ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY,NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2025-26

Electrical Engineering

SEMESTER I (Group 2)

Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks				Min Passing Marks	No. of Hrs for ESE
				L	T	P		Mid-Sem Examination	Continual Assessment	End Sem Examination	Total		
1	BSC	25EE101T	Applied Physics	2	-	-	2	10	10	30	50	23	1.5
2	BSC	25EE101P	Applied Physics Lab	-	-	2	1	-	25	25	50	25	-
3	BSC	25EE102T	Linear Algebra and Calculus	3		-	3	20	20	60	100	45	3
4	BSC	25EE102P	Linear Algebra and Calculus Lab			2	1	-	25	25	50	25	-
5	ESC	25EE103T	Basic Electrical Engineering	3	-	-	3	20	20	60	100	45	3
6	ESC	25EE103P	Basic Electrical Engineering Lab	-	-	2	1	-	25	25	50	25	-
7	ESC	25EE104T	Engineering Graphics	3	-	-	3	20	20	60	100	45	3
8	ESC	25EE104P	Engineering Graphics Lab	-	-	2	1	-	25	25	50	25	-
9	AEC	25EE105P	Business Communication Skills I Lab	-	-	2	1	-	25	25	50	25	-
10	SEC	25EE106T	Design Thinking #	2	-	-	2	10	10	30	50	23	1.5
11	CC	25EE207T	Co-curricular Courses - I	2			2	-	50	-	50	23	-
Total				15	-	10	20	80	255	365	700		

 # Course to be taken online through NPTEL

Chairman - BoS	Dean – Academics	July 2025 Date of Release	3.0 Version
			Applicable for 2025-26

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25EE101T	Applied Physics	2	--	--	2	10	10	30	50

Course Objectives	Course Outcomes
This course is intended 1. To understand the basic laws of physics and types of materials and their application in engineering and technology. 2. To develop scientific temper and analytical capability.	Students will be able to **1.** Explain the fundamental concepts of crystal structure, unit cells, Miller indices, and apply Bragg's law to analyze X-ray diffraction in crystalline solids. **2.** Classify different types of magnetic materials and analyze their properties (diamagnetic, paramagnetic, ferromagnetic) along with their practical applications. **3.** Illustrate the band theory of solids, differentiate between conductors, insulators, and semiconductors, and calculate Fermi energy for given systems. **4.** Distinguish between intrinsic and extrinsic semiconductors and evaluate the working principle and applications of p–n junction diodes in electronic devices.

Unit I CRYSTAL STRUCTURE	**[10 Hrs]**
Space lattice, Crystal structure, Unit cell, Types of unit cell, Characteristics of SC, BCC and FCC unit cell, Miller Indices, Interplanar distance and its derivation, Diffraction of X-rays - Braggs' Law and its applications.	
Unit II MAGNETIC MATERIALS	**[10 Hrs]**
Terms and definitions, Types of magnetic materials, characteristics of Diamagnetic, Paramagnetic and Ferromagnetic Materials, Applications of soft and hard magnetic materials.	
Unit III SEMICONDUCTORS	**[10 Hrs]**
Free electron Theory (qualitative idea) and its features; Idea of band formation in solids, Classification of solids: Metal, Insulator, Semiconductor; Fermi Energy, Types - Intrinsic and Extrinsic Semiconductors, Application of Extrinsic Semiconductors - p-n junction diode	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Fundamentals of Physics	David Halliday, Robert Resnick and Jerle Walker	8th extended	John-Wiley India
2	Engineering Physics	M. N. Avadhanulu	Latest edition	S. Chand & Co.

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Solid State Physics	Charles Kittel	Eighth edition	John Wiley & Sons, Inc
2	Solid State Physics	R.L. Singhal	Eighth edition	Kedarnath Ramnath

Online Resources

1	https://www.britannica.com/science/semiconductor#ref233890
2	https://www.geeksforgeeks.org/semiconductors/
3	https://www.sciencedirect.com/topics/chemistry/magnetic-material
4	https://www.livescience.com/33816-quantum-mechanics-explanation.html

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FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25EE101P	Applied Physics Lab	--	--	2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended 1. To understand the basic laws of physics and types of materials and their application in engineering and technology. 2. To develop scientific temper and analytical capability.	Students will be able to 1. Illustrate principles/ laws by selecting and using proper measuring instruments, interpret result and draw conclusions. 2. Find various parameters using various properties of light. 3. Demonstrate the concept and working of Semiconductor devices.

