professional lives. The course has been so designed as to enhance their linguistic and communicative competence.

COURSEOUTCOMES:

ThestudentswillacquirebasicproficiencyinEnglish withspecialemphasis on listening, comprehension and speaking skills both at social and professional platforms.

COURSE CONTENTS:

(i) Listening comprehension

(ii) Recognition of phonemes in International Phonetic Alphabet

(iii) Self introduction and introduction of another person

(iv)Conversationand dialogues in common everyday situations

(v) Communication at work place (Standard phrases and sentences in various situations) (vi)Telephonic communication

(vii) Speeches for specialoccasions (Welcomespeeches, Introductionspeeches, Felicitationspeechesand Farewell speeches)

(viii) Formal Presentations on literary texts prescribed in theory paper Note: Three hour time to each segment is recommended for instruction and practice.

Scheme of End Semester Practical Exam:

1. A small passage may be read out to the examinees and they will have to write the answers to the questions asked at the end of the passage. Questions will be short answer type.
2. Examinees may be asked to identify the sounds of phonemes in given words.
3. Examinees may be asked to introduce themselves or others, participate in role

play activities in mock situations, give short responses, and engage in hypothetical telephonic conversation or supply the tag questions to statements etc.

4. Examinees may also be asked to deliver speeches on given situations or make presentation on the literary texts prescribed in Unit IV of theory paper.

Recommended Readings:

1. Bhatnagar, Nitin and Mamta Bhatnagar.ljCommunicative English for Engineers and Professionals. Pearson Education, 2013.

2. Swan, Michael.Practical English Usage. OUP, 1995. 3. Gangal, J.K. Practical Course in Spoken English. New Delhi: PHI Learning, 2015.

3. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University

DESIGN THINKING AND IDEA LAB

B. Tech 1st Sem. / 2nd Sem. (Common to all the B.Tech Programmes)

Course code	**LC-ME-102H**				
Category	**Engineering Science Course**				
Course title	**Design Thinking and Idea Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credit**	Semester-I/II
	0	**0**	**2**	**1**	
Internal Lab	05 Marks				
External lab	20 Marks				
Total	25 Marks				
Duration of Exam	03 Hours				

Credit:1
Max. Marks: 5+20
Duration of Exam: 03Hrs.

COURSE OBJECTIVE(S):

The objective of this Course is to provide the new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products which useful for a student in preparing for an engineering career.

1. To learn all the skills associated with the tools and inventory associated with the IDEA Lab.
2. Learn useful mechanical and electronic fabrication processes.
3. Learn necessary skills to build useful and standalone system/ project with enclosures.

Course Outcomes (CO):

Student will able to:

1. Understand different measuring tool and equipment's.
2. Understand different mechanical machines operation & mechanism.
3. Understand additive and subtractive manufacturing processes.
4. Understand the concept of Design Thinking.
5. Empathize and define the problems.
6. Ideate and prototype the proposed solution.
7. Test and present the proposed solution.
8. Study skills associated with the tools and inventory associated with the IDEA Lab.

List of Experiments:

1. To study **An Insight to Learning:** Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting
2. To study **Remembering Memory:** Understanding the Memory process, Problems in retention, Memory enhancement techniques
3. To study **Emotions: Experience & Expression:** Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers
4. To study **Basics of Design Thinking:** Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test
5. To study **Being Ingenious & Fixing Problem:** Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving
6. To study **Process of Product Design:** Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design
7. To study **Prototyping & Testing:** What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing
8. To study about additive manufacturing processes like FDM printing, SLA and SLS printing.
9. To study different types of FDM printing machines.
10. Explore the effect of process parameters, e.g., layer thickness, orientation, and infill, on printing time using software. Download a .stl file of simple object from internet, convert into G-code and print with FDM 3D Printer at 30% infill density.

11. Explore the mechanical properties, surface finish, and printability of different materials (e.g., PLA, ABS, PETG) used in 3D printing and prepare a brief report.
12. Identify the defects in 3D-printed components and prepare a brief report.
13. To study basic hand tools - Tape measure, combination square, Vernier caliper, hammers, fasteners, wrenches, pliers, saws, tube cutter, chisels, vice and clamps, tapping and threading. Adhesives Introduction to Power tools: Power saws, band saw, jigsaw, angle grinder, belt sander, bench grinder, rotary tools. Various types of drill bits.
14. To study Prototyping using subtractive cutting processes.
15. To study Mechanical cutting processes - 3-axis CNC routing, basic turning, milling, drilling and grinding operations, Laser cutting, Laser engraving etc..
16. Familiarity and use of welding equipment.
17. Familiarity and use of normal and wood lathe.
18. Familiarization with soldering.
19. Discussion and implementation of a mini project.

Note: At least 11 experiments are to be performed by the students.

1).Each laboratory class/section shall not be more than about 20 students.

2).To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 6-10 students.

Reference Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), ISBN: 978-9391505332

2. 3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.

3.. Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer, 2004.

4. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010

5. Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and distributors, 5th Edition,2002.

6. All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.

7. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.

8. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan (Author). Weldon Owen; 2017. ISBN-13: 978- 1681881584.

9. Make: Tools: How They Work and How to Use Them. Platt, Charles. Shroff/Maker Media. 2018. ISBN-13: 978-9352137374.

10.E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company.

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. N	Experiment Name	Experiment Link(s)
1.	DESIGN THINKING	https://www.youtube.com/watch?v=AamBSYPJlcA&list=PLWbMIWDTOauAYFLqVdYby2ds2V7NffhSb
2.	DESIGN THINKING AND IDEA LAB	https://www.youtube.com/watch?v=fpoUXSFHlHQ&pp=ygUkREVTSUdOIFRISU5LSU5HIEFORCBJREVBIExBQiAgIG5wdGVs https://www.youtube.com/watch?v=3uBLLnHIGaA&pp=ygUkREVTSUdOIFRISU5LSU5HIEFORCBJREVBIExBQiAgIG5wdGVs https://www.youtube.com/watch?v=4nTh3AP6knM&pp=ygUkREVTSUdOIFRISU5LSU5HIEFORCBJREVBIExBQiAgIG5wdGVs

CO - PO mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	**3**	**3**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**3**	**2**	**2**	**2**	**3**	**1**	**-**	**-**	**3**	**2**	**-**	**3**

CO3	**3**	**3**	**2**	**1**	**2**	**1**	**-**	**1**	**2**	**1**	**2**	**2**
CO4	**3**	**3**	**1**	**3**	**2**	**1**	**-**	**-**	**2**	**1**	**-**	**2**

ENGINEERING GRAPHICS AND DESIGN

B. Tech 1st Sem. / 2nd Sem. (Common to all the B.Tech Programmes)

Course code	**25ESC-ME-101H**				
Category	**Engineering Science Course**				
Course title	**ENGINEERING GRAPHICS AND DESIGN**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	0	**0**	**4**	**2**	
Internal Lab	15 Marks				
External lab	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Credits - 2

Max. Marks: 5+20

Duration of exam – 3 hrs

COURSE OBJECTIVES

The objective of this Course is to provide the basic knowledge about Engineering Drawing. Detailed concepts are given in projections, technical drawing, dimensioning and specifications, so useful for a student in preparing for an engineering career.

