24MA102
Mathematics-II
(DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS)
COMMON TO ALL BRANCHES

Course Category:	**Basic Sciences (BS)**	**Credits:**	**4**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-2**
Pre-requisites:	**10+2 Mathematics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

An overview of the fundamental concepts and methods to solve differential equations, Numerical methods to solve algebraic and transcendental equations, initial, boundary value problems and polynomial estimation using interpolation technique with a focus on the applications in solving engineering problems

Course Objectives:

- Introduce techniques for solving differential equations
- Explain methods to solve algebraic and transcendental equations and estimate function values through interpolation /extrapolation
- Acquaint the knowledge of solving initial and boundary value problems

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Apply suitable approaches to solve first order and first-degree ordinary differential equations with engineering applications	**K3**
CO2	Solve higher order ordinary linear differential equations with engineering applications	**K3**
CO3	Solve the partial differential equations	**K3**
CO4	Use iterative methods for solving algebraic & transcendental equations and compute the functional values by polynomial interpolation	**K3**
CO5	Apply numerical methods to solve initial and boundary value problems	**K3**

Course articulation matrix

	POs											PSOs	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**2**	**2**			**1**								
CO2	**2**	**2**			**1**								
CO3	**2**	**2**			**1**								
CO4	**2**	**2**			**1**								
CO5	**2**	**2**			**1**								

(1-Low, 2 -Medium, 3–High)

Course Content

Unit-I

Differential Equations of First Order[T1]

Linear equations, Bernoulli's equation, Exact equations, Equations reducible to exact equations, Newton's Law of cooling, Law of growth and decay.

Unit-II

Higher Order Linear Differential Equations with Constant Coefficients [T1]

Definitions, Working procedure to solve the equation, Wronskian, Method of variation of

parameters, Simultaneous linear equations, Electrical circuits.

Unit-III

Partial Differential Equations **[T1]**

Introduction, Formation of partial differential equations, Solutions of a linear equation of the first order using Lagrange's method, Homogeneous linear partial differential equations with constant coefficients: Working procedure to solve the equation.

Unit-IV

Numerical Methods and Interpolation[T1]

Root finding methods: Bisection method,Method of Iteration,Newton-Raphson method

Interpolation: Introduction, Finite Differences, relation between the operators, Newton's interpolation formulae: forward and backward differences, Interpolation with unequal intervals: Lagrange's and Newton's divided difference formulae.

Unit-V

Initial and Boundary value problems **[T1]**

Numerical Solution of ordinary differential equations: Taylor's series, Euler's, modified Euler's and 4th order Runge-Kutta methods, Elliptic partial differential equations: Laplace's and Poisson's equations.

Text Books:

[1]. Grewal B. S. (2017). Higher Engineering Mathematics. (44th Edition).Khanna Publishers.
[2]. SankaraRao K (2014). Numerical Methods for Scientists and Engineers.(3rd Edition). PHI Learning Private Limited.

Reference Books:

[1].KreyszigErwin. (2013). Advanced Engineering Mathematics.(9th Edition).Wiley Publishers.
[2].RamanaB.V.(2007). Higher Engineering Mathematics.TataMc.Graw Hill.
[3].Sastry S.S. (2012). Introductory Methods of Numerical Analysis.(5th Edition). PHI Learning Private Limited.

Web Resources:

[1]. NPTEL:Differential Equations For Engineers
https://nptel.ac.in/courses/111106100
[2].NPTEL: Numerical Analysis
https://nptel.ac.in/courses/111101165
[3].MITOpenCourseware: Differential Equations
https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/
[4].MITOpenCourseWare: Introduction to Partial Differential Equations
https://ocw.mit.edu/courses/18-152-introduction-to-partial-differential-equations-fall-2011/
[5].MITOpenCourseware: Introduction to Numerical Analysis
https://ocw.mit.edu/courses/18-330-introduction-to-numerical-analysis-spring-2012/

24MA102

DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS

CourseCategory:	**HS**	**Credits:**	**1C**
CourseType:	**Integrated Lab**	**Lecture-Tutorial-Practice:**	**0L-0T-2P**
Pre-requisites:	**Mathematics-II**	**Continuous Assessment:** **Summative Assessment:** **TotalMarks:**	**40** **60** **100**

CourseDescription:

AN OVERVIEW OF THE FUNCTIONS OF MATHWORKS SYMBOLIC MATH TOOL BOX TO SOLVE FIRST ORDER DIFFERENTIAL EQUATIONS, HIGHER ORDER LINEAR PARTIAL DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS, ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS WITH INITIAL AND BOUNDARY CONDITIONS AND FIND ROOT OF TRANSCENDENTAL EQUATIONS.

CourseObjectives:

1. Find solution of first order differential equations.
2. Solve higher order linear differential equations with constant coefficients.
3. Solve elliptic partial differential equations with initial and boundary conditions
4. Find root of transcendental equations.
5. Solve numerically first order initial value problems.

CourseOutcomes:

At theendofthecourse,thestudents willbeable to

CO	CourseOutcomes:	BTL
CO1	Find solution of first order differential equations	(K3)
CO2	Solve higher order linear differential equations with constant coefficients.	(K3)
CO3	Solve elliptic partial differential equations with initial and boundary conditions.	(K3)
CO4	Find root of transcendental equations.	(K3)
CO5	Solve numerically first order initial value problems.	(K3)

Coursearticulationmatrix

ContributionofCourseOutcomestowardsachievementofProgramOutcomes(1 – Low,2-- Medium, 3 -- High)

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

CourseContent

Unit-I

`dsolve()`function to solve first order differential equations**.**

Unit-II

`dsolve()`function to solve higher order linear differential equations with constant coefficients

Unit-III

Laplace's pde solution using finite difference method
Poisson's pde solution using finite difference method

Unit-IV

`fzero()` function to find roots of an algebraic and transcendental equations
`interp1()` function for interpolation

Unit-V

Euler's method to solve first order initial value problem
Runge-Kutta 4^{th} order method to solve first order initial value problem
`Ode78()` function to solve first order initial value problems

TextBooks:

MatlabLabManual

WebResources:

- MathWorksOrdinary Differential Equations Documentation
  Solve nonstiff differential equations — medium order method - MATLAB ode45 - MathWorks India
- MathWork Symbolic Calculus Tool Box
  Solve system of differential equations - MATLAB dsolve - MathWorks India
- MathWorks Linear Algebra Documentation
  Linear Algebra - MATLAB & Simulink - MathWorks India
- MathWork Tool Box
  Root of nonlinear function - MATLAB fzero - MathWorks India
- MathWork Tool Box
  1-D data interpolation (table lookup) - MATLAB interp1 - MathWorks India
- MathWork ODE Tool Box
  https://in.mathworks.com/help/matlab/ref/ode78.html#d126e1197289

24PH102

ENGINEERING PHYSICS (Common to ECE,EEE & EIE)

Course Category:	**Basic Sciences**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites:	**10 + 2**	**Continuous Assessment: Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

Engineering physics refers to the study of the combined disciplines of science and engineering, particularly electrical, electronic, aerospace, materials or mechanical engineering and it bridges the gap between basic science and engineering. The concepts of physics such as electrostatics, magnetostatics, semiconductors, lasers, optical fibers and quantum mechanics play an important role in identifying and solving engineering problems.

