



"Empowerment through quality technical education"

AJEENKYA
DY Patil School of Engineering



An Autonomous Institute Affiliated to Savitribai Phule Pune University, Approved by AICTE, Recognized by Govt. of Maharashtra

Department of Engineering Sciences

First Year - Bachelor of Technology (F. Y. B.Tech.)

Curriculum Structure

(W.e.f. A.Y. 2026-27)

(Approved by the Board of Studies and Academic Council)



"Empowerment through quality technical education"
Dr. D Y Patil Educational Enterprises Charitable Trust's

AJEENKYA
DY PATIL SCHOOL OF ENGINEERING

AICTE ID: 1 - 3847411

AISHE Code: C-46648

DTE Code: EN6732

SPPU PUN Code: CEGP015720

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Accredited by NBA, NAAC with Grade 'A' & NABL, Recognized by UGC Under Section 2(f) of UGC Act, 1956

Institute Vision, Core Values, Mission and Quality Policy

Vision

“Empowerment through quality education for sustainable development”

Institute Core Values

1. **Excellence** – Commitment to quality, competence, and continuous improvement.
2. **Integrity** – Upholding ethics, transparency, and accountability.
3. **Innovation** – Fostering creativity, research, entrepreneurship, and problem-solving.
4. **Inclusivity & Social Responsibility** – Promoting equity, collaboration, sustainability, and positive societal impact.

Mission

M1: To nurture individuals through inclusive, holistic, and competency-based education.

M2: To foster innovation through research, entrepreneurship, and industry collaboration.

M3: To inculcate professional values, social responsibility, and future-ready competencies.

Quality Policy

We are committed to providing inclusive and quality education through learner-centric practices, innovation, ethical values, stakeholder engagement, and continual improvement for sustainable development.

Institutional Outcome Statement

Empowered, competent, ethical, and future-ready professionals contributing to sustainable development and societal progress.

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PROGRAM OUTCOMES (POs)

PO	PROGRAM OUTCOMES (POs)
PO1	Engineering Knowledge: Apply math, science, computing, and engineering fundamentals to complex problems.
PO2	Problem Analysis: Formulate and analyze complex engineering problems using research and first principles.
PO3	Design/Development of Solutions: Create solutions for complex problems while meeting public health, safety, and cultural needs.
PO4	Conduct Investigations of Complex Problems: Use research methods, design experiments, and analyze data to find valid conclusions.
PO5	Engineering Tool Usage: Create, select, and apply modern IT and engineering tools and simulations.
PO6	The Engineer and the World: Assess societal, health, safety, legal, and environmental impacts of engineering solutions (merged from old PO6 and PO7).
PO7	Ethics: Apply professional ethics, responsibilities, human values, diversity, and inclusion principles.
PO8	Individual and Collaborative Team Work: Function effectively as an individual or team leader in diverse settings.
PO9	Communication: Communicate effectively and inclusively with the engineering community and society.
PO10	Project Management and Finance: Apply engineering management and economic decision-making principles.
PO11	Life-Long Learning: Recognize the need for, and engage in, independent continuous learning.

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Knowledge and Attribute Profiles (WKs)

WK	Knowledge and Attribute Profiles (WKs)
WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development*
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical

CURRICULUM FRAMEWORK
(Regulations 2023)

LIST OF ABBREVIATIONS			
BSC	Basic Science Course	L	Lecture
ESC	Engineering Science Course	P	Practical
PCC	Programme Core Course	T	Tutorial
PEC	Programme Elective Course	TW	Term Work
MDM	Multidisciplinary Minor	CIE	Continuous Internal Evaluation
OEC	Open Elective Course	ESE	End Semester Examination
VSEC	Vocational and Skill Enhancement Course	FY	First Year B. Tech.
AEC	Ability Enhancement Course	HHVW	Holistic Health, Values & Wellness
EEM	Entrepreneurship/Economics/Management Course	IKS	Indian Knowledge System
VEC	Value Education Course	LLC	Liberal Learning Courses
ELC	Experiential Learning Courses	HSSM	Humanities, Social Science & Management
CC	Co-curricular Courses	PCA	Professional Communication Skills

COURSE WISE CREDIT DISTRIBUTION					
Sr.No.	Type of Course	Courses	Number of Courses	Number of Credits	Percentage (%)
1	Basic Science Course	Physics, Chemistry & Mathematics	6	14	36
2	Engineering Science Course	BXE, BEE, EM, EG, CPC, PSP	12	18	41
3	Vocational and Skill	DTIL, MPW	2	4	9
4	Ability Enhancement	IKS, PCS	2	4	9
6	Co-Curricular Courses	HHVW , IPD	2	4	5
	Total		24	44	100

Curriculum Structure _ F.Y. B. Tech. _ Group-1 _ Computer, AI & DS & E & Tc Engineering

Semester-I														
COURSE TYPE	COURSE CODE	COURSE NAME	TEACHING SCHEME (Hours/Week)				CREDIT SCHEME				EXAMINATION / EVALUATION SCHEME & MARKS			
			L	P	T	Total	L	P	T	Total	CIE	ESE	TW	Total
BSC	2601BSC101	Calculus & Linear Algebra (CLA)	3	-	1	4	3	--	1	4	40	60	25	125
BSC	2601BSC102	Modern Physics (MP)	2	2	-	4	2	1	-	3	40	60	25	125
	2601BSC103	Chemical Science & Technology (CST)												
ESC	2601ESC104	Principles of Electronics Engineering	2	2	-	4	2	1	-	3	40	60	25	125
	2601ESC105	(PDE) / Basic Electrical Engineering (BEE)												
ESC	2601ESC106	Applied Mechanics (AM) /	2	2	-	4	2	1	--	3	40	60	25	125
	2601ESC107	Engineering Drawing (ED)												
ESC	2601ESC108	Computer Programming using C (CPC)	2	2	-	4	2	1	--	3	40	60	25	125
AEC	2601AEC109	Professional Communication Skills	2	-	-	2	2	-	-	2		-	25	25
CC	2601CC110	Holistic Health, Values & Wellness	2	-	-	2	2	-	-	2		-	25	25
VSEC	2601VSL111	Design Thinking Ideation (DTI) (Mini	-	4	-	4	-	2	--	2		-	25	25
	2601VSL112	Project) / Manufacturing Practice Workshop (MPW)												
Total			15	12	1	28	15	6	1	22	200	300	200	700

Curriculum Structure _ F.Y. B. Tech. _ Group-1 _ Computer, AI & DS & E & Tc Engineering

Semester-II														
COURSE TYPE	COURSE CODE	COURSE NAME	TEACHING SCHEME (Hours/Week)				CREDIT SCHEME				EXAMINATION /EVALUATION SCHEME AND MARKS			
			L	P	T	Total	L	P	T	Total	CIE	ESE	TW	Total
BSC	2601BSC113	Differential Equations & Integral Calculus (DEIC)	3	-	1	4	3	--	1	4	40	60	25	125
BSC	2601BSC103 2601BSC102	Chemical Science & Technology (CST) / Modern Physics (MP)	2	2	-	4	2	1	-	3	40	60	25	125
ESC	2601ESC105 2601ESC104	Basic Electrical Engineering (BEE)/ Principles of Electronics Engineering (PDE)	2	2	-	4	2	1	-	3	40	60	25	125
ESC	2601ESC107 2601ESC106	Engineering Drawing (ED) / Applied Mechanics (AM)	2	2	-	4	2	1	--	3	40	60	25	125
PCC	2601PCC114	Problem Solving using Python (PSP)	2	2	-	4	2	1	--	3	40	60	25	125
IKS	2601IKS115	Indian Knowledge System	2	-	-	2	2	-	-	2		-	25	25
CC	2601CC116	Integrated Personality Development	2	-	-	2	2	-	-	2		-	25	25
VSEC	2601VSL112 2601VSL111	Manufacturing Practice Workshop (MPW) / Design Thinking Ideation (DTI) (Mini Project)	-	4	-	4	-	2	--	2	--	-	25	25
Total			15	12	1	28	15	6	1	22	200	300	200	700