1. To have an Understanding of Engineering Curves, Scales and geometrical construction and manufacturability, and sustainability , design a system,
2. Understand orthographic Projection (I and III angle) Projection.
3. Understand Isometric projection. Understand development of surfaces.
4. Understand engineering graphics standards and solid modelling.

COURSE OUTCOMES

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (Mechanical, civil,
electrical, architectural and industrial) in which the skills of the CAD technicians playmajor roles in the design and development of new products or construction. Students prepare foractual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

1. To prepare you to design a system, component, or process to meet desired needs within
   realistic constraints such as economic, environmental, social, political, ethical, health and
   safety, manufacturability, and sustainability
2. To prepare you to communicate effectively and use the techniques, skills, and modern engineering tools necessary for
   Engineering practice.
3. Introduction to engineering design and its place in society and exposure to the visual aspects of engineering design.
4. Exposure to engineering graphics standards and solid modeling.

Unit-I

Module 1: Introduction to Engineering Drawing
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Representative Fraction, Type of Scale, Plain and Diagonal Scale, Scale of chords and Vernier Scales.

Unit-II

Module 2: Projection of Points & Lines: Projection: Introduction, Principle of Projection, Method of projection, Planes of projection, four quadrant, first and third angle projection, Reference line, symbols for methods of projection, Orthographic projection. Projection of Point: Introduction, Point situated in first, second, third & fourth quadrant. Projection of lines: Introduction, Line parallel to One or both the planes, Line contained by one or both the planes, Line perpendicular to one of the planes, Line inclined to one plane and parallel to other. Line inclined to both the planes, Traces.

Unit-III

Module 3: Projection of Planes & Solids: Projection of planes: Introduction, Types of planes, Projection of planes, Projection of planes perpendicular to both the reference planes, Perpendicular to one plane and parallel to other plane, Perpendicular to one plane and inclined to the other plane, Inclined to both planes. Projection of solids: Introduction, Type of solid, Projections of solids in simple position, Projection of solids with axes inclined to one of the reference planes and parallel to the other, Projections of solids with axes inclined to both H.P. and the V.P.

Unit-IV

Module 4: Section of Solids, Development of Surfaces and Isometric Projection: Section of Solids: Sectional Planes, Section of solids, True Shape of Section. Development of Surfaces: Introduction, Method of development, Development of lateral surfaces of right solids, Cube, Prisms, Cylinders, Pyramids & Cone. Isometric Projection: Introduction, Isometric axes, Lines & planes, Isometric scale, Isometric projection and Isometric view, Conversion of Isometric to Orthographic Projections.

Module 5: Overview of Computer Graphics

Listing the computer technologies that impact on graphical communication, Demonstrating Knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids], Introduction to Building Information Modelling(BIM).

Suggested Text/Reference Books:

(i) Shah, M.B. & Rana B.C., Engineering Drawing, Pearson Education
(ii)Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
(iii)Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
(iv) Narayana, K.L.& P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
(v) (Corresponding set of) CAD Software Theory and User Manuals.
(Vi)AICTE's Prescribed Textbook: Engineering Graphics & Design (ISBN: 978-93-91505-066).

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

1.	**Introduction to Engineering Drawing**	**https://www.youtube.com/watch?v=iXksFTnzl-M&list=PLbRMhDVUMngel6OpnNppYzfJUQHSFePQb https://www.youtube.com/watch?v=p62LPzFqGQw&list=PLp6ek2hDcoNCjoRLQ4rjpCozisCACBxKA&pp=0gcJCV8EOCosWNin**
2.	**Projection of Points & Lines**	**https://www.youtube.com/watch?v=VrU73IwRyc4&list=PLLy_2iUCG87Bw9XPfEF3r3EW5UlAOv8iz**
3.	**Projection of Planes & Solids**	**https://www.youtube.com/watch?v=VrU73IwRyc4&list=PLLy_2iUCG87Bw9XPfEF3r3EW5UlAOv8iz**
4.	**Section of Solids, Development of Surfaces and Isometric Projection**	**https://www.youtube.com/watch?v=GSCiOdybqv0&pp=ygVJU2VjdGlvbiBvZiBTb2xpZHMsIERldmVsb3BtZW50IG9mIFN1cmZhY2VzIGFuZCBJc29tZXRyaWMgUHJvamVjdGlvbiBucHRlbA%3D%3D**
5.	**Computer Graphics**	**https://www.youtube.com/watch?v=6LjVtIcSbK8&list=PLwdnzlV3ogoWaYiowRtJ8t8FeR-ODfSV1 https://www.youtube.com/watch?v=fwzYuhduME4&list=PL338D19C40D6D1732 https://www.youtube.com/watch?v=V4mP2pQyou0&list=PL112A527F83F7A5E4**

CO - PO mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
1	2	1	2	-	-	3	-	3	-	-	-	-	3	-
2	3	2	3	-	1	3	-	3	-	-	-	2	3	-
3	3	2	3	-	1	3	-	3	-	-	-	2	3	-
4	3	3	3	-	1	3	-	3	-	-	-	2	3	-
Avg	**2.75**	**2.00**	**2.75**		**1.00**	**3.00**		**3.00**				**2.00**	**3.00**	

WORKSHOP TECHNOLOGY

B.Tech.Semester –I/II (Common to all the B.Tech Programmes)

Course Code	**25ESC-ME-102H**				
Category	**ENGINEERING SCIENCE COURSE**				
Course Title	**WORKSHOP TECHNOLOGY**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-I /II**
	2	**0**	**0**	**2**	
Theory-35 Marks	**Internal Assessment-15 Marks**		**Total-50 Marks**		**Duration of Exam-3 Hrs**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts each having equal marks from all units and remaining eight questions of equal marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes: Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

1. To Understand the fundamentals of various Manufacturing Processes, foundry operations, Casting and Machine Tools, Carpentry, Fitting and Forming Processes, Welding.
2. To have a study and hands-on-exercise on plumbing and carpentry components.
3. To have a practice on gas welding, soldering, foundry operations and fitting
4. To design small devices of their interest by assembling different components with the help of mechanical manufacturing processes.

UNIT-1

Manufacturing Processes: Introduction to Manufacturing Processes and their Classification, ,additive manufacturingIndustrial Safety; Introduction, Types of Accidents, Causes andCommon Sources of Accident, Methods of Safety, First Aid,Objectives of Layout, Types of Plant Layout and their Advantages.