Course Objectives:

1. Discuss the physical laws of electrostatics to compute problems related to static electric fields.
2. Discuss the physical laws of magnetostatics to solve various problems involving static magnetic fields.
3. Explain the basic concepts of quantum mechanics and formalization of Schrodinger's equations.
4. Elucidate the basic concepts of lasers and optical fibers and their diverse applications in science and technology.
5. Explain the basic concepts of semiconductors with respect to energy bands and their applications.

Course Outcomes:

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

CO	Course Outcomes	BTL
CO1	Explain the fundamental principles of electrostatics and their applications.	K3
CO2	Illustrate the laws of magnetostatics and their applications.	K3
CO3	Describe the basic concepts of quantum mechanics and its mathematical frame.	K2
CO4	Identify different types of lasers & optical fibers and their applications.	K2
CO5	Apply the concepts of semiconductors towards the classification of materials based on energy band.	K3

Course articulation matrix

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	**3**	**1**											
CO2	**3**	**1**											
CO3	2												
CO4	**3**		**2**										
CO5	**3**		**1**										

(1-Low, 2-Medium, 3-High)

Course Content

UNIT-I

Electrostatics

Electrostatics: Coulomb's law and electric field intensity, Gauss's law in electricity, applications of Gauss law - line of charge, sheet of charge, sphere of charge, electric potential, relation between E and V, potential and electric field due to electric dipole, application of electrostatics.

UNIT-II

Magnetostatics

Magnetostatics: Biot-Savart's Law, Ampere's circuit law, applications of Ampere's law, infinite line of current, infinite sheet of current, Maxwell's equation for static magnetic field, Faraday's law in electromagnetic induction, force due to magnetic field on a current element, force between two parallel current elements, Maxwell's equations in integral and differential forms.

UNIT-III

Quantum Mechanics

Quantum Mechanics: Dual nature of light, matter waves, properties and Debroglie's hypothesis, G.P.Thomson experiment, Heisenberg's uncertainty principle and its applications (non-existence of electron in nucleus) and physical significance of wave function – Schrodinger's time independent wave equation–particle in a one-dimensional infinite potential box.

UNIT-IV

Lasers and Optical Fibers

- **Lasers**: Introduction, characteristics of laser, basic principles of lasers (absorption, spontaneous emission and stimulated emission), requirements of lasers (pumping, population inversion, and resonance cavity), solid state laser (Ruby), applications of lasers.
- **Optical Fibers**: Introduction, fundamentals of optical fiber, propagation of light through optical fiber, types of optical fiber, numerical aperture, fractional refractive index change, losses in optical fibers, optical fibers in communication and its advantages.

UNIT-V

Semiconductor physics

Semiconductors: Introduction, formation of energy bands, classification of crystalline solids, Fermi level in intrinsic semiconductors, Fermi level in extrinsic semiconductors, large band gap semiconductors, drift, and diffusion currents, Einstein's equation, Hall effect and its applications.

Text Books:

1. Avadhanulu, M. N. (2019). A textbook of engineering physics (11th ed.). S. Chand Publishing.
2. R.K. Gaur and S.L. Gupta (2008),"Engineering Physics", Dhanpat Rai Publications (P) Ltd.
3. Halliday, D. Resnick, R., & Walker, J. (2020). Fundamentals of physics (10th ed.). John Wiley & Sons.
4. Matthew N. O. Sadiku, "Principles of Electromagnetics", 4thedition, Oxford University Press, New Delhi, 2009.

Reference Books:

1. Pandey, B. K., & Chaturvedi, S. (2021). *Engineering Physics* (1st ed.). Cengage Learning.
2. S.L.Gupta and Sanjeev Gupta.(2007),"Electricity,Magnetism & Electronics", J.Prakashnath & Co.
3. Srinivasan, M. R. (2009). *Physics for Engineers* (1st ed.). New Age International.
4. Bhattacharya, D. K., & Poonam Tandon. (2015). *Engineering Physics* (1st ed.). Oxford press.

Web Resources:

1. https://www.geeksforgeeks.org/physics/electrostatics/
2. https://www.geeksforgeeks.org/physics/biot-savart-law/
3. Introduction to LASER, NPTEL – M. R. Shenoy, Professor, IIT – Delhi, https://onlinecourses. nptel.ac.in/noc21_ph01/preview
4. Fiber Optics, NPTEL – Vipul Rastogi, Professor, IIT, https://onlinecourses.nptel.ac.in/ noc20_ph07/preview
5. Quantum Mechanics, NPTEL – S. Lakshmi Bala, Professor, IIT – Madras, https://nptel.ac.in/ courses/ 115106066.

24PH103 PHYSICS FOR ENGINEERS			
Course Category: Physics (PH)	**Program Core (PC)**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites: 10+2 Physics		**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

Physics is an interdisciplinary field that serves as a bridge between basic science and engineering, applying physical principles to solve engineering problems. This course encompasses modern concepts such as crystallography, X-ray diffraction, and crystal structure determination. It also covers the principles and applications of lasers and optical fibers. Additionally, the course delves into the mechanics, synthesis, characterization, and application of Nanomaterials, including carbon nanotubes.

Course Objectives:

1. Introduce the fundamentals of crystal structure and the techniques for its characterization using X-ray diffraction.
2. Elucidate the core principles of lasers and optical fibers, highlighting their diverse applications in science and technology.
3. Discuss the foundational concepts of mechanics and their formalization for various mechanical applications.
4. Develop skills to understand and apply the principles of physical properties of solids to solve engineering problems.
5. Explain how the dimensionality of materials at the Nanoscale influences their properties, along with exploring numerous industrial applications.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Describe various types of crystal structures and their characterization methods.	K2
CO2	Identify different types of lasers and optical fibers, and their applications.	K2
CO3	Explain the basic concepts of mechanics as applicable to engineering problems.	K2
CO4	Demonstrate the physical properties of solids and their interrelationships.	K3
CO5	Identify the fabrication methods of Nanomaterials and carbon nanotubes, along with their applications in engineering and technology.	K4

Course articulation matrix

COs	POs											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3												
CO2	3		2										
CO3	3	1											
CO4	3												
CO5	3				1								

(1-Low,2-Medium,3-High)

Course Content

UNIT-I

Crystallography and Characterization of Materials

Crystallography: Space lattice, basis, unit cell and lattice parameters, Bravais lattices, crystal systems (3 Dimensional), coordination number, packing fraction of SC, FCC, and BCC – Miller indices – separation between successive (hkl) planes.

Characterization of Materials: Introduction, diffraction of X – rays, derivation of Bragg's law, and Bragg's X – ray spectrometer, determination of crystal structure by powder crystal method.

UNIT-II

Lasers and Optical Fibers

Lasers: Introduction, characteristics of laser, basic principles of lasers (absorption, spontaneous emission and stimulated emission), requirements of lasers (pumping, population inversion, and resonance cavity), solid state laser (Ruby), applications of lasers.

Optical Fibers: Introduction, fundamentals of optical fiber, propagation of light through optical fiber, types of optical fiber, numerical aperture, fractional refractive index change, losses in optical fibers, optical fibers in communication and its advantages.

UNIT-III

Kinematics of Particle Motion

Kinematics of Rectilinear Motion: Displacement, velocity, and acceleration, uniform motion, motion with uniform acceleration, and motion with variable acceleration.