Expt. No.	Title of the experiment
1	Study of semiconductor diodes
2	Study of Phenomenon of Diffraction
3	Study of Interference
4	Study of Birefringence
5	Guoy's Balance Method a) Determination of Magnetic Susceptibility of different magnetic materials. b) Identification of different types of Magnetic Materials
6	Study of Planck's Constant by means of LED
7	Determination of Curie Temperature of Ferromagnetic Material.
8	Study of Transistors.
9	Study of Hall Effect.
10	Experiment on 'Quantum Eraser'.
11	Demonstration of phenomena of Optics using Laser.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Fundamentals of Physics	David Halliday, Robert Resnick and Jerle Walker	8e extended	John-Wiley India
2	A Textbook of Engineering Physics	Dr. M. N. Avadhanulu, Dr. P. G. Kshirsagar	Latest edition	S. Chand Publication.

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Solid State Physics	Charles Kittel	Eighth edition	John Wiley & Sons, Inc
2	Solid State Physics	R.L. Singhal	Eighth edition	Kedarnath Ramnath

Online Resources

1	https://www.britannica.com/science/semiconductor#ref233890
2	https://www.geeksforgeeks.org/semiconductors/
3	https://www.sciencedirect.com/topics/chemistry/magnetic-material

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SEMESTER-I

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25EE102T	Linear Algebra & Calculus	3		1	4	20	20	60	100

Course Objectives	Course Outcomes
This course is intended to 1. Develop students' conceptual understanding and computational skills in Matrix Algebra and Differential Equations for solving mathematical problems. 2. Enable learners to apply Multivariate and Vector Calculus for analyzing functions of several variables and modeling physical phenomena.	**Students will be able to** 1. Apply matrix concepts to solve and analyze linear systems. 2. Analyze and solve engineering problems involving eigenvalues, eigenvectors, and functions of matrices. 3. Solve multivariate calculus problems involving partial derivatives, Jacobians, and optimization. 4. Apply first order and higher order differential equations to solve problems in engineering. 5. Evaluate vector calculus operations and their physical applications.

Unit I	**[9Hrs]**
Matrix Algebra : Introduction to matrices, , Rank of a matrix, Consistency of system of linear equations, Linear and orthogonal transformations, Linear dependence of vectors.	
Unit II	**[9Hrs]**
Matrices: Characteristics equation, Cayley- Hamilton Theorem**,** Eigen values and Eigen vectors, Reduction to diagonal form, Reduction of quadratic form to canonical form by orthogonal transformation, Sylvester's theorem.	
Unit III	**[9Hrs]**
Multivariate Calculus: Functions of several variables and their partial derivatives, Chain rule and total differential coefficient, Jacobians and its properties, Maxima –Minima of functions of two variables, Lagrange's method of undetermined multipliers.	
Unit IV	**[9Hrs]**
Differential Equations: First order and first degree differential equations: Linear, Higher order differential equations with constant coefficients, Method of variation of parameters, Cauchy's homogeneous linear equation, Applications of differential equations.	
Unit V	**[9Hrs]**
Vector Calculus: Vector differentiation, Gradient, Directional derivatives, Divergence and Curl with their physical interpretation Solenoidal and Irrotational motions, Scalar potential, Line integral & Work done.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Higher Engineering Mathematics	B. S. Grewal	38th	Khanna Publishers, New Delhi.
2	Higher Engineering Mathematics	H. K. Das & Er. Rajnish Verma	1st	S. Chand & CO. Pvt. Ltd., New Delhi

Referenc Books

S.N	Title	Authors	Edition	Publisher
1	Higher Engineering Mathematics	B.V. Ramana,	11th reprint, 2010.	Tata McGraw Hill New Delhi
2	A Text Book of Engineering Mathematics	Peter O' Neil	8th	Thomson Asia Pvt. Ltd., Singapore.