UNIT-II

Carpentry, Fitting & Forming Processes: Basic Principle of Hot & Cold Working, Hot& Cold Working Processes, Rolling, Extrusion, Forging, Drawing,Wire Drawing and Spinning, Sheet Metal Operations: Measuring Layout marking, Shearing, Punching, Blanking, Piercing, Forming, Bending and Joining. Advantages of timber,types of timber,defects in timber,carpentry tools, classification of metals,fitting tools,fitting operations,glass cutting

UNIT-III

Casting and Machine Tools: Introduction to Casting Processes, Basic Steps in CastingProcesses, Pattern:Types of Pattern and Allowances, Sand Casting: Sand Properties, Constituents and Preparation. Gating System. Melting of Metal, Cupola Furnace, Casting Defects & Remedies, plastic moulding, lathe machine, lathe operations, CNC machining, Shaper and planner machine.

UNIT-1V

Welding : Introduction to welding, Classification of Welding Processes, GAS Welding : Oxy-Acetylene Welding, Resistance Welding : Spotand Seam Welding, Arc Welding : Metal Arc, TIG & MIG, WeldingDefects and Remedies, Soldering & Brazing.

Suggested Text/Reference Books:

(i) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 7th Edition, Pearson Education, 2018.
(ii) HajraChoudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
(iii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Processes for Engineering Materials, Pearson Education.
(iv)Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I" Pearson Education, 2008.
(v) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Pearson Education.
(vi) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House,
(vii) Workshop Technology (Manufacturing Process) By S.K. Garg, Laxmi Publications Private Limited; Fourth edition (1 January 2018).

SN	Topic Name	Topic Link(s)
1.	**Manufacturing Processes**	https://www.youtube.com/watch?v=jdFrBtHeJbs&list=PLSGws_74K01-g9nnTMBssGURHawYYQfMQ&pp=0gcJCV8EOCosWNin
2.	**Carpentry, Fitting Forming Processes**	https://www.youtube.com/watch?v=PhIFSTj-8WU&list=PLwdnzlV3ogoVIP4OxvoWMZXQYJdHn5NE9 https://www.youtube.com/watch?v=h0S4R9fW1ZM&pp=ygUsQ2FycGVudHJ5LCBGaXR0aW5nICYgRm9ybWluZyBQcm9jZXNzZXMgbnB0ZWw%3D
3.	**Casting and Machine Tools**	https://www.youtube.com/watch?v=ljveGnQw2G0&list=PLSGws_74K018JY-1RyIj0cm4yppa1h54r https://www.youtube.com/watch?v=p581wiEfLFI&pp=ygUfQ2FzdGluZyBhbmQgTWFjaGluZSBUb29scyBucHRlbA%3D%3D
4.	**Welding**	https://www.youtube.com/watch?v=cQEUJnMYf_U&list=PLwdnzlV3ogoUQnGO8eFFygVBTjF0xyYMq https://www.youtube.com/watch?v=m2B8t8vzeUE&list=PLbMVogVj5nJSjLB85-HKhw1aCIBxn3pWj

CO-PO Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
Avg	2.00	1.75			3.00							

WORKSHOP TECHNOLOGY LAB

B. Tech 1st Sem. / 2nd Sem. (Common to all the B.Tech Programmes)

Course Code	**25LC-ME-101H**				
Category	**ENGINEERING SCIENCE COURSE**				
Course Title	**WORKSHOP TECHNOLOGY LAB**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-I /II**
	0	**0**	**4**	**2**	
Internal Lab	15 Marks				
External lab	35 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

1. To provide exposure to the students with hands on experience on various basic engineering practices in Mechanical, Civil, Electrical and Electronics Engineering etc.
2. To have a study and hands-on-exercise on plumbing and carpentry components.
3. To have a practice on gas welding, soldering, foundry operations and fitting
4. To design small devices of their interest by assembling different components with the help of mechanical manufacturing processes.

Laboratory Outcomes:

Upon completion of this laboratory course, students will be able:

1. To fabricate components with their own hands.

2. To relate practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. Apply the fundamental knowledge to Practice on gas welding, soldering, foundry operations and fitting
4. Apply the fundamental knowledge for design small devices of their interest by assembling different components.

List of Experiments/ Jobs

1. To study different types of measuring tools used in metrology and determine least counts of vernier calipers, micrometers and vernier height gauges.
2. To study different types of machine tools (lathe, shaper, planer, milling, drilling machines)
3. To prepare a job on a lathe involving facing, outside turning,taper turning, step turning, radius making and parting-off.
4. To study different types of fitting tools and marking tools used in fitting practice.
5. To prepare lay out on a metal sheet by making and prepare rectangular tray pipe shaped components e.g. funnel.
6. To prepare joints for welding suitable for butt welding and lap welding.
7. To study plastic moulding and glass cutting process
8. To study various types of carpentry tools and prepare simple types of at least two wooden joints.
9. To prepare simple engineering components/shapes by forging.
10. To prepare mold and core assembly.

11. To prepare horizontal surface/vertical surface/curved surface/slats or V-grooves on a shaper/planner.
12. To prepare a job involving side and face milling on a milling

13. To study Mechatronic machines and their components and power tools.

14. Students will repair old and unusable items / furniture like table, chair, bench etc. or new product and submit as a minor project model it to mechanical department.

Note :

1. At least ten experiments/jobs are to be performed/prepared by the students in the semester.
2. Each laboratory class/section shall not be more than about 20 students.
3. Experiment :14. Will be Mandatory. At the end of semester a group of Minimum 4-6 students and maximum 6-10 students submit file and minor project model in presence of class Teacher.

Suggested Text/Reference Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai**.**
3. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
4. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
5. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
6. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S. N	Experiment Name	Experiment Link(s)
1.	**Manufacturing Processes**	https://www.youtube.com/watch?v=uRVaLUQUmA8&list=PLACB124F79F677B6A https://www.youtube.com/watch?v=dvsMOxxwmSc&pp=ygUpTWFudWZhY3R1cmluZyBQcm9jZXNzZXMgZXhwZXJpbWVudCAgbnB0ZWw%3D
2.	**Carpentry, Fitting & Forming Processes**	https://www.youtube.com/watch?v=Bg7CY9ALX10&pp=ygU5Q2FycGVudHJ5LCBGaXR0aW5nICYgRm9ybWluZyBQcm9jZXNzZXMgIGV4cGVyaW1lbnQgIG5wdGVs https://www.youtube.com/watch?v=FVgPwOA_Hys&pp=ygU5Q2FycGVudHJ5LCBGaXR0aW5nICYgRm9ybWluZyBQcm9jZXNzZXMgIGV4cGVyaW1lbnQgIG5wdGVs
3.	**Casting and Machine Tools**	https://www.youtube.com/watch?v=p581wiEfLFI&pp=ygUsQ2FzdGluZyBhbmQgTWFjaGluZSBUb29scyAgZXhwZXJpbWVudCAgbnB0ZWw%3D https://www.youtube.com/watch?v=GGe8RhRTUQg&pp=ygUsQ2FzdGluZyBhbmQgTWFjaGluZSBUb29scyAgZXhwZXJpbWVudCAgbnB0ZWw%3D
4.	**Welding**	https://www.youtube.com/watch?v=m2B8t8vzeUE&list=PLbMVogVj5nJSjLB85-HKhw1aCIBxn3pWj https://www.youtube.com/watch?v=1L4BSJIJuvM&pp=ygUaV2VsZGluZyAgZXhwZXJpbWVudCAgbnB0ZWw%3D