Curriculum Structure _ F.Y. B. Tech. _ Group-1 _ Computer, AI & DS & E & Tc Engineering

DEPARTMENT SPECIFIC EXIT COURSE (Group-1) (To award UG Certificate in Technology) First Year B.Tech. (Semester-II)												
COURSE TYPE	COURSE CODE	COURSE NAME	TEACHING SCHEME (Hours/Week)				CREDITS	THEORY EXAMINATION SCHEME		PRACTICAL EXAMINATION SCHEME		TOTAL
			L	PT	T	Total		CIE	ESE	TW	OR	
EXIT	2601EXT126	INTERNSHIP	-	16	-	16	8	-	-	50	50	8
Total			-	16	-	16	8					8
			Internship = Practical Training + Real work experience.									
Total			16 hrs per week for minimum 6 weeks (96 hrs)									

Note for Multiple Exits:

1. Students will have the flexibility to enter a programme in odd semesters and exit a programme after the successful completion of even / second semester as per their future career needs.
2. Students exiting the First Year B. Tech. after securing 44 credits will be awarded UG Certificate in the relevant Discipline provided they secure 8 credits in Internship offered during summer vacation in addition to 4 credits from skill-based courses earned during the first and second semester.

Curriculum Structure _ F.Y. B. Tech._ Group-2: Mechanical & Civil Engineering

Semester-I														
COURSE TYPE	COURSE CODE	COURSE NAME	TEACHING SCHEME (Hours/Week)				CREDIT SCHEME				EXAMINATION /EVALUATION SCHEME AND MARKS			
			L	P	T	Total	L	P	T	Total	CIE	ESE	TW	Total
BSC	2601BSC101	Calculus & Linear Algebra (CLA)	3	-	1	4	3	-	1	4	40	60	25	125
BSC	2601BSC117 2601BSC118	Applied Physics (AP) / Applied Chemistry (AC)	2	2	-	4	2	1	-	3	40	60	25	125
ESC	2601ESC119 2601ESC120	Basic Electronics Engineering (BXE) / Fundamentals of Electrical Engineering (FEE)	2	2	-	4	2	1	-	3	40	60	25	125
ESC	2601ESC121 2601ESC122	Engineering Mechanics (EM) / Engineering Graphics (EG)	2	2	-	4	2	1	--	3	40	60	25	125
ESC	2601ESC123	Basic Python Programming (BPP)	2	2	-	4	2	1	--	3	40	60	25	125
AEC	2601AEC109	Professional Communication Skills	2	-	-	2	2	-	-	2		-	25	25
CC	2601CC110	Holistic Health, Values & Wellness	2	-	-	2	2	-	-	2		-	25	25
VSEC	2601VSL111 2601VSL112	Design Thinking Ideation (DTI) (Mini Project) / Manufacturing Practice Workshop (MPW)	-	4	-	4	-	2	--	2		-	25	25
Total			15	12	1	28	15	6	1	22	200	300	200	700

Curriculum Structure _ F.Y. B. Tech._ Group-2: Mechanical & Civil Engineering

Semester-II														
COURSE TYPE	COURSE CODE	COURSE NAME	TEACHING SCHEME (Hours/Week)				CREDIT SCHEME				EXAMINATION /EVALUATION SCHEME AND MARKS			
			L	P	T	Total	L	P	T	Total	CIE	ESE	TW	Total
BSC	2601BSC113	Differential Equations & Integral Calculus (DEIC)	3	-	1	4	3	--	1	4	40	60	25	125
BSC	2601BSC118 2601BSC117	Applied Chemistry (AC) / Applied Physics (AP)	2	2	-	4	2	1	-	3	40	60	25	125
ESC	2601ESC120 2601ESC119	Fundamentals of Electrical Engineering (FEE) / Basic Electronics Engineering (BXE)	2	2	-	4	2	1	-	3	40	60	25	125
ESC	2601ESC122 2601ESC121	Engineering Graphics (EG) / Engineering Mechanics (EM)	2	2	-	4	2	1	--	3	40	60	25	125
PCC	2601PCC124* 2601PCC125#	Fundamentals of Civil Engineering (FCE)/ Systems in Mechanical Engineering (SME)	2	2	-	4	2	1	--	3	40	60	25	125
IKS	2601IKS115	Indian Knowledge System	2	-	-	2	2	-	-	2		-	25	25
CC	2601CC116	Integrated Personality Development	2	-	-	2	2	-	-	2		-	25	25
VSEC	2601VSL112 2601VSL111	Manufacturing Practice Workshop (MPW) / Design Thinking Ideation (DTI) (Mini Project)	-	4	-	4	-	2	--	2		-	25	25
Total			15	12	1	28	15	6	1	22	200	300	200	700

- 2601PCC124* : This course is intended for Civil Engineering students.
- 2601PCC125# : This course is intended for Mechanical Engineering students.

Curriculum Structure _ F.Y. B. Tech._ Group-2: Mechanical & Civil Engineering

DEPARTMENT SPECIFIC EXIT COURSE (Group-2) (To award UG Certificate in Technology) First Year B.Tech. (Semester-II)												
COURSE TYPE	COURSE CODE	COURSE NAME	TEACHING SCHEME (Hours/Week)				CREDITS	THEORY EXAMINATION SCHEME		PRACTICAL EXAMINATION SCHEME		TOTAL
			L	PT	T	Total		CIE	ESE	TW	OR	
EXIT	2601EXT126	INTERNSHIP	-	16	-	16	8	-	-	50	50	8
Total			-	16	-	16	8					8
			Internship = Practical Training + Real work experience.									
Total			16 hrs per week for minimum 6 weeks (96 hrs)									

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GROUP-I (COMPUTER, AIDS & E&TC ENGINEERING)

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Group-I (Computer, AIDS & E&TC Engineering)

CALCULUS & LINEAR ALGEBRA (CLA)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601BSC101	CIE	40 M
TEACHING HRS. / WK	03		
TUTORIAL HRS./WK	01	ESE	60 M
CREDITS	04	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Limits, continuity and differentiation, Maxima minima of functions of one variable, Matrix Algebra			
COURSE OBJECTIVES			
To develop fundamental knowledge and problem-solving skills in differential calculus, multivariable calculus, and linear algebra, and to apply these mathematical concepts and techniques to solve engineering and real-world problems			
COURSE OUTCOMES			
After successful completion of the course, students will be able to CO1: Determine the rank of a matrix and solve systems of linear equations to model electric network and traffic flow problems. CO2: Compute eigenvalues and eigenvectors of a matrix and apply the Cayley-Hamilton theorem to diagonalize matrices for machine learning applications. CO3: Analyze the behavior of functions using mean value theorems and series expansions to estimate errors in function approximations. CO4: Apply partial differentiation techniques, including Euler's theorem and the chain rule, to solve problems involving composite and homogeneous functions. CO5: Apply Jacobians and Lagrange's method of undetermined multipliers to solve problems involving coordinate transformations and optimization of multivariable functions.			
COURSE CONTENTS			
UNIT-I: MATRICES AND SYSTEM OF LINEAR EQUATIONS: Rank of a Matrix, Echelon Form of Matrix, Consistency of System of Linear Equations and its Applications in Electric Networks and Traffic Flow problems, Linear dependence and independence of vectors, Orthogonal Matrix.			
UNIT-II: EIGENVALUES, EIGENVECTORS AND DIAGONALIZATION: Characteristic equations, Cayley Hamilton theorem (Without proof) and its applications, Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Application of Eigen values and eigen vectors in Machine learning.			