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SEMESTER-I

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25EE102P	Linear Algebra & Calculus Lab	--	--	2	1	25	25	50

Course Objectives	Course Outcomes
This Course is intended to: 1. To develop students' computational proficiency in solving problems related to linear algebra, calculus, and differential equations using SageMath with an emphasis on symbolic computation and numerical methods. 2. To enable students to apply SageMath for solving and visualizing problems in vector calculus through effective use of graphical and analytical tools.	**Students will be able to:** 1. Apply fundamental matrix operations and solve systems of linear equations using SageMath. 2. Apply concepts of linear algebra to compute eigenvalues and eigenvectors of matrices using SageMath. 3. Evaluate partial derivatives of multivariable functions and solve first and higher-order ordinary differential equations using SageMath. 4. Analyze and visualize vector calculus operations including gradient, divergence, curl, and evaluate line and surface integrals using SageMath.

List of Experiments:-

Experiment No.	List of Experiment
1	To Implement basic matrix operations using SageMath's symbolic computation tools.
2	To check the consistency of a system of linear equations using augmented matrices and SageMath.
3	To solve systems of linear equations using various within the SageMath environment.
4	To determine eigenvalues and eigenvectors of matrices using built-in SageMath functions.
5	To implement and validate the Cayley-Hamilton Theorem with the aid of SageMath.
6	To compute partial derivatives of various orders for multivariable functions using SageMath.
7	To solve first-order and higher-order differential using SageMath's differential equation solvers.
8	To find maxima and minima of functions of two variables using partial derivatives and the second derivative test implemented in SageMath.
9	To compute and visualize vector differential operations using SageMath.
10	To compute vector integrals in SageMath.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Computational Mathematics with SageMath	Paul Zimmermann	1st	SIAM Publications Library.
2	Basics of SageMath : Mathematics(Practicals)	Varun Kumar	1st	Amazon KDP

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Mathematics-SageMath Software System	Indrajeet Varhadpande & Dr. Kirti Sahu	1st	Himalaya Publication
2	Applied Mathematics Using SageMath	Dr. Kirti Sahu & Dr. Sajid Anwar	1st	Himalaya Publication

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B.Tech. Scheme of Examination & Syllabus 2025-26

ELECTRICAL ENGINEERING

FIRST SEMESTER (GROUP-II)

Course Code	Course Name	Th	Tu	Pr	Credits		Evaluation		
						MSE	CA	ESE	Total
25EE103T	Basic Electrical Engineering	3	1	-	4	20	20	60	100

Course Objectives	Course Outcomes
• The goal of this course is to introduce advanced concepts of 1. To understand the basic fundamentals of Electrical Circuits and Machines. 2. To summarize and apply the basic concepts of Electrical Power System	Students will be able to • Demonstrate the ability to apply Kirchhoff's laws and Superposition theorem to analyze complex DC circuits. • Explain the concepts of magnetic circuits, including the relationship between electric and magnetic circuits • Explain the principles of alternating current (AC), including concepts of frequency, phase, impedance, real, reactive, and apparent power and analyse R, L & C components. • Describe the operating principles of single-phase transformers and explain the significance of turn ratio, voltage regulation, efficiency and understand losses in transformers. • Compare the methods of power generation, including Thermal, Hydro and Solar, also discuss different types of electric tariffs to evaluate electricity bill.

Unit I **[8Hrs]**

ELECTRIC CIRCUITS : EMF, Potential difference, current, power, Energy (Definition & Units SI), Ohms Law, Resistance in Series and Parallel. Current division rule, Voltage division rule, Star Delta Conversion, Types of sources (Current & Voltage), Ideal and Practical Sources, Kirchhoff's Laws (KVL, KCL) statement & Numerical, Superposition Theorem

Unit II **[6Hrs]**

MAGNETIC CIRCUITS : Flux, flux density, flux intensity, MMF, reluctance, permanence, permeability , Analogy with Electric Circuits, Leakage Flux, Magnetic Fringing, B-H Curve, Hysteresis Loop, Simple Calculations for series and Parallel composite magnetic circuits.

Unit III **[10Hrs]**

AC CIRCUITS : Generation of single phase voltage, Average and RMS value for sinusoidal waveform, periodic function, phasor representation of sinusoidal electrical quantities, reactance, impedance, power and energy in AC circuit, simple numerical on series and parallel AC circuit, concept and importance of power factor, resonance in series circuits. Principal of Generation of three phase voltage, Phase sequence, Star & Delta Connected three phase system, Voltage, Current & Power relations for Balanced three phase system only (With numerical)

Unit IV **[6Hrs]**

TRANSFORMER : Construction and principle of single-phase transformer, Ideal and Practical Transformer, operation at no load and on load, phasor diagram, equivalent circuit, losses, efficiency and regulation, O.C. & S.C. test, condition for maximum efficiency

Unit V **[6Hrs]**

Introduction to Electrical Power System: Introduction to Power Generation (Thermal, Hydro, and Solar) with block schematic presentation. Utilization of Electrical Energy: Necessity of equipment earthling, Importance of Fuses, Tariff, types of tariff & calculation of household electricity bill.