Kinematics of Curvilinear Motion: Rectangular components of velocity and acceleration, normal and tangential acceleration, motion of projectiles.

UNIT-IV

Properties of Solids

Properties of Solids: Motion of a particle in a central force field, Kepler's laws (qualitative) and applications, Hooke's law, stress – strain relation, elastic moduli, relation between elastic constants, Poisson's ratio, expression for Poisson's ratio in terms of elastic constants, determination of rigidity modulus by static torsion.

UNIT-V

Nanomaterials

Nanomaterials: Introduction to Nanomaterials, general properties of Nanomaterials, significance of the Nanoscale (surface to volume ratio, quantum confinement effect), fabrication of Nanomaterials using plasma arcing and chemical vapour deposition methods, characterization of Nanomaterials using SEM and TEM, Carbon nano tubes, SWNT, MWNT, formation of Carbon nanotubes by arc discharge, laser ablation, properties of Carbon nano tubes, Applications of CNTs & nanotechnology.

Text Books:

1. Avadhanulu, M. N. (2019). A textbook of engineering physics (11th ed.). S. Chand Publishing.
2. Tayal, A. K. (2006). Engineering Mechanics: Statics and Dynamics (13th ed.). Umesh Publications.

Reference Books:

1. Halliday, D. Resnick, R., & Walker, J. (2020). Fundamentals of Physics (10th ed.). John Wiley & Sons.
2. Pandey, B.K., & Chaturvedi, S. (2021). Engineering Physics (1st ed.). Cengage Learning.
3. Sharma, S., & Sharma, J. (2018). Engineering Physics (1st ed.). Pearson Education India.
4. Srinivasan, M. R. (2009). Physics for Engineers (1st ed.). New Age International.

Web Resources:

1. X – ray crystallography and Diffraction, NPTEL– Ranjit Kumar Ray, Professor, IIEST Shibpur, IIT Madras, https://onlinecourses.nptel.ac.in/noc22_mm39/preview
2. Introduction to LASER, NPTEL – M. R. Shenoy, Professor, IIT – Delhi, https://onlinecourses. nptel.ac.in/noc21_ph01/preview
3. Fiber Optics, NPTEL – Vipul Rastogi, Professor, IIT – Roorkee, https://onlinecourses.nptel.ac.in/ noc20_ph07/preview
4. Mechanics, NPTEL – Anjani Kumar Tiwari, Professor, IIT – Roorkee, https://onlinecourses.nptel.ac.in/ noc24_me148/preview.
5. Mechanics of Solids, NPTEL – Priyanka Ghosh, Professor, IIT Kanpur, https://onlinecourses.nptel.ac.in/noc22_ce46/preview.
6. Introduction to Nanoscience and Nanotechnology, NPTEL – Swayam, Swapna Nair, Professor, Central University of Kerala, https://onlinecourses.swayam2.ac.in/cec24_cy03/preview

24EN101
COMMUNICATIVE ENGLISH

Course Category:	**HS**	**Credits:**	**4.5C**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3L-0T-3P**
Pre-requisites:	**Intermediate English**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

Communicative English course covers Intercultural Communication, AI in higher education , and Natural Language Processing. It emphasizes effective listening, presentation techniques, innovation, creativity, advanced reading, and technical writing skills, addressing verbal and nonverbal communication fundamentals, processes, barriers, and strategies for confidence and fluency, preparing students for career readiness and leadership.

Course Objectives:

1. Explain the verbal and nonverbal processes of Communication.
2. Familiarize active listening skills and explain the traits of a good listener.
3. Introduce speaking skills for effective presentations.
4. Teach reading techniques to enhance employability skills.
5. Instruct writing techniques to enhance employability skills.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes:	BTL
CO1	Relate and recall the verbal and nonverbal processes of Communication.	(K1)
CO2	Demonstrate active listening skills and acquire the traits of good listener	(K2)
CO3	Apply English speaking skills to deliver effective presentations	(K3)
CO4	Appraise reading techniques like skimming and scanning to enhance employability skills	(K4)
CO5	Assess writing techniques like outlining and clustering to enhance employability skills	(K5)

Course articulation matrix

Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2--Medium, 3 --High)

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

Course Content

Unit-I

Introduction to Communication:

Basics of Communication, Process of Communication, Levels of Communication, Verbal and Nonverbal Communication, Channels of Communication, Barriers to Communication, ***Intercultural Communication.***

Unit-II

Listening Skills:

Effective Listening, Active Traits of a Good Listener, Listening Modes, Types of Listening, Barriers to Effective Listening, Listening for general content, ***AI in Higher Education: Opportunities, Challenges, and Ethical Considerations.***

Unit-III

Speaking Skills:

Achieving Confidence, Clarity & Fluency, Effective Presentation Strategies, Meetings, Conferences, Paralinguistic Features, Barriers to Speaking, ***Natural Language Processing.***

Unit-IV

Reading Skills:

Reading Techniques, Techniques for Good Comprehension, Study Skills, Reading and Interpretation, Intensive, Extensive & Critical Reading, Reading for Different Purposes, ***Innovation and Human Creativity.***

Unit-V

Writing Skills:

Technical Writing, Importance and Characteristics, Techniques for Good Technical Writing ,Paragraph Construction, Essays, Reports, ***Communication for Career-readiness and Leadership.***

Text Books:

1) Raman,M., & Sharma,S.(2012).*Technical Communication* (2nd ed.). Oxford University Press.

Reference Books:

1) Pushplata, & Kumar, S.(2011).*Communication Skills*. Oxford University Press.
2) Rizvi,A.(2005).Eff*ective Technical Communication*. Tata Mc Graw- Hill Publishing Company Limited.
3) Mishra,S, & Muralikrishna,C.(2006). *Communication Skills for Engineers*. Pearson.

Web Resources:

http://ndl.iitkgp.ac.in/he_document/ekumbh/ekumbh/85?e=5|text%20books%20on%20technical%20communication||| Kulbhushan Kumar. *English for Technical Professionals.*

https://www.gtuelibrary.edu.in/publication/Technical%20communication%205th%20June'09.pdfProf. (Dr.) M. D. Desai, *Technical Communication.*

https://gnindia.dronacharya.info/CSE-AI-ML/Common-Subjects/Downloads/Technical-Communication/Books/Technical-Communication-Book-1.pdf

Technical Communication Principles and Practice
Meenakshi Raman and Sangeeta Sharma

Laboratory Exercises

1) Phonetics.

Introduction – Articulatory Phonetics (The Sounds of Speech Production) – Phonological Concepts (Sound Patterns and Rules) – Practical Applications.

2) Listening Comprehension

Introduction – Strategies for Effective Listening – Types of Listening (Discriminative, Comprehensive, Evaluative, and Appreciative) – Improving Listening Comprehension (Note-taking and Summarizing) – Overcoming Distractions and Misunderstandings – Practice Activities.

3) Conversation Starters- Introducing Self and others

Icebreakers – Introducing Yourself – Introducing Others – Accepting – Declining – Agreeing – Disagreeing – Seeking Clarification – Seeking Permission – Expressing Interest – Offering Help.

4) Just A Minute

Introduction – Rules of the Game (No Hesitation, No Deviation, No Repetition)– Strategies for Success – Benefits of JAM – Common Challenges – Practice Sessions.