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UNIT-III: DIFFERENTIAL CALCULUS:

Indeterminate Forms, Rolle's Theorem, Cauchy Mean Value Theorem (Without proof), Lagrange's Mean value theorem (Without proof), Taylor's Series and Maclaurin's Series, Expansion of functions using standard expansions, Error estimation using Taylor series.

UNIT-IV: PARTIAL DIFFERENTIATION

Introduction to functions of several variables, Partial Derivatives, Euler's Theorem on Homogeneous functions, Partial derivatives of Composite Function and Total Derivative using Chain Rule.

UNIT V: APPLICATIONS OF PARTIAL DIFFERENTIATION:

Jacobian and its properties, Partial derivatives of implicit function and functional dependence using Jacobian, Applications of Jacobian in transformation of coordinates, Error and Approximations, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

LIST OF TUTORIAL ASSIGNMENTS

1. Activity-I (Pre-requisite revision)
2. Matrices and System of Linear Equations
3. Eigen Values, Eigen Vectors and Diagonalization
4. Differential Calculus
5. Partial Differentiation
6. Applications of Partial Differentiation
7. Activity -II (Self learning): Case study / Solving problems using software NumPy / SciPY / Scilab / R Programming / MATLAB

Tutorial for the subject will be conducted in the batches with activity-based learning. Tutorials must be written in the Tutorial book for uniform representation among students. Term work consists of tutorials and activities.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

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Reference Books:

1. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th Edition.
3. Applications to Linear Algebra by Gilbert Strang, 4th Edition, Brooks/Cole Thomson Learning
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson).
5. Applied Mathematics (Vol. I & Vol. II) by P. N. Wartikar and J. N. Wartikar, Vidyarthi Griha Prakashan, Pune.

Text Books:

1. H. K. Das, "Advanced Engineering Mathematics", S Chand Publication
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, New Delhi.
3. D. C. Lay, S. R. Lay, J. J. McDonald, "Linear Algebra and Its Applications", Pearson

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

Online Resources:

1. NPTEL Course on "Engineering Mathematics-I"
<https://nptel.ac.in/courses/111105121/>
2. NPTEL Course on "Basic Calculus-I"
<https://nptel.ac.in/courses/111/106/111106146/>
3. NPTEL Course on "Basic Linear Algebra"
<https://nptel.ac.in/courses/111/101/111101115/>

ACTIVITY BASED LEARNING (SUGGESTED ACTIVITIES IN CLASS)

Activity Based Learning:

1. Collaborative and Individual Problem based learning
2. Think Pair Share
3. Surprise Test, Open Book Test
4. Quiz
5. Seminar / Presentation
6. Use of ICT

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MODERN PHYSICS (MP)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601BSC102	CIE	40 M
TEACHING HRS. / WK	02		
TUTORIAL HRS./WK	01	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
A fundamental understanding of mathematics, physics, electrical, electronic, and electromagnetic technologies is required. Introduction to astrophysics and aerospace. Basic knowledge of nanoscience and basic semiconductor physics.			
COURSE OBJECTIVES			
1The objective of the course is to impart the knowledge of fundamentals of physics through hands-on experiments and extend it to relevant engineering applications.			
COURSE OUTCOMES			
After successful completion of this course, students will be able to, CO1: Explain phenomena of interference in thin films, polarization, law of Malus and applications such as anti-reflection coating, liquid crystal display (LCD). CO2: Develop the understanding of the working principle of lasers, optical fibers, and extend it to fiber optic communication. CO3: Deduce Schrödinger's wave equations and apply it to problems on bound states by summarizing fundamentals of quantum physics. CO4: Understand basic concepts, manufacturing methods and applications of nanochips, and compare nanochips with microchips. Describe the principles and engineering applications of superconductors, ultrasonic generators, and piezoelectric generators in manufacturing quality testing. CO5: Analyze space technology and aerospace engineering principles—including satellites, aerodynamics, and Indian space missions – to evaluate their engineering applications and emerging trends.			
COURSE CONTENTS			
UNIT 1: WAVE OPTICS Interference in thin films of uniform thickness, conditions for maxima and minima for reflected system; Conditions for maxima and minima for wedge shaped films (qualitative), engineering applications – anti-reflecting coating (ARC), determination of optical flatness; Numerical problems on thin films and wedge shaped films; Types of polarization: unpolarized, polarized, plane polarized light (PPL), circularly polarized light (CPL) and elliptically polarized light (EPL), Malus's law and related numerical problems; Engineering applications of polarization: liquid			

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crystal display (LCD), communication and radar.

UNIT 2: PHOTONICS

Laser: Spontaneous and stimulated emission, population inversion, pumping, active medium and active center, resonant cavity; Engineering applications of laser (IT, medical, industry).

Optical fibers: Critical angle, acceptance angle, acceptance cone, numerical aperture, total internal reflection and propagation of laser; Classification of optical fibers: single mode and multimode, step index and graded index; Attenuation: attenuation coefficient, causes of attenuation; Advantages of optical fiber communication; Numerical problems on parameters of optical fiber.

UNIT 3: QUANTUM PHYSICS

de Broglie hypothesis of matter waves, de Broglie wavelength for a particle accelerated by KE 'E' and a charged particle accelerated by PD 'V', properties of matter waves; Wave function and probability density, mathematical conditions for wave function, problems on de Broglie wavelength; Need and significance of Schrödinger's equations, Schrödinger's time-independent and time-dependent equations; Energy of a particle enclosed in a rigid box and related numerical problems; Quantum mechanical tunneling, alpha particle decay, principle and applications of scanning tunneling microscope (STM); Principles of quantum computing: concept of qubit, superposition and entanglement, potential applications of quantum computing.

UNIT 4: MODERN APPLICATIONS OF PHYSICS

Nanochips and physics: Basics of nanochips, types, methods of manufacturing, applications, nanochips vs microchips.

Superconductor and applications: Basics of superconductor applications (only qualitative), bullet train (overview and technological aspect or correlation of physics)

Ultrasonic generator and its application in quality testing: Piezoelectric generator - construction and working, applications in quality testing.

UNIT 5: SPACE TECHNOLOGY AND AEROSPACE ENGINEERING

Space technology: Satellite communication; artificial satellites - types and applications, orbital motion and geostationary satellites; India space mission - Chandrayaan, Mangalyaan.

Aerospace engineering: Fundamentals of aircraft, aerodynamics - lift, drag and thrust, global positioning system (GPS); Overview of emerging technology in aerospace engineering and case study.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Introduction to Solid State Physics, *C. Kittel*, Wiley and Sons.
2. Quantum Mechanics, *A. K. Ghatak, S. Lokanathan*, Laxmi Publications.
3. Nanotechnology: Principles and Practices, *S. K. Kulkarni*, Capital Publishing.
4. Physics for Scientists and Engineers with Modern Physics, *Serway and Jewett*, Cengage

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Publications.