Text Books

S.N	Title	Authors	Edition	Publisher
1	A Text Book of Electrical Technology	B. L. Theraja and A. K.Theraja,	(Volume I, II & III)	S. Chand and Company
2	Basic Electrical Engineering	D. P. Kothari and I. J. Nagrath	4 th Edition	Tata McGraw Hil, 2010
3	Basic Electrical Engineering	D. C. Kulshreshtha	4 th Edition,	McGraw Hill, 2009
4	Fundamentals of Electrical Engineering	L. S. Bobrow	4 th Edition,	Oxford University Press, 2011

		July 2025	1	Applicable for 2025-26
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FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25EE103P	Basic Electrical Engineering Lab			2	1	25	25	50

Course Objectives	Course Outcomes
This course is intended • To study performance of Electric circuits. • To study performance of Transformer. • To study performance of DC Machines.	**Students will be able to** • To identify various laws for simplification of electric circuit • To analyze characteristic of magnetic material. • To discuss characteristics of AC circuits • To analyze Polarity of Single phase transformer • To illustrate the tests performed on transformer

Expt. No. (Any 08)	Title of the experiment (Any 08)
1	Study of Ammeter, Voltmeter, Wattmeter, Earthing, Fuse and various electric devices
2	To verify KVL and KCL for DC Circuit
3	To verify Superposition Theorem for DC Circuit
4	To plot B-H curve of the given magnetic material
5	To study RLC series circuit hence apply KVL to AC Circuit
6	To study RLC series circuit hence find Power Factor of the circuit.
7	To study the balanced Three phase system for star connected balanced load.
8	To study the balanced Three phase system for delta connected balanced load.
9	To mark the dot polarity of single phase transformer.
10	To find efficiency and regulation of single phase transformer by using direct loading test.
11	To Perform open circuit and short circuit test on 1-Phase Transformer
12	Case study on Electricity Bill Calculation.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Laboratory Courses in Electrical Engineering	R.L. Kharbanda and S. G. Tarnekar		
2	Laboratory manual of Electrical Machines	D.P.Kothari and B.S. Umre		
3	Electrical Technology Volume I	B. L. Thareja		
4	Electrical Technology Volume II	B. L. Thareja		

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25EE104T	Engineering Graphics	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
• To expose the students to the area of Engineering Graphics. • To enable the student to communicate effectively through technical drawings.	Students will be able to • Recognize the application of drawing standards, construct engineering curves and orthographic projections of lines. • Construct orthographic projections of Planes and solids. • Apply concepts of orthographic projections to construct the Development of Lateral surfaces of sections of solids. • Apply concepts of projections and convert pictorial views to orthographic views. • Apply concepts of projections and construct isometric views.

Unit I	**[8Hrs]**
Introduction to Engineering Graphics: Types of lines, standard layout, Lettering, Standard representation of dimensions. **Types of Curves** - Ellipse, Parabola, Hyperbola, Cycloid, involute and Spiral. Construction of Ellipse (Arcs of circles method), Parabola (Rectangle Method) and Hyperbola (Rectangle Method) **Introduction to Orthographic projections**- Projection of Points and Lines in the first quadrant. [Problem-solving on lines inclined to one reference plane].	
Unit II	**[8Hrs]**
Projection of Planes- Projection of planes in the first quadrant. Problem-solving on planes inclined to one reference plane. **Projection of Solids-** Projection of solids in the first quadrant. Problem-solving for the solids with an axis inclined to one reference plane.	
Unit III	**[8Hrs]**
Development of lateral Surfaces for Section of solids: Introduction to Sectional Planes, Section of solids, Method of development, Development of lateral surfaces of right solids including Prisms, Cylinders, Pyramids & Cone cut by different section planes.	
Unit IV	**[8Hrs]**
Introduction to Orthographic drawings: Conversion of Pictorial / Isometric drawings of machine components to Orthographic drawings.	
Unit V	**[8Hrs]**
I**ntroduction to Isometric drawings**: Isometric concepts of Isometric axes, Isolines, Isometric scale, Isometric projection and Isometric view. Construction of Isometric drawings and views from a given orthographic view.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Engineering Drawing	N. D. Bhatt	-	Charotor Publishing House
2.	Engineering Drawing	D. N. Johle	-	Tata McGraw-Hill Publishing