CO - PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	2	2	-	-
CO2	2	2	-	-	-	-	-	-	2	2	-	-
CO3	2	2	-	-	-	-	-	-	2	2	-	-
CO4	2	2	-	-	-	-	-	-	2	2	-	-
Average	**2.00**	**2.00**							**2.00**	**2.00**		

BIOTECHNOLOGY FOR HUMAN WELFARE

B.Tech.Semester –I/II (Common to all the B.Tech Programmes)

Course code	**25ESC- BT-101H**				
Category	**ENGINEERING SCIENCE COURSE**				
Course title	**BIOTECHNOLOGY FOR HUMAN WELFARE**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-I/II**
	3			**3**	
Internal Assessment	**25 Marks**				
Theory	**50 Marks**				
Total	**75 Marks**				
Duration of Exam	**03 Hours**				

Note: Examiner will set nine questions in total. Each question carries equal marks**.** Question one will be compulsory and from all units and remaining eight questions of equal marks by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

COURSE OBJECTIVES

1. To understand the use of biotechnology in industries like food, textiles, and biofuels.
2. To learn how biotechnology helps in solving environmental problems.
3. To explore the role of biotechnology in improving human health.
4. To study the applications of biotechnology in agriculture and livestock.

COURSE OUTCOMES

CO1 Understanding of applications of biotechnology in industries
CO2 Application of Biotechnology in environmental aspects
CO3 Role of biotechnology in health care
CO4 Application of Biotechnology in livestock improvement.

UNIT-1

Industry: Enzymes for textile industry, breweries, food supplements – single cell protein, vitamins, food processing - cheese, yoghurt making, biodegradable plastics, biofuels.

UNIT-2

Environment: Applications of Biotechnology in environmental aspects: waste management, biodegradation of heavy metals, water cleaning, removing oil spills, air and soil pollution, bioremediation, biomining.

UNIT-3

Applications in Human Health: Antibiotic production, Molecular diagnostics, vaccines and vaccine delivery, recombinant therapeutics – insulin, gene therapy, forensics.

UNIT-4

Applications in agriculture and livestock improvement: transgenic plants; disease free plants, transgenic animals; animal vaccine production, increased milk production, artificial insemination.

Text Books/References

1. Bhasin, M.K. and Nath, S. 2002. Role of Forensic Science in the New Millennium, University of Delhi,
2. Crueger Wand Crueger, A. 2000. Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
3. Eckert, W.G. and Wrightin, R.K. 1997. Introduction to Forensic Sciences, 2nd Edition, CRC Press, Boca Raton.
4. Hans-Joachim Jordening and Jesef Winter, 2005. Environmental Biotechnology Concepts and Applications.
5. James, S.H. and Nordby, J.J. 2005. Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton.
6. Nanda, B.B. and Tiwari, R.K. 2001. Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi
7. Patel, A.H. 1996. Industrial Microbiology.1st edition, Macmillan India Limited.
8. Pradipta Kumar Mohapatra, 2020. Environmental Biotechnology, Dreamtech Press.
9. Stanbury, P.F., Whitaker, A. and Hall, S.J. 2006. Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	2	2			1	1	2
CO2	2	2	3	2	2	3	3					2
CO3	3	2	3	2	2	3	2	2		1		2
CO4	3	2	3	2	2	2	2			1		2

BASICS OF MECHANICAL ENGINEERING

B.Tech.Semester –I/II (Common to all the B.Tech Programmes)

Course Code	**25ESC-ME-103H**				
Category	**ENGINEERING SCIENCE COURSE**				
Course Title	**BASICS OF MECHANICAL ENGINEERING**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-I /II**
	3	**0**	**0**	**3**	
Internal Assessment-	**25 Marks**				
Theory-	**50 Marks**				
Total-	**75 Marks**			**Duration of Exam-3 Hrs**	

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts each having equal marks from all units and remaining eight questions of equal marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

COURSE OBJECTIVES:

1. To Learn Manufacturing Processes.
2. To Understand Basic Refrigeration & Air Conditioning Processes.
3. To Understand Hydraulic Turbines & Pumps and strain and strain for the strength of materials.
4. To learn power transmission methods.

COURSE OUTCOMES: At the end of the course, the student shall be able to:

1. Understand the principles and applications of various manufacturing processes.
2. Understand methods of thermodynamics, refrigeration & air conditioning in mechanical system
3. Understand the concept of Hydraulic Turbines & Pumps and strain and strain for the strength of materials.
4. Grasp the concepts of power transmission devices methods.

UNIT-I

Introduction to Commonly used Machine Tools in a Workshop : Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting. Basic concept of thermodynamics

Introduction, States, Work, Heat, Temperature, Zeroth, 1st, 2nd and 3rd law of thermodynamics,Concept of internal energy, enthalpy and entropy, Problems.

UNIT-II

Refrigeration & Airconditioning: Introduction to refrigeration and air-conditioning, Rating of refrigeration machines, Coefficient of performance, simple refrigeration vapour compression cycle, Psychrometric charts and its use, Human comforts.

Hydraulic Turbines & Pumps : Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Classification of water pumps and their working.

UNIT-III

Power Transmission Methods and Devices : Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches.

Stresses and Strains: Introduction, Concept & types of stresses and strains, Poison's ratio, Stress-strain diagrams. Hook's law, Elastic constants, Mechanical Properties of metals.

UNIT-IV

Introduction to Manufacturing Systems, Fundamentals of Numerical Control (NC). Advantage of NC systems, Classifications of NC, Comparison of NC and CNC.

Text Books :

1. Elements of Mechanical Engineering- R.K. Rajput LAkmi Pub., Delhi.
2. Elements of Mechanical Engineering- D.S. Kumar, S.K. Kataria and Sons
3. Engineering Thermodynamics - P.K. Nag TMH, New Delhi.
4. Refrigeration & Airconditioning- Arora & Domkundwar, Dhanpat rai & Co. Pvt. Ltd.
5. Worshop Technology Volt. I & II - Hazra & Chaudhary, Asian Book Comp., New Delhi.
6. Process and Materials of Manufacture- Lindberg, R.A. Prentice Hall of India, New Delhi.
7. Principles of Manufacturing Materials and Processes- Compbell, J.S. - McGraw Hill.

Reference Books :

1. Strength of Materials- Popov, Pub. - PHI, New Delhi.
2. Hydraulic Machines- Jagdish Lal, Pub. Metropolitan, Allahabad.
3. Strength of Materials- G.H. Ryder, Pub. ELBS.
4. Hydraulic and Fluid Mechanics- Modi and Seth, Pub.- Standara Book House, New Delhi.
5. Engineering Thermodynamics- C.P. Arora, Pub. - TMH, New Delhi.
6. Refrigeration & Airconditioning- C.P. Arora, Pub. -TMH, New Delhi.
7. Manufacturing Science- Amitabha Ghosh & Ashok Kumar Malik, East-West Press.