5. Fundamental Astronomy – Ed. *H. Karttunen, P. Kroger, H. Oja* et al., 1987, Springer-Verlag, Berlin

Text Books:

1. A Textbook of Engineering Physics, *M. N. Avadhanulu, P. G. Kshirsagar* and *TVS Arun Murthy*, S. Chand Publications.
2. Engineering Physics, *R. K. Gaur* and *S. L. Gupta*, Dhanpat Rai Publications.
3. Optics, *Ajoy Ghatak*, Tata McGraw Hill.
4. Integrated Design for Space Transportation System, *B. N. Suresh and K. Sivan*, Springer.
5. ISRO: A Personal History, *R. Aravamudan*, HarperCollins India.
6. An Introduction to Modern Astrophysics, *B. W. Carroll* and *D. A. Ostlie*, Cambridge University Press.
7. Introduction to Flight, *Jr. Anderson* and *John D.*, McGraw-Hill Science Engineering.

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MODERN PHYSICS LABORATORY (MPL)			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Basic knowledge of physics, laboratory dos and don'ts, laboratory safety practices and safe handling of optical, electrical and electronic equipment, fundamentals of mechanics, waves and oscillations, geometrical and wave optics, interference, diffraction and polarization, basic semiconductor physics, electrostatics and electromagnetism, elementary electrochemical and electronic measurements, simple mathematical calculations, graphical data analysis and basic computer skills.			
COURSE OBJECTIVES			
1. To provide these basic concepts to resolve engineering and technological problems. 2. After completing this course, students will be able to appreciate and use the methodologies to analyze and design a wide range of engineering systems. 3. To use various techniques for measurement, calculation, control and analysis of engineering problems based on the principles of optics, ultrasonics, acoustics, quantum physics, superconductivity, laser, physics of nanoparticles, and semiconductor physics. 4. To understand the recent trends and advances in technology, this requires precise control over the dynamics of macroscopic engineering systems. 5. Basic sciences like Physics also invoke manipulation of processes over micro- and even nano-scale level as there is a growing demand of solid understanding of principles of basic sciences. 6. Physics provides the basic ideas and gives the solution for developing mathematical and analytical abilities with higher precision.			
COURSE OUTCOMES			
CO1: Apply the principles of interference, diffraction, polarization and double refraction to investigate the optical properties of materials and determine relevant physical parameters. CO2: Analyze the characteristics of diffraction gratings, optical instruments, lasers and optical fibers to determine wavelength, resolving power, geometrical parameters and transmission characteristics. CO3: Characterize semiconductor and optoelectronic devices by analyzing their electrical and temperature-dependent properties and determine parameters such as band gap, Hall coefficient, carrier concentration, fill factor and efficiency. CO4: Perform experiments involving magnetic materials and ultrasonic waves to determine magnetic susceptibility, velocity of ultrasonic waves and related material properties. CO5: Develop proficiency in experimental techniques, data acquisition, graphical analysis, error estimation and interpretation of results using appropriate laboratory instruments and basic computational tools.			
COURSE CONTENTS			

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1. LIST OF EXPERIMENTS (Any 8)

2. Experiment based on Newton's rings (determination of wavelength of monochromatic light, determine radius of curvature of plano-convex lens).
3. To determine position of diffraction minima by studying diffraction at a single slit.
4. To determine the unknown wavelength by using a plane diffraction grating.
5. To find out the resolving power of a diffraction grating/telescope.
6. To verify Malus's law.
7. Any experiment based on double refraction (determination of refractive indices, identification of types of crystal).
8. Any experiment based on Laser (thickness of wire, determination of number of lines on grating surface).
9. To study I-V characteristics of solar cell and determine parameters (fill factor and efficiency).
10. To determine the bandgap of a given semiconductor.
11. To determine Hall coefficient and charge carrier density.
12. Temperature dependent characteristics of semiconductor laser.
13. Ultrasonic Interferometer: Determination of velocity of ultrasonic waves in given liquid and find its compressibility.
14. Estimating Star Temperatures (Wien's Law)
15. Demonstrating Stellar Parallax (Distance Measurement)
16. Retrograde Motion of Mars (Planetary Dynamics)

LEARNING RESOURCES

Textbooks:

1. Engineering Physics, Avadhanulu, Kshirsagar, S. Chand Publications.
2. A textbook of optics – N Subrahmanyam and Brij Lal, S. Chand Publications.
3. Engineering Physics, Gaur, Gupta, Dhanpat Rai and Sons Publications.
4. Concept of Physics, H. C. Verma, Bharati Bhavan Publications.

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PRINCIPLES OF ELECTRONICS ENGINEERING (PXE)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601ESC104	CIE	40 M
TEACHING HRS. / WK	02		
PRACT/TUT HRS./WK	02	ESE	60 M
CREDITS	02	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Basic Physics, Basic Digital Electronics, Mathematics.			
COURSE OBJECTIVES			
1. To understand the working principles of PN junction diode and Special purpose diodes. 2. To study the operating principle and applications of Bipolar Junction Transistors & MOSFET. 3. To learn the concepts of various logic gates, digital circuits, Microprocessor & Controller. 4. To understand the concepts of Opamp, its applications and electronic Instruments. 5. To know the methods of measurement of physical parameters using sensors and transmission with			
COURSE OUTCOMES			
CO1: Know about the working of active and passive components. CO2: Understand the working of BJT & MOSFET, their characteristics & compare. CO3: Learn logic gates & realization of the digital circuits. CO4: Understand the functioning of Opamp and electronic instruments. CO5: Identify different electronics sensors and understand basic communication system.			
COURSE CONTENTs			
UNIT-I: INTRODUCTION TO ELECTRONICS			
Introduction to active and passive components. P-N Junction Diode: P-N Junction diode construction and its working in forward and reverse bias conditions, V-I characteristics of P-N junction Diode, Diode as a switch, Half wave rectifier, Full wave and Bridge rectifier, Need for voltage regulation , IC 78XX series , zener diode as a regulator. Special purpose diodes: Light Emitting Diode (LED) and photo diode along with V- I characteristics and their applications..			

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UNIT-II: TRANSISTORS (BJT & MOSFET)

Bipolar Junction Transistor: Construction, type, Operation, V-I Characteristics in common emitter mode, Transistor configurations (CE, CB, CC comparison only), BJT as switch and Common Emitter (CE) amplifier.

Enhancement Metal Oxide Semiconductor Field Effect Transistors (EMOSFET):

Construction, Types, Operation, V-I characteristics, MOSFET as switch & amplifier.

FinFET : Introduction To FinFET.

UNIT-III: DIGITAL CIRCUITS

Number System: Introduction of Binary, Decimal, Octal, Hexadecimal, Conversion of Binary to Decimal, Decimal to Binary, Binary addition.

Logic Gates - AND, OR, NOT, XOR, XNOR. Universal Gates – NAND, NOR. De-Morgan's theorem.

Logic circuits - Half & Full adders, SR, JK, T & D Flip Flops.

Introduction to Microprocessor and Microcontroller (Only block diagram and explanation). Basics of Arduino.

UNIT-IV: OPERATIONAL AMPLIFIER AND ELECTRONIC INSTRUMENTS

Operational amplifier: Functional block diagram of operational amplifier, Ideal & practical values of performance parameters, Op-amp applications: Inverting, Non-inverting amplifier.

Electronic Instruments: Block diagram of Digital Multimeter, Function Generator, Digital Storage Oscilloscope (DSO), DC power supply.

UNIT-V: SENSORS AND COMMUNICATION SYSTEMS

Need Classification of sensors: Active/Passive Sensors, Selection Criteria/Characteristics of sensor. Motion Sensors (LVDT), Temperature Sensors (Thermocouple, RTD), Mechanical Sensors (Strain Gauge). Block diagram of IoT based Data Acquisition and Automation System.