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Fundamentals of Engineering Drawing	Luzadder Warren J, Duff John		PHI publications

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25EE104P	Engineering Graphics Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
• To expose the students to the area of Engineering Graphics. • To enable the student to communicate effectively through technical drawings.	Students will be able to • Apply engineering drawing standards and construct engineering curves and orthographic projections of lines. • Construct orthographic projections of Planes and solids. • Apply orthographic projection concepts to construct the Development of Lateral surfaces of sections of solids. • Apply concepts of projections and convert pictorial views to orthographic views through pencil drawings and CAD. • Apply concepts of projections and construct isometric views through pencil drawings and CAD.

A minimum of eight experiments to be performed

Expt. No.	Title of the experiment
1	Pencil drawings on Engineering Curves
2	Pencil drawings on Projection of Lines
3	Pencil drawings on Projection of Planes
4	Pencil drawings on Projection of Solids
5	Pencil drawings on the Development of Lateral surfaces
6	Pencil drawings on Orthographic Views
7	Pencil drawings on Isometric Views / Projection
8	Computer-Aided Drawing on Orthographic Views
9	Computer-Aided Drawing on Isometric Views

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Engineering Drawing	N. D. Bhatt	-	Charotor Publishing House
2.	Engineering Drawing	D. N. Johle	-	Tata McGraw-Hill Publishing

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Fundamentals of Engineering Drawing	Luzadder Warren J, Duff John		PHI publications

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
25EE106P	Business Communication Skills I Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
To empower students to develop a career-oriented mindset while harnessing the power of LSRW skills.	**Students will be able to:** 1. apply verbal and non-verbal skills to confidently and effectively deliver presentations. 2. prepare themselves for overall language ability through listening and reading tasks. 3. demonstrate formal writing skills. 4. draft impactful Resumes and Cover Letters. 5. prepare themselves for Personal Interviews.

Expt. No.	Title of the experiment
1	Presentation Skills
2	Poster Making (Product/ Event)
3	Reading Comprehension for Competitive Exams.
4	Writing Skills for Academic Purposes.
5	Listening Skills I
6	Business Correspondence I
7	Resume Writing and Cover Letter
8	Mock Interviews

Reference Books:

S. N	Title	Authors	Edition	Publisher
1	Communication Skills for Engineers	C. Muralikrishna & SunitaMIshra	2nd Edition, 2011	Pearson India Education Services
2	Communication Skills	Dr. L .Bisen, Dr. B. Agrawal & Dr. N. T. Kalyani	1st Edition, 2021	Himalaya Publishing House
3	Barron's IELTS Superpack	Lin Lougheed	2012	Barrons Educational Series

FIRST SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
25EE207T	Design Thinking	2	-	-	2	10	10	30	50

Course Objectives	Course Outcomes
1. Learn design thinking concepts and principles 2. Use design thinking methods in every stage of the problem 3. Learn the different phases of design thinking 4. Apply various methods in design thinking to different problems	1. Define key concepts of design thinking 2. Practice design thinking in all stages of problem solving 3. Apply design thinking approach to real world problems

Unit I **[10 Hrs]**

INTRODUCTION: Why Design? - Four Questions, Ten Tools - Principles of Design Thinking - The process of Design Thinking - How to plan a Design Thinking project.
UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM: Search field determination - Problem clarification - Understanding of the problem – Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.

Unit II **[10 Hrs]**

IDEATION AND PROTOTYPING: Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.

Unit III **[10 Hrs]**

TESTING AND IMPLEMENTATION: Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking.
FUTURE: Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow.

Text Books

Title	Authors	Edition	Publisher
Handbook of Design Thinking - Tips & Tools for how to design thinking	Christian Mueller-Roterberg	2021	Independently Published
Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation	Tim Brown	2019	HarperCollins

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Design Thinking for Strategic Innovation	Idris Mootee		Wiley

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