8. Manufacturing Process and Systems- Ostwaid, Munoz, John Wiley.
9. Workshop Technology, Vol. 1, 2, & 3- Chapman, WAJ Edward Amold.

S. N	Topic Name	Topic Link(s)
1.	Manufacturing Processes	https://www.youtube.com/watch?v=jdFrBtHeJbs&list=PLSGws_74K01-g9nnTMBssGURHawYYQfMQ&pp=0gcJCV8EOCosWNin
2.	Refrigeration & Airconditioning	https://www.youtube.com/watch?v=nlsNmhiID74&list=PLJjrv2_3aFXdh1PQVeO1RRl_NmXiiPZh0
3.	Machine Tools	https://www.youtube.com/watch?v=ljveGnQw2G0&list=PLSGws_74K018JY-1RyIj0cm4yppa1h54r https://www.youtube.com/watch?v=p581wiEfLFI&pp=ygUfQ2FzdGluZyBhbmQgTWFjaGluZSBUb29scyBucHRlbA%3D%3D
4	NC and CNC	https://www.youtube.com/watch?v=B7MM5M7DzpM&pp=ygURTkMgQU5EIENOQyAgbnB0ZWw%3D
5	Stresses and Strains	https://www.youtube.com/watch?v=DzyIEz3dKXQ&pp=ygUaU3RyZXNzZXMgYW5kIFN0cmFpbnMgbnB0ZWw%3D
6	Power Transmission Methods and Devices	https://www.youtube.com/watch?v=jMWaZQy22mg&list=PLdoIhVhbPQV7X5JcgKGg-tyXxf-jXWtWi&pp=0gcJCV8EOCosWNin
7	Hydraulic Turbines & Pumps	https://www.youtube.com/watch?v=2NAItlcTAGE&list=PLwdnzlV3ogoUqmN9vBhT5K-7wvsDg1TOT

CO - PO mapping

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
Average	**2.25**	**1.25**										

BASICS OF CIVIL ENGINEERING

B.Tech. Semester –I/II (Common to all the B.Tech Programmes)

Course code	**25ESC-CE-101-H**				
Category	Engineering Science Course				
Course title	**Basics of Civil Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester: I/II**
	3	**0**	0	**3**	
Class work	25 Marks				
Exam	50 Marks				
Total	75 Marks				
Duration of Exam	3 Hours				

COURSE OBJECTIVES:

- To understand the fundamental concepts and the scope of various specialized fields within Civil Engineering.
- To identify different types of building materials and their basic properties and applications in construction.
- To comprehend the significance of basic surveying principles and practices in civil engineering projects.
- To become familiar with fluid mechanics, soil mechanics and understand their importance in civil engineering practices.
- To appreciate the role and responsibilities of an environment and highway engineer in society and the ethical considerations involved in the profession.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: **Understand** the fundamental scope of Civil Engineering disciplines, the role of a Civil Engineer in society, and basic surveying principles including instrumentation and contouring.

CO2: **Identify** common building materials, classify buildings based on structure and loads, understand the functions of building components, and gain a basic understanding of estimation and valuation principles.

CO3: **Comprehend** fundamental fluid properties, principles of fluid statics and buoyancy, basic concepts of fluid flow and open channels, and gain an introductory understanding of soil types, properties, and foundations.

CO4: **Recognize** the sources and characteristics of water and wastewater, understand basic water treatment and sewage systems, and gain a basic introduction to different modes of transportation and highway development.

Note: Examiner will set 9 questions in all with two questions from each unit and one question covering all sections which will be Q.1. This Q1 is compulsory and of short answer type. Each question carries equal marks(14 marks). Examinee have to attempt 5 questions in total selecting at least one from each unit.

COURSE CONTENT

UNIT-I

Introduction: Branches of Civil Engineering, scope of Civil Engineering, role of Civil Engineer in society. Impact of infrastructural development on economy of country

Surveying: Definition of Surveying, Aims and applications, Fundamental principles of surveying, Classification of surveying, basic introduction to Instruments used in chain surveying and leveling, Contour and its Characteristics.

UNIT-II

Building Materials and Construction: Introduction to construction materials, Classification of buildings, Types of loads acting on buildings, Building components and their functions and nominal dimensions.

Estimating and valuation: Purpose of estimating and valuation, Principle of estimation, unit of measurement, item work,Estimation of quantity of load bearing structure with single room, Tenders and Contracts, Purpose of valuation

Unit-III

Fluid Mechanics: Distinction between a fluid and a solid; Fluid properties, Fluid Statics: Pressure density height relationship, Buoyancy and stability of floating bodies, Fluid Kinematics: types of flows, Basics of open channel flow.

Soil Mechanics: Types of Soil, Three Phase System, Index Properties, Sieve Analysis, Compaction and Consolidation Process, Types of Lateral Earth Pressure, soil exploration, basic introduction to types of foundations.

Unit-IV

Environmental Engineering: Sources of water, water demand, water and waste water characteristics, basic introduction to water treatment, sewage, sewerage system, types of sewers, sludge and its disposal.

Transportation Engineering: Modes of transportation, History of road development, Road development Plans in India, Classification of highways, road patterns, Introduction to road traffic and traffic control.

Suggested Text Books:

- Basic Civil Engineering by S.S. Bhavikatti, Publisher: New Age International (P) Limited
- Elements of Civil Engineering by S.C. Rangwala, Publisher: Charotar Publishing House
- Civil Engineering: Through Objective Type Questions by S.P. Gupta and S.S. Gupta, Publisher: CBS Publishers & Distributors Pvt Ltd
- Surveying and Levelling by N.N. Basak, Publisher: Tata McGraw-Hill Education (now McGraw Hill)
- Building Construction by B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, Publisher: Laxmi Publications
- Estimating and Costing in Civil Engineering by B.N. Dutta, Publisher: UBS Publishers' Distributors

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	-	2	-	-	-	-	-	-	2
CO2	3	3	2	3	2	1	-	-	2	1	-	3
CO3	2	2	2	1	2	1	-	1	2	1	-	2
CO4	2	23	2	3	2	1	-	-	2	1	-	1

BASICS OF CHEMICAL ENGINEERING

B.Tech. Semester –I/II (Common to all the B.Tech Programmes)

Course code	25ESC-CHE-101-H				
Category	Engineering Science Course				
Course title	**Basics of Chemical Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**0**	**0**	**3**	

Classwork	25 Marks
Examination	50 Marks
Total	75 Marks
Duration of Exam	03 Hours

COURSE OBJECTIVES:

- To understand the basic concepts of chemistry relevant to materials
- To understand and explain scientifically the various chemistry related problems in the industry/engineering field.
- To apply electrochemical concepts for energy harvesting, conversion and storage.
- To determine the rate of corrosion by a redox reaction and understand the mechanism of organic reactions.
- To study the bonding and properties of transition metal complexes.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: **Define** order and rate of reaction, catalysis, thermodynamics terms, electrode potential and EMF, types of corrosion, coordination complexes, types of organic reactions and polymers.