5) Situational Dialogues & Role Plays

Introduction – Benefits – Planning and Structuring a Role Play – Everyday Scenarios – Tips for Effective Role Playing – Role Play Practice.

6) Reading Comprehension

Understanding Reading Comprehension – Strategies for Effective Reading – Types of Reading Comprehension Questions – Improving Vocabulary and Context Clues – Practice Exercises – Techniques to Master.

7) Vocabulary

Vocabulary Building –Exploring Prefixes– Discovering Suffixes– Uncovering Roots– Selected Word List (500 Essential Words for Vocabulary Development) – Practical Application.

8) Grammar

Introduction to Grammar Essentials – Understanding Tenses – Mastering Articles – Navigating Prepositions – Practice Exercises – Tips for Improving Grammar Skills.

9) Describing People, Places, Objects and Events

Introduction to Descriptive Language –Describing People – Describing Places – Describing Objects – Describing Events – Practice Activities.

10) Poster Presentation

Introduction – Designing an Effective Poster – Content Development – Presenting Information Visually – Effective Delivery – Tips for Engaging Your Audience.

11) Letter Writing

Introduction – Structure of a Letter – Types of Letters – Writing Techniques – Addressing Envelopes –Practice Activities.

12) Email Writing

Introduction – Parts of an Email – Tone, Style and Language – Email Etiquette – Dos and Don'ts of Professional Email Communication – Organizing Inbox and Responding Promptly – Practice Activities.

Textbook:

Communicative English Lab Manual

References:

1) D. Sudha Rani. (2011). *A Manual for English Language Laboratories*. Pearson, Noida,
2) Nira Konar. (2011). *English Language Laboratories*. PHI Learning Private Limited, New Delhi.

English Language Communication Skills Lab Software:

1) Walden
2) Softx
3) Visionet Spears Digital Language Lab software Advance Pro
4) ODll Language Learner's Software, Orell Techno Systems

24ME101
ENGINEERING MECHANICS
(CE & ME)

Course Category:	**Programme Core (PC)**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites:	**10+2 Mathematics & Physics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

Engineering Mechanics is a fundamental course that builds the analytical foundation required for understanding the behavior of bodies under the influence of forces and motion. It prepares students for advanced mechanical engineering subjects by developing essential problem-solving skills in statics, dynamics, and structural analysis, enabling them to model and evaluate real-world engineering systems effectively.

Course Objectives:

1. Develop a strong foundation in engineering mechanics for analyzing coplanar concurrent, parallel, and general force systems, including forces in plane trusses.
2. Enable students to determine centroids and moments of inertia of various plane figures and material bodies.
3. Provide understanding of mass moments of inertia and their evaluation for different bodies.
4. Build competency in analyzing rectilinear and curvilinear motion of particles.
5. Apply principles of dynamics to analyze the fixed-axis rotation of rigid bodies.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	*Apply* the principles of statics to determine the resultant and equilibrium of coplanar concurrent and parallel force systems.	**K3**
CO2	*Compute* the centroid and moment of inertia for standard and composite plane figures.	**K3**
CO3	*Analyze* coplanar general force systems and plane trusses.	**K3**
CO4	*Apply* the principles of dynamics to solve problems in rectilinear and curvilinear motion of particles.	**K3**
CO5	*Understand* the basic concepts of rigid-body rotation about a fixed axis.	**K2**

Course articulation matrix

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									
CO2	3	2									
CO3	3	2									
CO4	3	2									
CO5	3	2									

(1-Low, 2 -Medium, 3–High) (WK8)

Course Content

Unit-I

Equilibrium of Systems of Concurrent Forces

Composition and resolution of forces – Constraint, Action and Reaction, Types of supports and support reactions, Free body diagram, Equilibrium of concurrent forces in a plane – Method of Projections, Method of moments

Unit-II

Equilibrium of Systems of Parallel Forces: Introduction, Types of parallel forces, Resultant, Couple, Resolution of Force into force and a couple.

Centroid: Centroids of standard figures, Centroids of Composite Figures.

Area Moments of Inertia: Definition– Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, Mass moment of inertia of slender rod, Circular disc. Mass Moment of Inertia of 3D bodies– Cone, Solid cylinder & Sphere.

Unit-III

Friction: Introduction, limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, Numerical problems.

Coplanar General case of force system: Equilibrium of forces in plane-

Analysis of plane trusses: Method of joints

Unit-IV

Kinetics of Rectilinear motion: D'Alembert's Principle, Work energy principle, Impulse and Momentum principle.

Kinetics of Curvilinear motion: D'Alembert's Principle, Work energy principle

Unit-V

Rigid body Motion: Kinematics of rotation: Linear & angular velocity, Linear & angular acceleration in uniformly accelerated motion.

Kinetics of a rigid body in rotation of about a fixed axis: Equation of motion for a rigid body rotating about a fixed axis- Rotation under the action of constant moment

Text Books:

1. Engineering Mechanics by S. Timoshenko & D. H. Young, 4th Edition, 2007, McGraw Hill International Edition. (For Concepts and symbolic Problems).
2. Engineering Mechanics Statics and dynamics by A. K. Tayal, 13th Edition, 2006, Umesh Publication, Delhi, (For numerical Problems using S.I.System of Units).
3. A Textbook of Engineering Mechanics, S.S Bhavikatti. New age international publications 2018.

Reference Books:

1. Engineering Mechanics, P.C.Dumir- S.Sengupta and Srinivas V Veeravalli , University press. 2020. First Edition.
2. Engineering Mechanics, Statics and Dynamics, I.H. Shames., PHI, 2002. 4th Edition.
3. Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. Meriam and L. G. Kraige., John Wiley, 2008. 6th Edition

Web Resources:

1. http://emweb.unl.edu/
2. https://nptel.ac.in/courses/122/104/122104015/
3. Prof. U.S. Dixit, , IIT Guwahati, Engineering Mechanics [English], Web available: https://nptel.ac.in/courses/112103109
4. Prop. K.Ramesh, IIT Madras, Engineering Mechanics, , [English], Web available: https://nptel.ac.in/courses/112106286

24EE101
ELECTRICAL NETWORK ANALYSIS
(Common to EEE/ECE/EIE branches)

Course Category:	**Engineering Science (ES)**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites:	**10+2 Physics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:
This course covers essential principles of electrical circuits and their applications. It begins with D.C. circuits, exploring various circuit components, sources, and key theorems such as Superposition, Thevenin's, and Norton's. It progresses to understanding alternating quantities, involving RMS and average values, and phasor representations in AC circuits. Transient analysis of first and second-order differential equations, time constants, and RLC circuits with D.C. excitations are also examined. This course also covers resonance in series and parallel circuits, and parameters like bandwidth and Q factor. Finally, it addresses two-port networks, including impedance, admittance, and hybrid parameters, and their interrelationships.