Communication Systems: Block Diagram, Communication Media: Wired and Wireless, Electromagnetic Spectrum, Cellular concept, Block diagram of GSM system, Introduction of 5G mobile network.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Digital Fundamentals by Thomas. L. Floyd, 11th Edition, Pearson
2. Mobile Communication by J. Schiller, 2nd Edition, Pearson
3. Sensors Handbook, by S. Soloman, 2nd Edition.
4. CMOS Circuit Design, Layout & Simulation, by Baker, 2nd Edition, Wiley IEEE Press

Text Books:

1. Electronics Devices by Thomas. L. Floyd, 9th Edition, Pearson
2. Modern Digital Electronics by R. P. Jain, 4th Edition, Tata McGraw Hill
3. Electronic Instrumentation by H. S. Kalsi, 3rd Edition, Tata McGraw Hill
4. Sensors and Transducers by D. Patnabis, 2nd Edition, PHI
5. Electronic Communication Systems by Kennedy & Davis, 4th Edition, Tata McGraw Hill

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6. Mobile Wireless communication by M. Schwartz, Cambridge University Press.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

Online Resources:

e-Books: <https://www.pearson.com/en-us/subject-catalog/p/electronic-devices-electron-flow-version/P200000001048>

MOOC / NPTEL/YouTube Links:

1. <https://nptel.ac.in/courses/117103063>
2. <https://nptel.ac.in/courses/117103064>
3. <https://archive.nptel.ac.in/courses/106/105/106105166/>

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ELECTRONICS ENGINEERING LAB (EEL)			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Fundamental understanding of mathematics, physics, electronic, and sensor technologies is required.			
COURSE OBJECTIVES			
1. To impart the fundamental knowledge of Electronic Engineering to all the students of various disciplines. 2. To provide the comprehensive basics about Analog and Digital components and circuits. 3. To impart the knowledge of Introduction to use various sensors and components for application.			
COURSE OUTCOMES			
After successful completion of this course, students will be able to, CO1: Understand basics of electronics components. CO2: Construct and test basic electronic circuits, and perform experimental verification of fundamental electronic circuits digital and analog. CO3: Conduct experimental studies of components with graphical representation. CO4: Explain the operating principles of logic gates and perform experimental verification. CO5: Learn how to use virtual Lab and perform experimental verification.			
COURSE CONTENTS			
PART-A: LIST OF EXPRIMENTS (Any 9)			
1. Study Electronic Components: Study of Active and Passive components i. Resistors (Fixed & Variable), Calculation of resistor value using color code. ii. Capacitors (Fixed & Variable) iii. Inductors, Calculation of inductor value using color code. iv. Devices such as Diode, BJT, MOSFET, various IC packages v. Switches & Relays. 1. 2. Measurements using various measuring instruments: i. Setup CRO and function generator for measurement of AC & DC voltages and frequency ii. Measure Voltage, Resistance using digital Multimeter. Also use Multimeter to check diode, BJT. 2. V-I characteristics of P-N Junction Diode (Study the datasheets of typical PN junction diode) 3. Rectifier circuits: Implement DC Regulated Power Supply using bridge rectifier & diodes. 4. Build and test Common Emitter (CE) BJT Amplifier Circuit. i. Calculate the Gain of CE Amplifier			

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5. Linear applications of Op-amp:
 - i. Build inverting and non-inverting amplifier using op-amp (Study the data sheet of typical Op-Amp 741)
6. Test and verify the truth tables of:
 - i. Basic and Universal Gates (Study the datasheets of respective ICs)
 - ii. Half & Full Adder
7. Study of transducers/sensor (Any 3)
8. Build and test any circuit using BJT/MOSFET/Op-Amp/Logic Gates using any one sensor.
9. Case Study of any one electronics appliances with block diagram, specification etc.
10. Virtual Lab experiments based on digital circuit/sensor application.

<https://sl-coep.vlabs.ac.in/Introduction.html>

<https://de-iitr.vlabs.ac.in/List%20of%20experiments.html>

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APPLIED MECHANICS (AM)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601ESC106	CIE	40 M
TEACHING HRS. / WK	02		
PRACT/TUT HRS./WK	02	ESE	60 M
CREDITS	02	TW	25 M
		TOTAL	125 M
PREREQUISITES			
A fundamental understanding of Basic Calculus, Trigonometry, Geometrical expressions and physics.			
COURSE OBJECTIVES			
1. To learn the basic concept of force systems and resultant of forces. 2. To solve problems involving equilibrium of concurrent and general force systems, reaction of statically determinate beams and the concept of connected bodies and pulley systems. 3. To determine the centroid of composite sections and to solve practical examples involving friction. 4. To determine the geometric components of motion for rectilinear and curvilinear motion of a particle. 5. To use Newton's laws and energy principles for analyzing rectilinear and curvilinear motion of a particle.			
COURSE OUTCOMES			
CO1: Understand the basic concept of forces, moments and force couples. CO2: Apply concept of free body diagram for static equilibrium, analyze the reactions of statically determinate beams and learn the concept of connected bodies and pulley system. CO3: Solve the problems involving Centroid of composite sections along with practical examples involving friction. CO4: Describe the rectilinear and curvilinear motion of a particle. CO5: Apply Newton's second law, work energy and impulse momentum principles for particles.			
COURSE CONTENTS			
UNIT-I: FORCE SYSTEMS			
Introduction and Fundamental Laws of Mechanics, Derived laws of Mechanics, Force systems, Resolution and Composition of forces, Free Body Diagram, Resultant of Coplanar Concurrent force systems, Moment of force, Couple, Varignon's theorem, Resultant of Coplanar General force systems, Resultant of forces in space.			
UNIT-II: EQUILIBRIUM OF STRUCTURES			
Equilibrium of Concurrent, Parallel and General Force Systems in a Plane. Equilibrium of forces in space. Types of Supports, Loads and Beams. Reactions for Statically Determinate Beams. Connected Bodies and Pulley Systems. Simple Machines – Mechanical Advantage, Velocity Ratio and Efficiency of Levers, Wheel and Axle, and Pulley Systems.			

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UNIT-III: CENTROID, MOMENT OF INERTIA AND FRICTION

Introduction, centroid of basic figures, centroid of composite figure, moment of inertia of simple geometrical figures, parallel axis theorem, perpendicular axis theorem (polar moment of inertia). Friction – Introduction, coefficient of friction, angle of friction, angle of repose, friction on inclined plane, ladder friction and belt friction.

UNIT-IV: KINEMATICS

Introduction, Basic Concepts, Rectilinear Motion: Motion with Uniform Acceleration, Gravitational Acceleration, Curvilinear Motion: Rectangular Components, Normal and Tangential Components, Motion of Projectile, Introduction to Relative Motion and its Engineering Applications.

UNIT-V: KINETICS

Introduction, D'Alembert's principle of dynamic equilibrium and its application to rectilinear and curvilinear motion, Conservative and non-conservative forces, Work energy principle, conservation of energy, Impulse momentum principle, Impact – types, coefficient of restitution.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. R. K. Rajput, *Engineering Mechanics*, Laxmi Publications.
2. R. S. Khurmi, *Applied Mechanics*, S. Chand Publications.
3. S. Timoshenko and D. H. Young, *Engineering Mechanics*, McGraw-Hill.