CO2: **Understand** the concepts of chemical kinetics, thermodynamics, electrochemistry, corrosion, bonding in transition metal complexes, mechanism of organic reactions, polymerisation.

CO3: **Apply** the basic principles of thermodynamics, electrochemistry, organic reactions and polymerization, to simple chemical engineering systems.

CO4: **Analyze** the kinetics and thermodynamics of systems, various electrochemical cells, transition metal complexes preventive measures of corrosion, reaction mechanisms and properties of commercially important polymers

Note:

Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Chemical Kinetics and Thermodynamics: Rate of reaction, Order and Molecularity of a reaction, Theories of reaction rates, Homogeneous and Heterogeneous Catalysis,

Thermodynamic terms (System, Processes, Properties), Laws of thermodynamics (Qualitatively), Thermodynamic Relationships (Enthalpy, Entropy, Free energy)

UNIT-II

Electrochemistry and Corrosion: Introduction to Electrochemistry, Electrode Potential and EMF, Electrochemical cell, Batteries (primary and secondary cells), fuel cell. Types of Corrosion and its prevention.

UNIT-III

Transition Metal Chemistry: Bonding in transition metal complexes; Valence bond Theory and Crystal field Theory, Magnetic properties and colour of Coordination complexes

Organic Reaction Mechanism: Introduction, electron displacement effect, reactive intermediates; Types of organic reactions and their mechanism - substitution reaction, addition reaction and elimination reaction.

UNIT-IV

Polymer Chemistry: Types of polymerisation (Addition, Condensation, Copolymerisation), Molecular weight of polymers, Preparation, properties and applications of some commercially important polymers - Polyethylene, Polypropylene, PVC, PVA, Nylon, Polyester, Introduction to Composites.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	-	-	1	-	-	-	-	-
CO2	2	2	1	-	2	2	3	2	-	-	-	-
CO3	3	2	3	3	3	3	3	3	-	2	-	2
CO4	3	3	3	3	3	2	2	3	-	2	-	2

Suggested Text Books:

1. Shashi Chawla, A Text Book of Engineering Chemistry, Dhanpat Rai & Co. Publications, 2007, 6th Edition.
2. Ashutosh Kar, Text Book of Engineering Chemistry, ED-Tech Publications, 2018.
3. William Kemp, Organic Spectroscopy, Macmillan Education, Limited, 2017.

4. Charles Corwin, Introductory Chemistry laboratory manual: Concepts and Critical Thinking, Pearson Education, 2012.
5. David Collins, Investigating Chemistry: Laboratory Manual, Freeman & Co., 2006.

Reference Books:

1. Michael F. Ashby, David R.H. Jones, Engineering Materials, Elsevier Science, 2012.
2. V. Raghava, Material Science and Engineering, PHI Learning, 2015.
3. J. M. Martin, Materials for Engineering, Elsevier Science, 2006.
4. Peter Atkins, Julio de Paula, James Keeler, Physical Chemistry, Oxford University Press, 2018

BASICS OF MATERIAL SCIENCE

B.Tech. Semester –I/II (Common to all the B.Tech Programmes)

Course code	25ESC-MS-101-H				
Category	Engineering Science Course				
Course title	**Basics of Material Science**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester I/II
	3	**0**	**0**	**3**	
Classwork	25 Marks				
Exam	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

5. To provide a foundation in the basic principles of solid-state physics, including crystal structures, lattice dynamics and lattice defects.
6. To provide a good knowledge of the basics of nanoscience and nanotechnology.
7. To introduce the students to material processing techniques.
8. Introduce students to techniques for characterizing the materials, including microscopy (TEM, SEM), thermography and diffraction methods.

COURSE OUTCOMES (CO):

After completing the course, students will be able to:

CO1: Identify and differentiate between various types of crystalline and amorphous materials based on their structural characteristics.

CO2: Understand the unique physical, chemical, and biological properties that emerge at the nanoscale.

CO3: Identify and apply various material processing techniques. Students will be able to distinguish between different methods and apply the appropriate techniques for specific

materials and applications.

CO4: Select and utilize appropriate analytical techniques to characterize different materials under various analysis conditions.

Note: Examiner will set 9 questions in total, two questions from each unit and one question covering all units, which will be Q.1. This Q.1 is compulsory and will have 7 parts of 2 marks each from all units. Each question carries an equal mark (14 marks). Students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT - 1

Crystal Structure: Introduction to Material Science, Selection of Material, Crystalline and non-crystalline solids, Lattice points and space lattice, basis and crystal structure, lattice translation vectors, unit cell and primitive unit cell, Crystal systems, symmetry elements, Closed-packed structures (sc, bcc, fcc, hcp), Cubic crystal structures (diamond, sodium chloride, zinc blend, cesium chloride). Imperfections in crystals: point, line (dislocation), surface and volume imperfections.

UNIT - 2

Nanoscale Science and Technology: Implications for Physics, Chemistry, Biology and Engineering, Nanoscale architecture, Effects of the nanometer length scale: surface to volume ratio, Effect of nanoscale dimensions on various properties: structural, thermal, chemical, mechanical, magnetic, optical, electronic properties and biological systems.

UNIT - 3

Material processing

(i)Polymer processing: Rheology of polymeric materials, Compounding of plastics, processing techniques: Compression, Transfer, injection, blow molding, Extrusion,

(ii)Ceramic processing: Processing of traditional ceramics- types of composites, Slurry processing, Slip casting, Pressure casting

(iii) Metallic processing: Casting process- major casting techniques, Solidification and volume shrinkage, Casting design and defects

UNIT - 4

Material Characterisation Techniques: Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM), X-ray diffraction, Bragg's law, Bragg's X-ray spectrometer, Non-destructive testing: Radiography, Ultrasonic, Acoustic emission, Thermography, Energy dispersive X-ray microanalysis (EDS).