Course Objectives:

- To introduce basic analysis techniques and theorems for solving electrical circuits
- To impart knowledge on single phase AC circuits
- To explain transient behavior of circuits in time and frequency domain
- To teach concepts of Resonance
- To introduce two port parameters and their inter relationship

Course Outcomes:
At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Analyze DC Circuits by applying network theorems.	K4
CO2	Find the response of series and parallel RC, RL and RLC circuits.	K3
CO3	Analyze the transient response of RL, RC and RLC circuits.	K4
CO4	Design series and Parallel resonance circuits for the given specification.	K4
CO5	Evaluate two port network parameters.	K3

Course articulation matrix

	POs											PSOs	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**3**	**3**		**3**	**3**						**3**		
CO2	**3**	**3**		**3**	**3**						**3**		
CO3	**3**	**3**		**3**	**3**						**3**		
CO4	**3**	**3**		**3**	**3**						**3**		
CO5	**3**	**3**		**3**	**3**						**3**		

(1-Low, 2 -Medium, 3–High)

Course Content

Unit-I

D.C Circuits & Network Theorems:

- Types of circuit components, Types of Sources, Source Transformations, Star-Delta Transformation, Kirchhoff's Laws, Mesh and Nodal analysis, Super Mesh and Super Node analysis.
- Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer Theorem, Reciprocity theorem, Millman's theorem, Tellegen's theorem.

Unit-II

Single Phase AC Circuits:

- Generation of Alternating Voltages, Terms Related to Alternating Quantities, Root Mean Square (rms) Value, Average Value, Phasor Representations of Alternating Quantities, Mathematical Representations of Phasors, Behaviour of a Pure Resistor, Pure Inductor, Pure Capacitor in an ac Circuit, Series RL, RC and RLC Circuit, Parallel ac Circuits.

Unit-III

Transient Analysis:

- First order differential equations, definition of time constant, RL circuit, RC circuit with DC excitation, evaluating initial condition procedure, second order differential equations, homogeneous and non-homogeneous problem solving using RLC elements with DC excitation.

Unit-IV

Resonance:

- Introduction, Series resonance, Parallel resonance, Concept of band width and Q factor, Comparison between series and parallel resonant circuits, Tank Circuit, Parallel RL-RC Branch Circuit.

Unit-V

Two-port Networks:

- Open circuit impedance parameters, Short circuit admittance parameters, Transmission line parameters, Hybrid parameters, Inter Relationships Between parameters, Parallel & series connection of two port networks, cascading of two port networks.

Text Books:

- Hayt. William H.,& Kemmerly Jack., & Phillips Jack., & Steven M.Durbin. (2020), *Engineering Circuit Analysis* (9thed.).McGraw Hill Education.
- Ravish R Singh,(2013), *Network Analysis and Synthesis* (1st ed.). McGraw-Hill Education,

Reference Books:

- Roy Choudhury, D., (2013). *Networks and Systems* (2nded.). New Age International Publications
- Edminister, Joseph., & Nahvi, Mahmood. (2017). *Electric Circuits, Schaum's Outline Series* (7th ed.), Tata McGraw Hill Publishing Company, New Delhi.
- Alexander, Charles. K., & Matthew .N., & Sadiku .O.(2021). *Fundamentals of Electric Circuits* (5th ed.).McGraw-Hill Education.
- A.Chakrabarti.,(2010), *Circuit Theory (Analysis and Synthesis)* (6th ed.). Dhanpat Rai & Co.,

Web Resources:

- https://onlinecourses.nptel.ac.in/noc23_ee54/preview
- https://onlinecourses.nptel.ac.in/noc25_ee91/preview

24IT103 PROBLEM SOLVING WITH PYTHON			
Course Category:	**Engineering Science (ES)**	**Credits:**	**3**
Course Type:	**Integrated Course**	**Lecture-Tutorial-Practice:**	**2-0-2**
Pre-requisites:	Programming through C	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

This course introduces fundamental programming and problem-solving concepts using Python. It provides students with a solid foundation for computational thinking, program design, and logical reasoning. Students will learn Python syntax, data handling, and modular design techniques. The course emphasizes problem-solving through programming constructs, functions, data structures, and object-oriented principles.

Course Objectives:

- Introduce the foundational concepts of Python programming, syntax, and control structures for computational problem solving. (K1)
- Explain the use of iteration (for, while, nested loops) and loop control statements (break, continue, pass) along with Python string operations for effective sequential processing. (K2)
- Develop proficiency in manipulating strings and core data structures such as lists, tuples, sets, and dictionaries for effective data handling. (K3)
- Demonstrate modular program design using user-defined functions, modules, and exception handling for reliable and reusable software development. (K3)
- Apply object-oriented programming principles — abstraction, encapsulation, inheritance, and polymorphism — to design efficient and scalable applications. (K4)

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Explain the syntax, semantics, and control structures of Python programming for solving computational problems. (K1)	K1
CO2	Explain iteration constructs and loop control statements, with Python string operations for sequential processing. (K2)	K2
CO3	Implement Python's built-in functions and data structures (lists, tuples, sets, dictionaries) for structured data processing. (K3)	K3
CO4	Develop modular and reusable programs using functions, packages, and exception handling mechanisms to improve code efficiency and reliability. (K3)	K3
CO5	Design object-oriented Python solutions applying abstraction, encapsulation, inheritance, and polymorphism for real-world problem-solving. (K4)	K4

Course Articulation Matrix

	POs											PSOs	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	2	3	2								1	3	2
CO2	3	2	2								2	2	2
CO3	2	2	3								2	2	2
CO4	1	3	3								2	3	1
CO5	1	2	3								2	1	2

(1-Low, 2 -Medium, 3–High)

Course Content

Unit-I

Introduction to Python Programming

- **Overview of Python**: Features, installation, execution model, Literals, variables, identifiers, and data types, Input/Output operations and indentation, Operators and expressions
- **Control structures**: Conditional and looping statements: Selection: if, if–else, nested if, if–elif–else

Unit-II

Iterative Statements & String Handling

- **Iterative Statement**: while, for, nested loops, break, continue, pass, else in loops
- **Strings**: Creation, indexing, slicing, concatenation, String formatting, f-strings, and escape sequences, String methods (upper(), lower(), replace(), split(), join()), Membership operators (in, not in) and iteration, String comparison and manipulation

Unit-III

Python Data Structures

- **Lists**: Creation, indexing, slicing, mutability, methods (append(), insert(), sort(), remove()), nested lists
- **Tuples**: Creation, immutability, packing/unpacking, tuple operations
- **Sets**: Creating sets, uniqueness, set operations (union(), intersection(), difference()), set comprehension
- **Dictionaries**: Key-value pairs, insertion, deletion, traversal, dictionary methods (items(), keys(), values())

Unit-IV

Functions, Modules, and Exception Handling

- **Functions**: Definition, parameters, arguments, and return values, Variable scope and lifetime, Recursion and lambda functions
- **Modules and Packages**: Importing and creating modules and their usage.
- **Exception handling**: try, except, finally, and custom exceptions

Unit-V

Object-Oriented Programming(OOP) in Python

- **OOP concepts**: Classes, objects, attributes, and methods, Constructors, destructors, and encapsulation, Inheritance, polymorphism, Aggregation and composition, Real-world applications of OOP to solve engineering problems(Case Study)

List of experiments

Unit 1:

1. Install Python on Windows / Ubuntu.
2. Print two strings with custom separator and suppress newline; then print "ENDLINE".
3. Check whether number is Odd or Even.
4. Solve a Quadratic Equation using formula.
5. Find Area of a Triangle.
6. Swap two variables.
7. Convert kilometres to miles.
8. Check Leap Year.
9. Check Armstrong Number.
10. Check if number is Positive, Negative or Zero.
11. Attendance percentage program:
    Input working days, absent days
    Calculate attendance and check eligibility (<75%).
12. Road tax calculation based on cost of bike (Slab-based conditional).
13. Grade calculation based on score range (0.0–1.0).
14. Interactive integer reading:
    i. Print binary for positive numbers
    ii. Ignore negative
    iii. Exit when input = 999

Unit 2:

1. Nested-loop patterns:
2. Print Multiplication Table using format().
3. Count how many times a number can be divided by 3 until ≤10.
4. Sum of first 20 terms of sequence 1 + 2 + 4 + 8 + 16 + … using while True + break.
6. Modify 0–100 summation code to use continue and sum only odd numbers.
7. Create student name, roll no, marks inputs and print formatted output using %s, %d, %f.
8. Extract substring between two given substrings.
9. Split each word into two halves based on a given percentage.