Text Books:

1. R. C. Hibbeler, *Engineering Mechanics: Statics & Dynamics*, Pearson Education.
2. Beer and Johnston, *Vector Mechanics for Engineers – Statics and Dynamics*, McGraw-Hill.
3. S. S. Bhavikatti, *Engineering Mechanics*, New Age International.
4. A. K. Tayal, *Engineering Mechanics*, Umesh Publications.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

Online Resources:

Engineering Mechanics lecture series by Prof. K. Ramesh – IIT Madras
https://www.youtube.com/playlist?list=PLyqSpQzTE6M_MEUdn1izTMB2yZgP1NLfs

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MECHANICS LABORATORY (ML)			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
A fundamental understanding of Basic Calculus, Trigonometry, Geometrical expressions and physics.			
COURSE OBJECTIVES			
1. To impart the fundamental knowledge of Applied Mechanics to all the students of various disciplines. 2. To provide the comprehensive basics about force systems and equilibrium. 3. To impart the knowledge of and applications of friction. 4. To understand particle motion and impact of bodies.			
COURSE OUTCOMES			
Course Outcome: CO1: Construct a concurrent force system in two dimensions and determine the resultant graphically CO2: Determine the reactions of determinate beams and verify equilibrium of three force system. CO3: Calculate the coefficient of friction for various surfaces. CO4: Calculate the coefficient of restitution and understand the aspects of projectile motion.			
COURSE CONTENTS			
PART-A: LIST OF EXPRIMENTS (Any 8) 1. Verification of the Polygon law of forces. 2. To find support reaction of beam 3. To verify Lami's theorem 4. To determine coefficient of friction 5. To simulate Projectile motion 6. Determination of coefficient of restitution PART B: Assignment on each unit comprising of at least five application-level problems.			

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SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

REFERENCE BOOKS

1. R. K. Rajput, *Engineering Mechanics*, Laxmi Publications.
2. R. S. Khurmi, *Applied Mechanics*, S. Chand Publications.
3. S. Timoshenko and D. H. Young, *Engineering Mechanics*, McGraw-Hill

TEXTBOOKS

4. R. C. Hibbeler, *Engineering Mechanics: Statics & Dynamics*, Pearson Education.
5. Beer and Johnston, *Vector Mechanics for Engineers – Statics and Dynamics*, McGraw-Hill.
6. S. S. Bhavikatti, *Engineering Mechanics*, New Age International.
7. A. K. Tayal, *Engineering Mechanics*, Umesh Publications.

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COMPUTER PROGRAMMING USING C (CPC)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601ESC108	CIE	40 M
TEACHING HRS. / WK	02		
CREDITS	02	ESE	60 M
		TW	25 M
		TOTAL	125 M
PREREQUISITES			
Basic knowledge of computer fundamentals and operating systems.			
COURSE OBJECTIVES			
1. To introduce the basics of program design tools and C programming concepts, including data types 2. To acquire knowledge of Operators in C Programming 3. To apply Control Flow structures in C Programming. 4. To design a solution using Arrays, and String in C programming. 5. To develop simple C programs using user-defined functions.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Understand the basics of program design tools and C programming concepts. CO2: Use different operators in C programming to perform various operations. CO3: Apply control flow statements to solve simple programming problems. CO4: Develop C programs using arrays and strings. CO5: Create simple C programs using user-defined functions.			
COURSE CONTENTS			
UNIT 1: FUNDAMENTALS OF PROGRAMMING Introduction to programming, why to learn programming, Definition and importance of programming, Role of programming languages. Program Design Tools- Algorithm, Characteristics of Algorithm, Flowcharts- Different symbols used in flowchart, Characteristics of flowchart, Pseudo code. FUNDAMENTALS OF C Overview of C, History of C, Application & features of C, Tokens, and Character set, Datatypes. Executing the first C program.			
UNIT II: OPERATORS Operators-arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operator, Expression			
UNIT III: DECISION CONTROL AND LOOPING STATEMENTS Decision Control Structure- If statement, if-else statement, Nested if-else statement, Control structure- Switch Case Statements, GOTO statement. Loop Control Structure- while statement, do while statement, for statement, break and continue statement Comparison of different loops.			

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UNIT IV: ARRAY, STRING

Array Declaration and Initialization, need of array, accessing array elements, one dimensional array, two-dimensional array

Strings- Introduction to String, String built in Functions, String operations.

UNIT V: INTRODUCTION TO USER DEFINED FUNCTION

Need for User-defined Functions, Function definition, declaration, Elements of User defined Functions, Category of Functions: No Arguments and no Return Values, Arguments but No Return Values, Arguments with Return values, No Arguments but Returns a Value.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books

1. B. S. Gottfried, Programming with C (Schaum's Outline Series), 2nd ed. McGraw-Hill, 1996.
2. S. C. Kochan, Programming in C, Sams Publishing, 3rd ed. 2004.
3. B. W. Kernighan and D. M. Ritchie, The C Programming Language, 2 nd ed. UK: Prentice Hall, 1988.
4. W. Kernighan and B. Pike, The Practice of Programming, UK: Addison-Wesley, 1999
5. H. M. Deitel and P. J. Deitel, C: How to program, 8 th ed. Pearson Education, 2015.
6. P. Prinz & T. Crawford, C in a Nutshell: The Definitive Reference, 2nd ed., O'Reilly Media, 2016.

Textbooks:

Programming in ANSIC, 8e –E. Balagurusamy, Let us C- Yashwant Kanitkar

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

Online Resources:

e-Books:<https://studylib.net/doc/25796931/programming-in-ansic--8e---balagurusamy> MOOC /

NPTEL/YouTube Links: https://onlinecourses.nptel.ac.in/noc22_cs40/preview :

https://onlinecourses.nptel.ac.in/noc23_cs53/preview

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COMPUTER PROGRAMMING USING C LAB			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Basic knowledge of computer fundamentals and operating systems.			
COURSE OBJECTIVES			
1. To introduce the basics of program design tools and C programming concepts, including data types			
2. To acquire knowledge of Operators in C Programming			
3. To apply Control Flow structures in C Programming.			
4. To design a solution using Arrays, and String in C programming.			
5. To develop simple C programs using user-defined functions.			
COURSE OUTCOMES			
After completion of this course, student shall be able to:			
CO1: Understand the basics of program design tools and C programming concepts.			
CO2: Use different operators in C programming to perform various operations.			
CO3: Apply control flow statements to solve simple programming problems.			
CO4: Develop C programs using arrays and strings.			
CO5: Create simple C programs using user-defined functions.			
COURSE CONTENTS			
List of Laboratory Experiments (Perform any eight programs)			
1. Write a C program to calculate the gross salary of an employee. The program should take the Basic Salary as input, compute and display the following:			
• H.R.A. (House Rent Allowance) = 20% of Basic Salary			
• D.A. (Dearness Allowance) = 150% of Basic Salary			
• Gross Salary = Basic Salary+ H.R.A. + D.A.			
2. Write a C program to accept an object's mass (kg) and velocity(m/s) from the user, then compute and display			
its momentum (E) using the formula: $E = m \times c^2$			
3. Write a C program to accept marks for five subjects of a student and calculate the total and percentage. Based on the percentage, determine the result classification as follows: Percentage $\geq$ 75% - Distinction, 60% – 74% First Class, 50% – 59% Second Class, 35% –49% Pass, < 35% Fail			
4. Write a C program to generate and display the Fibonacci series. Accept the number from user to print Fibonacci series			
5. Write a C program to calculate factorial of number.			
6. write a C program to perform the following operations on array			
• Find given element in array			
• Find Max and Min element			
7. write a C program to perform the following operations			
• Find frequency of given element in array			