Alternative NPTEL/SWAYAM Course:

Sr. No.	SWAYAM course name	Instructor	Host Institute
1	MATERIAL SCIENCE AND ENGINEERING	DR. VIVEK PANCHOLI	IIT ROORKEE

Course Articulation Matrix

COs	Programme Outcomes

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

Suggested Reference Books:

1. Solid State Physics, S.O.Pillai, New Age International (P) Ltd. (2002).
2. Introduction to Solid State Physics, C. Kittel, Wiley Eastern Ltd (2003).
3. Solid State Physics, Rita John,1st edition, Tata McGraw-Hill Publishers (2014).
4. Introduction to nanoscience and nanotechnology. Gabor L. Hornyak, H.F. Tibbals, Joydeep Dutta, John J. Moore.
5. Introduction to Nanoscale Science and Technology, Massimiliano Di Ventra
6. Introduction to nanoscience and nanotechnology. K. K. Chattopadhyay, A.N. Banerjee
7. Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, by Yang Leng, John Wiley & Sons, 2013.
8. Materials Characterization Techniques, Sam Zhang, Lin Li, Ashok Kumar, CRC Press, 2008.
9. Synthesis and Characterization of Advanced Materials, Michael A. Serio, Dieter M. Gruen, Ripudaman Malhotra, ACS Publications, 1997.B.S. Mitchell, An Introduction to Materials Engineering and Science for Chemical and Materials Engineers, Wiley-Interscience
10. Materials Science & Engineering: A first course, 5th ed., V. Raghavan, PHI Learning
11. Practical Non-Destructive Testing, 2nd ed., B. Raj, T. Jayakumar, M. Thavasimuthu, Narosa Publishing House
12. Manufacturing Engineering and Technology, 6th ed., S. Kalpakjian, S.R. Schmid, Pearson
13. Mechanical Metallurgy, G.E. Dieter, McGraw-Hill,
14. Advanced Aerospace Materials, Springer-Verlag, B.Horst, B. Ilschner, K.C. Russel, Berlin

BASICS OF TEXTILE CHEMISTRY

B.Tech Semester – I/II

Course code	25ESC-TC-101-H				
Category	EngineeringScience Course				
Course title	Basics of Textile Chemistry				
Scheme and Credits	**L**	**T**	**P**	**Cr**	Semester-I/II
	3	**0**	**0**	**3**	
Classwork	25 Marks				
Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

- To provide fundamental knowledge of textile terminology and an introduction to textile raw materials.
- To familiarize the students with the basic steps of textile manufacturing: spinning, weaving/knitting, chemical processing, and garmenting operations.
- To provide a foundation for textile chemical processing: pre-treatments, dyeing/printing, and finishing of textiles and quality evaluation methods.
- To create awareness about modern aspects of textile chemical processing and technical textiles, with share of textile business in Indian economy.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: Understand fundamental knowledge of textile terminology and textile raw materials.

CO2: Describe the basic steps of textile manufacturing: spinning, weaving/knitting, chemical processing, and garmenting operations through flowcharts.

CO3: Demonstrate the fundamental principles of textile chemical processing: pre-treatments, dyeing/printing, and finishing of textiles and quality evaluation methods.

CO4: Explain the modern technologies, sustainable practices, and various technical textiles with share of textile business in Indian economy.

Note:

Examiner will set 9 questions in all with two questions from each unit and one question covering all sections which will be Q.1. This Q1 is compulsory and of short answer type. Each question carries equal marks (10 marks). Examinee have to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Textile terms and definitions, Introduction to various types of fibers, their properties and applications, including natural fibers like cotton, wool, and silk, as well as synthetic

fibers such as polyester, nylon, and acrylic. Basic concepts of polymer chemistry: monomers, polymers, degree of polymerization.Chemical structure of fiber-forming polymers: cellulose, protein, and synthetic polymers (polyester, nylon, acrylic).

UNIT-II

Introduction of yarn manufacturing process through flow chart. Introduction to different types of yarns and concept of yarn numbering systems. Introduction to passage of material through weaving preparatory, and fabric formation processes viz, weaving, knitting and nonwoven by flow charts.
General sequence for chemical processing of textile materials including pretreatments, coloration, and finishing. Introduction to the sequence of operations for converting fabric to garment. Awareness of trims and accessories. Introduction to fabric sourcing and merchandising.

UNIT-III

Introduction to preparatory processes for natural and synthetic fibers: desizing, scouring, bleaching, mercerization. Classification of dyes (reactive, direct, acid, basic, disperse, vat). Fundamentals of textile coloration. Quality aspects of textiles: color fastness evaluation.

Basic principles of textile printing: block, screen, and digital printing. Introduction to styles of printing: direct, discharge, resist. Textile Finishing: definition, objectives, and types (temporary and permanent finishes). Common finishes: softening, wrinkle resistance, water repellency. Concept of functional and nanofinish.

UNIT-IV

Elementary idea of computer colour measurement system and its applications in industry. Introduction to sustainable practices in chemical processing: Plasma and ultrasound-assisted pretreatment methods, waterless dyeing techniques (e.g., supercritical CO_2 dyeing). Basic idea of Zero Liquid Discharge (ZLD) systems and circular economy in textiles.
Introduction to technical textiles with their classification. Brief idea of share of textile business in Indian economy.

CO - PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	1	1	1	-	-	1	-	-	2
CO2	3	2	2	2	-	1	-	1	1	1	-	3
CO3	2	2	2	3	-	1	1	-	1	1	1	2
CO4	3	2	2	3	2	1	-	-	1	1	-	3

Suggested Textbooks:

Title	**Author**
Textiles Fibre to Fabric	Corbmann
Cotton Spinning	K Ganesh & A R Garde
Principles of Weaving	Marks & Robinson
Fundamentals and Practices in Colouration of Textiles	J N Chakraborty
Dyeing and Chemical Technology of Textile Fibres	E R Trotman
Technology of Clothing Manufacture	Carr & Latham
Colour Technology: Tools, Techniques & Applications	V C Gupte
Chemical Finishing of Textiles	W.D. Schindler and P.J. Hauser

BASICS OF TEXTILE TECHNOLOGY

B.Tech.Semester –I/II

Course code	25ESC-TT-101-H				
Category	EngineeringScience Course				
Course title	Basics of Textile Technology**(Theory)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**0**	**0**	**3**	

Classwork	25 Marks
Examination	50 Marks
Total	75 Marks
Duration of Exam	03 Hours

COURSE OBJECTIVES:

- To provide fundamental knowledge of textile terminology and introduction to textile raw materials.
- To familiarize students with basics of yarn formation and fabric formation techniques through flowcharts and material passage.
- To introduce students to the fundamental principles of textile chemical processing and garmenting operations.
- To create awareness about modern textile technologies, quality evaluation methods, and technical textiles with share of textile business in Indian economy.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: Understand fundamental knowledge of textile terminology and textile raw materials.

CO2: Describe the basics of yarn formation and fabric formation techniques through flowcharts.

CO3: Demonstrate the fundamental principles of textile chemical processing and garmenting operations.

CO4: Explain the modern textile technologies, quality evaluation methods, and various technical textiles with share of textile business in Indian economy.

Note:
Examiner will set 9 questions in all with two questions from each unit and one question covering all sections which will be Q.1. This Q1 is compulsory and of short answer type. Each question carries equal marks (10 marks). Examinee have to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Textile terms and definitions, Introduction to various types of fibers, their properties and applications, including natural fibers like cotton, wool, and silk, as well as synthetic fibers such as polyester, nylon, and acrylic. Concept of yarn numbering systems.

UNIT-II

Introduction to different types of yarns, Introduction to conventional yarn manufacturing processthrough flow chart. Introduction to modern methods of spun yarns (Rotor, Air-jet, Friction spun yarns) and their end uses.

Introduction to passage of material through weaving preparatory and fabric formation processes viz, weaving, knitting and nonwoven by flow charts. Introduction to Shuttle and Shuttle-less weaving technologies (Projectile, Rapier, Air-jet, Water-jet), Concept of warp and weft knitting and their applications.