10. Find all adverbs and their positions in the given string.
11. Extract date from a string using regex (re.search, strptime).

Unit 3:

1. Accept comma-separated numbers → generate list and tuple.
2. Find tuples divisible by k from list of tuples.
3. Find tuples with all positive elements.
4. Remove duplicate tuples from a list.
5. Row-wise custom addition in a tuple matrix**.**
6. Extract digits from tuple list → return flat list.
7. Sort dictionary by value (ascending & descending).
8. Convert dictionary string values → int / float.
9. Map each element of list to each item of dictionary (nested dictionary).
10. Convert list → dictionary (odd elements = keys, even = values).
11. Create dictionary from two equal-length lists (keys, values).
12. Input string & pattern → check if characters follow same order.
13. Perform and display union, intersection, difference, and symmetric difference
14. Check whether A is a subset or superset of B
15. Remove Duplicate Words from a Sentence using sets

Unit 4:

1. Two functions:
    - Area of circle
    - Perimeter of circle
2. Rectangle: area & perimeter via functions.
3. Recursive functions for:
    - GCD
    - LCM
    - Factorial
    - Fibonacci
4. showEmployee(name, salary=10000) — default argument.
5. Function to accept variable number of subject marks (variable-length args).
6. Find day of the week given date (use datetime).
8. Program to perform x / y and handle ZeroDivisionError with message.
9. Input list & n — sum first n values; if n invalid → raise IndexError.
10. Student class:
    - Method: check_marks
    - Raise custom exception NotEligibleException if marks < 90.
11. Create a module mymath.py with functions:
    - add(a, b)
    - mul(a, b)

    Write a main program that imports the module and calls these functions.
12. Create a Custom Module With Constants

    Task:
    File: const.py
    Contains:
    PI = 3.14
    GRAVITY = 9.8
    Import it and print both constants.

Unit 5:

1) Design a class **Person** that contains the public attributes:
    - name
    - age

    Create an object and display the stored values.
2) Create a class **Person** with the private attributes:

- __name
- __age

Implement:

- A constructor to initialize the attributes
- A __str__() method to return a formatted representation of the object

3) Develop a class **Person** with:

- Private attributes: __first_name, __last_name, __age
- A **class variable** domain_name used to auto-generate the email
- A method fullname() returning "First Last"
- A __str__() method showing full details including the generated email ID

4) Create an abstract class **AbstractStall** with an abstract method display(). Implement three derived classes:

- **Stall**
- **ExecutiveStall**
- **PremiumStall**

Each subclass should override display() to show details relevant to its type (demonstrating polymorphism).

5) Inheritance with Constructor Execution Order (Employee → Developer)

Define a base class **Employee** and a derived class **Developer**.

Tasks:

- Demonstrate the sequence of constructor calls when the child class is instantiated.
- Print and compare the class attributes of Employee and Developer.

6) Multi-Level OOP with @property and Aggregation (Employee → Developer, Manager)

Build a class hierarchy:

- **Employee** class with @property for the name attribute
- **Developer** class derived from Employee with an additional attribute (e.g., programming language)
- **Manager** class derived from Employee containing a list of employees managed

Include:

- Methods to addEmployee() and removeEmployee()
- A separate **Utility** class to generate a formatted report of employees under each manager

7) Operator Overloading (Bank Entry Counter)

Implement a **Bank** class that tracks the number of persons inside a bank.

Overload operators:

- + to increment count when a person enters
- - to decrement count when a person leaves

This demonstrates operator overloading in a real-world context.

Text Books:

1. R. Thareja, *Python Programming: Using Problem Solving Approach*, 2nd ed., Oxford University Press, 2019

Reference Books:

1. John Guttag, Introduction to Computation and Programming Using Python, MIT Press, 2016.
2. K. Beecher, Computational Thinking: A Beginner's Guide to Problem-Solving and Programming, BCS Learning, 2017.
3. L. Ramalho, Fluent Python, 2nd ed., O'Reilly Media, 2022.
4. B. Downey, Think Complexity: Complexity Science and Computational Modeling, 2nd ed., O'Reilly Media, 2018.
5. S. Hall, Effective Python: 90 Specific Ways to Write Better Python, 2nd ed., Addison-Wesley, 2019.

Web Resources: [Internet]

1. NPTEL. *The Joy of Computing using Python* . Available from: https://archive.nptel.ac.in/courses/106/106/106106182/
2. GeeksforGeeks. *Python Programming Language – Basics* . Available from: https://www.geeksforgeeks.org/python-programming-language/
3. W3Schools. *Python Basics Tutorial* . Available from: https://www.w3schools.com/python/
4. GeeksforGeeks. *Memory Management in Python* . Available from: https://www.geeksforgeeks.org/memory-management-in-python/

5. RealPython. *Understanding Python Objects and Memory Management* . Available from: https://realpython.com/python-memory-management/
6. W3Schools. *Python Strings* . Available from: https://www.w3schools.com/python/python_strings.asp
7. GeeksforGeeks. *Python Data Structures* . Available from: https://www.geeksforgeeks.org/python-data-structures/
8. W3Schools. *Python Lists, Tuples, Sets, and Dictionaries* . Available from: https://www.w3schools.com/python/python_lists.asp
9. RealPython. *Python Functions and Exceptions* . Available from: https://realpython.com/python-functions/
10. W3Schools. *Python Exception Handling* . Available from: https://www.w3schools.com/python/python_try_except.asp
11. AlgoDaily. *Association, Aggregation, and Composition in Python OOP* . Available from: https://algodaily.com/lessons/association-aggregation-composition-casting
12. GeeksforGeeks. *Python OOP Concepts* . Available from: https://www.geeksforgeeks.org/python-oops-concepts/

Designation	Name in Capitals	Signature with Date
Course Coordinator	Dr. G KALYANI Dr. C S PAVAN KUMAR	
Head of the Department	Dr. M SUNEETHA	

24UC181
DESIGN THINKING
(CE, ECE, EEE, EIE & ME)

Course Category:	**Engineering Sciences (ES)**	**Credits:**	**1**
Course Type:	**Laboratory**	**Lecture-Tutorial-Practice:**	**0-0-2**
Pre-requisites:		**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description:

This course introduces first-year undergraduate engineering students to the principles and practices of design thinking, emphasizing user-centred problem-solving and innovation. Students will learn to empathize with users, define problems, ideate solutions, develop prototypes, and test these solutions. The course will also explore the application of design thinking across various engineering disciplines, including Civil Engineering (CE), Electronics and Communication Engineering (EC), Electrical Engineering (EE), Mechanical Engineering (ME), and Information Technology (IT).