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• Find Average of elements in Array. 8. Write a C program to accept a string and perform the following operations: • Calculate the length of the string • Check equality with another string entered by the user 9. Write a C program to calculate square of number by using user defined function. 10. Write a C program to find the largest of two numbers using user defined function
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SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)
Reference Books: 1. B. S. Gottfried, Programming with C (Schaum's Outline Series), 2nd ed. McGraw-Hill, 1996. 2. S. C. Kochan, Programming in C, Sams Publishing, 3rd ed. 2004. 3. B. W. Kernighan and D. M. Ritchie, The C Programming Language, 2nd ed. UK: Prentice Hall, 1988. 4. W. Kernighan and B. Pike, The Practice of Programming, UK: Addison-Wesley, 1999 5. H. M. Deitel and P. J. Deitel, C: How to program, 8th ed. Pearson Education, 2015. 6. P. Prinz & T. Crawford, C in a Nutshell: The Definitive Reference, 2nd ed., O'Reilly Media, 2016 Text Books: 1. Programming in ANSIC, 8e –E. Balagurusamy
WEB LINKS AND VIDEO LECTURES (E-RESOURCES)
1. e-Books: https://studylib.net/doc/25796931/programming-in-ansic--8e---balagurusamy MOOC / NPTEL/YouTube Links: https://onlinecourses.nptel.ac.in/noc22_cs40/preview : https://onlinecourses.nptel.ac.in/noc23_cs53/preview
ACTIVITY BASED LEARNING (SUGGESTED ACTIVITIES IN THE PRACTICAL)
1. Role Play 2. Online Interactive Tool 3. Collaborative and Individual Problem based learning. 4. Quizzes/Assignment 5. Seminars/Presentations

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DIFFERENTIAL EQUATIONS AND INTEGRAL CALCULUS (DEIC)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	26-01-BSC-113	CIE	40 M
TEACHING HRS. / WK	03		
TUTORIAL	01	ESE	60 M
CREDITS	04	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Differentiation and Integration, Taylors and Maclaurins series, Differential equations.			
COURSE OBJECTIVES			
1.To make the students familiarize with Mathematical Modeling of physical systems using differential equations 2. To make the students familiarize with advanced techniques of integration, tracing of curves, multiple integrals and their applications. 3.The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Apply the effective mathematical tools to solve first order differential equations to model physical processes such as Newton’s law of cooling, electrical circuit etc. CO2: Determine the Fourier series representation and harmonic analysis of periodic continuous and discrete systems. CO3: Use advanced integration techniques such as Reduction formulae, Beta functions, Gamma functions, Differentiation under integral sign needed in evaluating multiple integrals and their applications. CO4: Draw Cartesian, Polar, Parametric curves for a given equation. CO5: Evaluate multiple integrals and its application to find area bounded by curves, volume bounded by surfaces.			
COURSE CONTENTS			
UNIT 1: FIRST ORDER DIFFERENTIAL EQUATION & ITS APPLICATIONS			
Exact differential equations, Equations reducible to exact form. Linear differential equations. Applications of Differential Equations to Orthogonal Trajectories, Newton’s Law of Cooling, Kirchhoff’s Law of Electrical Circuits UNIT-II: FOURIER SERIES: Definition, Dirichlet conditions, Full range Fourier series, Half range Fourier series and harmonic analysis.			

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UNIT III: INTEGRAL CALCULUS

Reduction Formulae of standard trigonometric functions, Beta function, Gamma functions, properties of Beta & Gamma function, Differentiation under integral sign.

UNIT IV: Curve Tracing

Tracing of Cartesian Curve, Tracing of Parametric curves, Tracing of Polar Curves, Rectification of curves.

UNIT V: Multiple Integration

Double Integration: Direct evaluation, limits are not given, transformation to polar & Change of order of integration, Triple integration and Applications

List of Tutorials:

1. Activity -I (Revision of Prerequisites)
2. First order Linear Differential equation and Applications
3. Full, Half range fourier series
4. Integral Calculus
5. Curve tracing
6. Multiple integration and Applications
7. Activity-II Case Study

Tutorial for the subject shall be engaged in minimum three batches per division and activity-based learning. Term work shall consist of five tutorials, one on each unit. Tutorials must be written in the Tutorial book for uniform representation among students.

Activity Based Learning:

1. Collaborative and Individual Problem based learning
2. Think Pair Share
3. Surprise Test, Open Book Test
4. Quiz
5. Seminar / Presentation
6. ICT- Slido / Kahoot etc.
7. Case study

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

REFERENCE BOOKS

1. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th Edition.
3. Applications to Linear Algebra by Gilbert Strang, 4th Edition, Brooks/Cole Thomson Learning
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson).
5. Applied Mathematics (Vol. I & Vol. II) by P. N. Wartikar and J. N. Wartikar, Vidyarthi Griha Prakashan, Pune.

Text Books:

1. H. K. Das, "Advanced Engineering Mathematics", S Chand Publication
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, New Delhi.
3. D. C. Lay, S. R. Lay, J. J. McDonald, "Linear Algebra and Its Applications", Pearson

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

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Online Resources:

1. NPTEL Course on “Engineering Mathematics-II”
<https://nptel.ac.in/courses/111105121/>
2. NPTEL Course on “Basic Calculus-2”
<https://nptel.ac.in/courses/111/106/111106146/>
3. NPTEL Course on Mathematics”
<https://nptel.ac.in/courses/111/101/111101115/>

ACTIVITY BASED LEARNING (SUGGESTED ACTIVITIES IN CLASS)

1. Flipped Classroom
2. Surprise / Open book Test
3. Online Interactive Tool
4. Collaborative and Individual Problem based learning.
5. Quizzes/Assignment

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CHEMICAL SCIENCE & TECHNOLOGY(CST)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601BSC103	CIE	40 M
TEACHING HRS. / WK	02		
PRACTICAL HRS./WK	02	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Understanding of chemistry including titrations, chemical reactions, acids and bases, electricity, heat energy concepts, along with fundamental laboratory practices and basic computer skills.			
COURSE OBJECTIVES			
1. To acquire knowledge of water quality analysis, treatment methods, and electroanalytical techniques for chemical analysis. 2. To understand the properties and applications of specialty polymers, composites, and nanomaterials in engineering fields. 3. To study conventional and alternative fuels, corrosion mechanisms, methods of corrosion prevention, and sustainable e-waste management practices.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Understand the practical approaches and techniques required for effective water quality monitoring. CO2: Select appropriate electro analytical techniques for understanding the materials. CO3: Demonstrate the structure and properties of advanced engineering materials for various technological applications. CO4: Analyze different types of conventional and alternative fuels for energy applications. CO5: Explain causes of corrosion, prevention methods and e-waste management.			
COURSE CONTENTS			
UNIT I: WATER TECHNOLOGY Water quality Parameter, Types of hardness of water, Units (mg, ppm), Analytical determination of water quality: Hardness (by EDTA method) and alkalinity, Numericals, Effects of hard water in boilers- scale & sludge Purification of water: Reverse osmosis (RO) & Electrodialysis cell, Fundamentals of IoT-Based water quality monitoring, Digital monitoring of water quality parameters using smart sensors.			
UNIT 2: ANALYTICAL TECHNIQUES IN ENGINEERING CHEMISTRY			

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Introduction: Types of reference electrode(SCE), indicator electrode (Glass electrode), EMF of cell & Nernst Equation, PH metry: Introduction, standardization of pH meter, Buffer & their types, pH metric titration of strong acid versus strong base, Applications

Conductometry: Introduction, Conductometric titration of strong acid versus strong base, Applications.

UV Visible Spectroscopy: Lambertz -Beer Law, Instrumentation of UV Visible Spectrophotometer (Double Beam), Terms used in UV spectroscopy & Applications.