UNIT-III

Introduction to various textile chemical processes: General sequence used for chemical processing of textile materials of fibre, yarn, fabric, and garments. Overview of wet processing, viz dyeing, printing and finishing of textile materials.

Introduction to sequence of operations for converting fabric to garment, Awareness of trims and accessories. Brief idea of quality evaluation parameters of fibers, yarns, fabrics and garments.

UNIT-IV

Types of Nonwoven fabric and their applications. High-Performance Fibres and their applications. Introduction to Technical Textiles, their classification and applications, Introduction to Textile Composites and their applications. Brief idea of share of textile business in Indian economy.

Suggested Text/ Reference Books:

Title	**Author**
Cotton Spinning	K Ganesh & A R Garde
Cotton Yarn Weaving	RN Kanungi & AR Garde
Principles of Weaving	Marks & Robinson
Textiles Fibre to Fabric	Corbmann
Fundamental Principles of Textile Processing	V A Shenai
Technology of Clothing Manufacture	Carr & Latham

CO - PO mapping

	PO 1	**PO 2**	**PO 31**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	**2**	**1**	**1**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**-**	**2**
CO2	**2**	**1**	**1**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**-**	**2**
CO3	**2**	**1**	**1**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**-**	**2**
CO4	**2**	**1**	**1**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**-**	**2**

BASICS OF FASHION AND APPAREL ENGINEERING

B.Tech.Semester –I/II

Course code	25ESC-FAE-101-H				
Category	EngineeringScience Course				
Course title	Basics of Fashion and Apparel Engineering**(Theory)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3	**0**	**0**	**3**	
Classwork	25 Marks				
Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES:

- To provide fundamental knowledge of textile terminology and introduction to textile raw materials and yarn manufacturing techniques
- To familiarize students with fabric formation methods and textile chemical processing using flowcharts.
- To develop insights into the fashion supply chain, key production stages, and various business models within the fashion, handloom, and handicraft sectors.
- To promote awareness of sustainable practices and the role of digital design development in the modern apparel industry

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1: Define key textile terminologies and identify various textile raw materials and yarn manufacturing techniques**.**

CO2: Illustrate fabric formation methods (weaving, knitting, non-woven) and explain textile chemical processing steps using flowcharts.

CO3: Analyze the fashion supply chain and differentiatebetween production stages and business types in the fashion, handloom, and handicraft sectors.

CO4: Create basic digital design concepts that reflect sustainability and contemporary fashion trends.

Note:
Examiner will set 9 questions in all with two questions from each unit and one question covering all sections which will be Q.1. This Q1 is compulsory and of short answer type. Each question carries equal marks (10 marks). Examinee have to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Textile terms and definitions, Introduction to various types of fibers, their properties and applications, including natural fibers like cotton, wool, and silk, as well as synthetic fibers such as polyester, nylon, and acrylic. Concept of yarn numbering systems. Introduction to different types of yarns, Flowchart of conventional and modern yarn manufacturing process and their uses.

UNIT-II

Flowcharts of passage of material through weaving preparatory and fabric formation processes viz, weaving, knitting and nonwoven. General sequence used for chemical processing of textile materials of fibre, yarn, fabric, and garments. Requirements of fabric sourcing process followed in apparel industry,Introduction to sequence of operations for converting fabric to garment

UNIT-III

Fashion supply chain overview, Types of fashion businesses: Designers, Brands, Export Houses, Buying Houses. Fashion production process: Designing, Sampling, Merchandising Manufacturing, Finishing, Marketing and Retailing. Handloom and Handicraft Industry: Definitions, Importance, Challenges, and Emerging Trends

UNIT-IV

Types of wearable fashion and protective clothing technology, Introduction and uses of digital design tools and e-commerce platforms in different sectors of fashion and apparel industry. Sustainable materials and eco-friendly practices in fashion, Basic concept of Circular fashion. Brief idea of share of textile business in Indian economy.

Suggested Text/ Reference Books:

Title	**Author**
Cotton Spinning	K Ganesh & A R Garde
Cotton Yarn Weaving	RN Kanungi & AR Garde
Principles of Weaving	Marks & Robinson
Textiles Fibre to Fabric	Corbmann
Fundamental Principles of Textile Processing	V A Shenai
Technology of Clothing Manufacture	Carr & Latham

Inside The Fashion Business	Kitty G. Dickerson
Fashion Marketing	Mike Easey

CO - PO mapping

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

INTRODUCTION TO IoT

B.Tech.Semester –I/II (Common to all the B.Tech Programmes)

Course code	25ESC-IOT-101H				
Category	EngineeringScience Course				
Course title	Introduction to IoT				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester-I/II
	3		**0**	**3**	
Classwork	25 Marks				
Examination	50 Marks				
Total	75 Marks				
Duration of Exam	03 Hours				

COURSE OBJECTIVES

- To understand basic networking concepts and their role in IoT.
- To learn about IoT components, sensors, and actuators.
- To explore data processing and cloud technologies used in IoT.
- To study real-life applications of IoT in various domains.

COURSE OUTCOMES (CO):

By the end of the Course, Students will be able to:

CO1 Describe the evolution of IoT and IoT networking components in IoT.
CO2 Classify and analyze various sensing devices and actuator types.
CO3 Demonstrate the processing in IoT and Explain Associated IOT Technologies.
CO4 Illustrate architecture of IOT Applications.

Note:
Examiner will set 9 questions in all with two questions from each unit and one question covering all sections which will be Q.1. This Q1 is compulsory and of short answer type. Each question carries equal marks(14 marks). Examinee have to attempt 5 questions in total selecting at least one from each unit.

UNIT-I

Basics of Networking: Introduction, Network Types, Layered network models

Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components.

IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.

UNIT-II

IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

UNIT-III

ASSOCIATED IOT TECHNOLOGIES: Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service.

UNIT-IV

IOT CASE STUDIES: Agricultural IoT – Introduction and Case Studies. Vehicular IoT – Introduction Healthcare IoT – Introduction, Case Studies IoT Analytics – Introduction

Alternative NPTEL/SWAYAM Course:

https://onlinecourses.nptel.ac.in/noc22_cs53/preview

CO - PO mapping

	PO	**PO2**	**PO3**	**PO**	**PO5**	**PO6**	**PO**	**PO8**	**PO**	**PO1**	**PO1**	**PO1**

	1			4			7		9	0	1	2
CO1	**3**	**3**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**3**	**3**	**2**	**3**		**1**	**-**	**-**	**2**	**1**	**-**	**2**
CO3	**3**	**3**	**2**	**1**	**2**	**1**	**-**	**-**	**2**	**1**	**-**	**2**
CO4	**3**	**3**	**1**	**3**	**2**	**1**	**-**	**-**	**2**	**1**	**-**	**2**

Suggested Text Books:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, “Introduction to IoT”, Cambridge University Press 2021.

Reference:

2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

3. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”,1st Edition, VPT, 2014.

4. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.