Course Objectives:

1. To introduce the fundamental concepts and process of design thinking.
2. To develop students' ability to empathize with users and accurately define engineering problems.
3. To encourage creativity and the generation of a wide range of ideas.
4. To enable students to prototype and test their design solutions.
5. To illustrate the application of design thinking to solve core engineering design problems.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Explain the principles of design thinking.	**K2**
CO2	Apply empathy and problem-defining techniques in engineering contexts.	**K3**
CO3	Employ innovative ideas using various ideation techniques.	**K3**
CO4	Model and test prototypes to validate engineering solutions.	**K4**
CO5	Practice design thinking strategies in civil, electronic, electrical, mechanical, and IT engineering projects	**K3**

Course articulation matrix

	POs										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1								3	3		3
CO2								3	3		3

CO3			3		3	3		3	3		3
CO4					3			3	3		3
CO5					3			3	3		3

(1-Low, 2 -Medium, 3–High) (WK8)

Course Content

Unit-I

Description: This unit introduces the foundational concepts of design thinking and its importance in solving complex engineering problems.

Introduction to Design Thinking: Introduction to Design Thinking, History and Evolution of Design Thinking, Key Principles and Mindsets, The Design Thinking Process: An Overview, The Role of Design Thinking in Engineering.

Examples/Applications/Case Studies:

- Case Study: How IDEO uses design thinking to innovate.
- Example: Apple's design thinking approach in product development.

Lab/Practice Exercises:

1. Identifying and analyzing engineering problems.
2. Group discussions on real-world design thinking examples.
3. Role-playing to understand user perspectives.

Unit-II

Description: This unit focuses on understanding users through empathy and accurately defining engineering problems to guide the design process.

Empathize and Define: The Importance of Empathy in Design Thinking, Techniques for Empathy: Interviews, Observations, and Surveys, Defining the Problem: Point of View Statements, Tools for Problem Definition: Journey Maps, Personas, Translating Empathy into Insights.

Examples/Applications/Case Studies:

- Example: Empathy maps in understanding customer needs.
- Case Study: How Airbnb uses empathy in design thinking.

Lab/Practice Exercises:

1. Conducting user interviews.
2. Creating personas and journey maps.
3. Developing problem statements.

Unit-III

Description: This unit explores creative techniques for generating a wide range of ideas to solve defined engineering problems.

Ideate: The Ideation Phase in Design Thinking, Brainstorming Techniques, Creative Thinking and Innovation, Selecting and Refining Ideas, Overcoming Creative Blocks.

Examples/Applications/Case Studies:

- Example: Brainstorming session in a tech startup.
- Case Study: Google's "20% time" policy for innovation.

Lab/Practice Exercises:

1. Group brainstorming sessions.
2. Idea selection and refinement exercises.
3. Sketching and visualizing ideas.

Unit-IV

Description: This unit covers the creation of prototypes and the methods for testing and

iterating on these prototypes to develop viable engineering solutions.

Prototype and Test: Prototyping Basics and Importance, Types of Prototypes: Low-fidelity vs. High-fidelity, Tools and Materials for Prototyping, Testing Prototypes: Methods and Techniques, Iterating Based on Feedback.

Examples/Applications/Case Studies:

- Example: Prototyping in the automotive industry.
- Case Study: Iterative prototyping at Dyson.

Lab/Practice Exercises:

1. Building low-fidelity prototypes.
2. Conducting user testing sessions.
3. Analyzing feedback and iterating designs

Unit-V

Description: This unit examines the application of design thinking across various engineering disciplines, including CE, EC, EE, ME, and IT, to solve engineering design problems.

Design Thinking in Civil Engineering (CE) , Applying Design Thinking in Electronics and Communication Engineering (EC), Design Thinking for Electrical Engineering (EE) , Innovation in Mechanical Engineering (ME), Design Thinking in Information Technology (IT).

Examples/Applications/Case Studies:

- Case Study: Design thinking in sustainable building design (CE).
- Example: Innovation in wearable technology (EC).
- Case Study: Smart grid solutions (EE).
- Example: Prototyping in automotive design (ME).
- Case Study: User-centric software development (IT).

Lab/Practice Exercises:

1. Developing design thinking strategies for a civil engineering project.
2. Prototyping an electronic device solution.
3. Creating user-centric IT solutions

Text Books:

1. Brown, T. (2009). Change by Design: How Design Thinking Creates New Alternatives for Business and Society. Harper Business.
2. Cross, N. (2011). Design Thinking: Understanding How Designers Think and Work.
    1. Berg.

Reference Books:

1. Liedtka, J., & Ogilvie, T. (2011). Designing for Growth: A Design Thinking Tool Kit for Managers. Columbia University Press.
2. Kelley, T., & Kelley, D. (2013). Creative Confidence: Unleashing the Creative Potential Within Us All. Crown Business.
3. Martin, R. L. (2009). The Design of Business: Why Design Thinking is the Next Competitive Advantage. Harvard Business Press.

Web Resources:

1. https://onlinecourses.swayam2.ac.in/aic26_ge05/course

24PH181
PHYSICS LAB

Course Category:	**Programme Core (PC)**	**Credits:**	**1**
Course Type:	**Practical**	**Lecture-Tutorial-Practice:**	**0-0-2**
Pre-requisites:	**10+2 Physics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description:

The Engineering Physics laboratory for B. Tech students is designed to provide hands on experience in basic concepts of optics, lasers, optical fibers, waves and oscillators, electricity and magnetism, quantum mechanics, and semiconductors. This course aims to foster the practical skills essential through experimentation, measurement, and analysis for the students of computer science allied branches like CSE, AI-ML, AI-DS, and Information Technology, ECE, EEE, EIE, CE and ME branches. Students will work with advanced equipment under the guidance of experienced faculty to explore various physical phenomena and their engineering applications.

Course Objectives:

1. Demonstrate the basic concepts of wave optics and the experimental evidence of wave nature of light by interference and diffraction phenomena.
2. Provide the experimental knowledge of understanding the properties of semiconductors and their applications.
3. Elucidate the basic concepts of Lasers and Optical fibers and their diverse applications in Science and Technology.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Identify the wave nature of light by the concepts like interference and diffraction of light.	**K4**
CO2	Distinguish the semiconductors based on carrier concentration and Hall coefficient.	**K4**
CO3	Calculate the specific charge of an electron and work function of a photocell.	**K4**
CO4	Demonstrate a comprehensive understanding of wave phenomena, resonance, and their application across various physical systems.	**K3**
CO5	Apply the laser principles, optical fiber transmission characteristics, and their practical applications in telecommunications and photonics.	**K4**

Course articulation matrix

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**3**										
CO2	**3**										
CO3	**3**				**2**						
CO4	**3**										
CO5	**3**				**2**						

(1-Low, 2 -Medium, 3–High)

Course Content with CO mapping

A. Experiments common to all branches:

1. Solar cell – Determination of fill factor (Common to all branches). (CO2)
2. Hall effect – Hall coefficient measurement (Common to all branches). (CO2)

B. Experiments for CSE, IT, AIDS, and AIML branches:

3. Newton's Rings – Radius of Curvature of a plano convex lens (CO1)
4. Diffraction grating – Wavelength of laser light (CO1,CO5)
5. Photocell – Study of V – I characteristics and determination of work function (CO3)
6. Compound pendulum – Measurement of 'g' (CO4)
7. Specific charge (e/m) of an electron – J. J. Thomson method (CO3)
8. AC Sonometer – Verification of vibrating laws (CO4)
9. Optical Fiber – Determination of Numerical Aperture (CO5)
10. Figure of Merit of a Galvanometer (CO4)
11. Variation of Magnetic field along the axis of current – carrying circular coil (CO3)
12. Diffraction grating – Measurement of wavelength of mercury source (CO1,CO5)

C. Experiments for ECE, EEE, and EIE branches:

3. Figure of Merit of a Galvanometer. (CO4)
4. LCR circuit – Study of Resonance. (CO4)
5. Variation of Magnetic field along the axis of current – carrying circular coil (CO3)
6. Wedge method – Measurement of thickness of a foil. (CO1)
7. Specific charge (e/m) of an electron – J. J. Thomson method (CO3)
8. B-H Curve Unit- Determination of hysteresis loss (CO3)
9. Diffraction grating – Wavelength of laser light (CO1,CO5)
10. Photocell – Study of V – I characteristics, determination of work function. (CO3)
11. Optical Fiber – Determination of Numerical Aperture (CO5)
12. Torsional pendulum-Measurement of Rigidity Modulus (CO4)

D. <u>Experiments for CE and ME branches:</u>

3. AC Sonometer – Verification of vibrating laws (CO4)
4. Wedge method – Measurement of thickness of a foil (CO1)
5. Diffraction grating – Wavelength of laser light. (CO1, CO5)
6. Photocell – Study of V – I characteristics and determination of work function (CO3)
7. Torsional pendulum-Measurement of Rigidity Modulus (CO4)
8. Determination of Dielectric constant of a sample (CO2, CO3)
9. Optical Fiber – Determination of Numerical Aperture (CO5)
10. Compound pendulum – Measurement of 'g' (CO4)
11. Variation of Magnetic field along the axis of current – carrying circular coil (CO3)
12. Figure of Merit of a Galvanometer. (CO4)

Text Books:

1. Panigrahi, S., & Mallick, B. (2015), Engineering Practical Physics (1st ed.). Cengage Learning.
2. Madhusudhana Rao, C. V., & Vasanth Kumar, V. (2015), Engineering Physics Lab Manual (4th ed.). Scitech publications.
3. Ramarao Sri, Choudary Nityanand and Prasad Daruka, "Lab Manual of Engineering Physics"., Vth ed., Excell Books, 2010.

Virtual Lab References:

1. [1] http://vlab.amrita.edu/?sub=1&brch=201&sim=366&cnt=1
2. [2] http://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1
3. [3] http://vlab.amrita.edu/?sub=1&brch=282&sim=879&cnt=1

Web Resources:

1. Web Resources:
2. http://plato.stanford.edu/entries/physics-experiment
3. http://www.physicsclassroom.com/The-Laboratory
4. http://facstaff.cbu.edu/~jvarrian/physlabs.html

24UC182
AI TOOLS & APPLICATIONS
(CE/ECE/EEE/EIE/ME)

Course Category:	**Engineering Science**	**Credits:**	**1**
Course Type:	**Practical**	**Lecture-Tutorial-Practice:**	**0-0-2**
Pre-requisites:	**Nil**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description:

This course introduces fundamental concepts and practical tools of Artificial Intelligence relevant to all engineering disciplines. It emphasizes the effective and ethical use of AI for productivity, analytical reasoning, research, and real-world engineering applications.

Course Objectives:

1. To provide an overview of AI and its applications in various engineering fields.
2. To demonstrate the use of AI as a personal assistant for productivity enhancement.
3. To explore AI as a tool for logical reasoning and mathematical analytics.
4. To utilize generative AI for literature review, gap analysis, ideation, and article writing.
5. To discuss detailed applications of AI in CE, Electronics, and ME.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Explain the basic concepts of AI and its historical evolution	**K2**
CO2	Apply AI tools for productivity enhancement	**K3**
CO3	Develop logical reasoning and analytical skills using AI tools	**K3**
CO4	Conduct literature reviews and write articles using generative AI	**K3**
CO5	Implement AI solutions in their respective engineering branches	**K3**

24UC101
Essence of Indian Knowledge Tradition

Course Category:	**Mandatory (MC)**	**Credits:**	**0**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**2-0-0**
Pre-requisites:	**-**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**100** **-** **100**

Course Description:

This course provides an in-depth exploration of the rich Indian knowledge tradition spanning philosophy, scientific advancements, cultural perspectives, educational heritage, and contemporary relevance. Students will delve into foundational texts, philosophical schools, scientific contributions, cultural artefacts, and the impact of Indian knowledge systems on global thought.

Course Objectives:

1. To introduce students to the major philosophical schools (Darshanas) of India and their foundational principles.
2. To familiarize students with significant scientific contributions in mathematics, astronomy, medicine, and technology from ancient India.
3. To explore the cultural perspectives of India through its literature, arts, architecture, and political systems.
4. To understand the educational heritage of ancient India and its impact on holistic learning and societal evolution.
5. To analyse the influence and contemporary relevance of Indian knowledge systems globally.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Analyse and differentiate between the various philosophical schools of India	**K4**
CO2	Assess the contributions of ancient Indian scientists and their impact on global knowledge systems.	**K4**
CO3	Interpret and discuss the cultural and societal norms depicted in Indian literature, arts, and architecture.	**K3**
CO4	Assess critically the educational methods and institutions of ancient	**K4**

	India and their relevance today.	
CO5	Identify the challenges and opportunities in reviving and adapting traditional Indian knowledge systems in contemporary contexts.	**K3**

Course articulation matrix

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

(1-Low, 2 -Medium, 3–High) (WK9)

Course Content

Unit-I
Foundations of Indian Philosophy

Introduction to Darshanas; detailed study of Nyaya, Vaisheshika, Sankhya, Yoga, Mimamsa and Vedanta.

Unit-II
Scientific Advancements

Mathematical theorems of Aryabhata, Astronomical discoveries of Brahmagupta, Principles of Ayurveda, Techniques in Metallurgy and Chemistry.

Unit-III
Cultural Perspectives

Analysis of Ramayana and Mahabharata, Study of classical texts (Puranas and Shastras), Evolution of temple architecture, Ethical governance principles.

Unit-IV
Educational Heritage of Ancient India

Gurukul system, Nalanda and Takshashila Universities, Role of women scholars, Influence of Southeast Asian education.

Unit-V
Influence and Contemporary Relevance

Spread of Indian philosophies to the West, Modern adaptations of Ayurveda, Challenges in preserving oral traditions.

Text Books:

1. Radhakrishnan, S., & Moore, C.A. (Eds.). (1957) *A Source Book in Indian Philosophy*. Princeton University Press.

Reference Books:

1. Basham, A. L. (1954). *The Wonder That Was India: A Survey of the Culture of the Indian Sub-Continent Before the Coming of the Muslims.* Sidgwick & Jackson.

Web Resources:

1. https://iep.utm.edu/category/traditions/indian/
2. https://www.britannica.com/biography/Aryabhata-I
3. https://sacred-texts.com/hin/dutt/index.htm
4. https://nalandauniv.edu.in/
5. https://www.vidhyanjaliacademy.com/gurukul-education-system-in-ancient-india/
6. https://brownhistory.substack.com/p/how-indian-philosophies-influenced