UNIT III: ENGINEERING MATERIALS AND NANOTECHNOLOGY

Polymers: Introduction, Monomer & Functionality of monomers. Polymer classification based on thermal properties (Thermoplastic & Thermosetting)

Engineering materials

1.Engineering thermoplastic: Properties and Applications of Polycarbonate

2.Conducting polymers: Polyacetylene and the effect of doping.

3.Polymer Composites: Introduction, functions of phases, types & Applications.

Nanomaterials: Types & size range (0D, 1D, 2D, 3D), Carbon nanotubes (CNTs), Graphene, Quantum Dots, Application of nanomaterials.

UNIT IV: RENEWABLE ENERGY SYSTEMS AND DEVICES

Fuels-HCV, LCV and properties of Fuel, Determination of calorific value: Principle, construction and working of Bomb calorimeter & numericals.

Liquid fuels: Properties, advantages and disadvantages of Power Alcohol and Biodiesel.

Gaseous fuels: Hydrogen: Future Fuel, Production by steam reforming of methane.

Fuel Cells-H₂-O₂ fuel cell, Polymer electrolyte membrane fuel cell.

Batteries: Classification, construction, working and applications of lithium-ion batteries.

UNIT V: CORROSION SCIENCE AND E-WASTE MANAGEMENT

Introduction, Types of corrosion: Dry corrosion, mechanism of dry corrosion, types of oxide films.

Wet corrosion: Mechanism: hydrogen evolution and oxygen absorption,

Factors influencing corrosion rate (Nature of Metal & Nature of Environment)

Methods of corrosion control and prevention: Cathodic protection (Sacrificial anode and Impressed current), Metallic coatings - Hot dipping and electroplating, Non-metallic coating-powder coating, Corrosion Resistant / Anti corrosive paints.

Corrosion science in computing and network systems

E-waste management and sustainable disposal:Overview

Additional topics beyond the Syllabus (Any Two per semester)

Students are required to complete any two of the following activities along with the prescribed laboratory experiments during semester. These activities will help improve their practical knowledge, analytical skills, problem-solving ability, and understanding of recent developments in Applied chemistry. The completed activities will be evaluated as part of the Best practices & will be evaluated based on the quality of work, understanding of the topic, presentation, and timely submission. Assessment will be carried out through indirect assessment methods, including the course exit survey.

1. **Study of Corrosion Prevention Methods and Protective Coatings:** Study of corrosion on different metals and corrosion control methods using paints and protective coatings, followed by comparison of results and preparation of a short report or presentation.

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2. **Virtual Laboratory Simulation of Chemical Analysis Experiments:** Virtual laboratory simulation of chemical analysis experiments, including observation recording, result analysis, and preparation of a short report or presentation.
3. **Survey and Analysis of Water Conservation Practices in Society:** Survey on water saving methods used in homes or society, including data collection, analysis of results, and preparation of a short report or presentation.
4. **Case Study on Solar Cell Technologies and Applications:** Study of solar cell technologies and their applications in daily life, including working principles and benefits of solar energy, followed by preparation of a short report or presentation.
5. **Comparative Study of Fuel Cells and Conventional Batteries:** Comparison of fuel cells and conventional batteries based on working, efficiency, applications, advantages, and limitations, followed by preparation of a chart, report, or presentation.
6. **Case Study on Conducting and Biodegradable Polymers:** Study of conducting and biodegradable polymers, including comparison of their properties, uses, and environmental benefits, followed by preparation of a short report, chart, or presentation on their applications.
7. **Energy Audit and Sustainable Energy Utilization Survey:** Study of electricity usage in classrooms or homes by identifying energy-consuming devices, analyzing their power consumption, and suggesting simple energy-saving measures, followed by preparation of a short report or presentation.
8. **Survey and Analysis of Corrosion Prevention Practices in Society:** Students will survey metallic structures in their residence or society (gates, railings, pipelines, tanks, vehicles) to identify and classify corrosion type (uniform, pitting, galvanic, etc.), assess contributing environmental factors, and document existing protective measures (coatings, galvanization, cathodic protection). Based on their findings, students will prepare a technical report analyzing the corrosion mechanisms observed and recommending improved prevention methods.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Basic Concept of Analytical Chemistry, 2ed, S. M. Khopkar, New Age-International Publisher.
2. Instrumental Methods of Chemical Analysis, G. R. Chatwal & S. K. Anand, Himalaya Publishing House.
3. Spectroscopy of organic compounds, 2ed, P. S. Kalsi, New Age-International Ltd., Publisher.
4. Polymer Science, V. R. Gowarikar, N. V. Viswanathan, Jayadev Sreedhar, Wiley Eastern Limited.
5. Inorganic Chemistry, 5ed, Shriver and Atkins, Oxford University Press.
6. Fundamentals of Nanotechnology, G. L. Hornyak, J. J. Moone, H. F. Tihhale, J. Dutta, CRC press.

Text Books:

1. Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd.
2. Engineering Chemistry by O. G. Palanna, Tata Magraw Hill Education Pvt. Ltd.
3. Textbook of Engineering Chemistry by Dr. Sunita Rattan, S. K. Kataria & Sons Publisher.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

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1. <https://chem.nju.edu.cn/upload/article/files/b5/6f/01f0f2434d708df797208aea2613/83f2b441-65ee-44a6-ac47-ed21db462c5d.pdf>.
2. https://edisciplinas.usp.br/pluginfile.php/5955761/mod_resource/content/1/CORROSION_A_NDCORROSION_CONTROL_An_Intro%20%20Revie%20and%20Uhlig.pdf
3. MOOC / NPTEL/YouTube Links: <https://nptel.ac.in/courses/113104082>

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CHEMICAL SCIENCE & TECHNOLOGY LAB			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Basic knowledge of chemistry, laboratory dos and don'ts, hazardous chemicals and their safe handling, laboratory safety equipment, chemical reactions, acids and bases, concentration and titration methods, fundamental laboratory techniques, basic electrochemistry, simple mathematical calculations, graphical data analysis and elementary computer skills.			
COURSE OBJECTIVES			
1. To acquire knowledge of water quality analysis, treatment methods, and electroanalytical techniques for chemical analysis. 2. To understand the properties and applications of specialty polymers, composites, and nanomaterials in engineering fields. 3. To study conventional and alternative fuels, corrosion mechanisms and methods of corrosion prevention.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Understand the practical approaches and techniques required for effective water quality monitoring. CO2: Select appropriate electro analytical techniques for understanding the materials. CO3: Demonstrate the structure and properties of advanced engineering materials for various technological applications. CO4: Analyze different types of conventional and alternative fuels for energy applications. CO5: Explain causes of corrosion, prevention methods and e-waste management.			
COURSE CONTENTS			

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PART-A: LIST OF EXPERIMENTS

Chemistry Laboratory Induction and Safety practices: Laboratory rules and dos and don'ts, safe handling of hazardous chemicals, use of PPE and safety equipment, chemical labels, safe storage and disposal of chemicals, emergency procedures, chemical spills, and first aid, proper use of laboratory instruments, and laboratory waste management and environmental safety.

1. To determine total hardness of water by EDTA method.
2. To determine alkalinity of water.
3. To determine strength of strong acid using pH meter.
4. Titration of strong acid with strong base using conductometer.
5. To determine maximum wavelength of absorption of CuSO₄/FeSO₄/ KMnO₄, verify Beer's law and find unknown concentration of given sample.
6. Preparation of urea-formaldehyde resin
7. Proximate analysis of coal.
8. Preparation of biodiesel from oil.
9. To coat copper and zinc on an iron plate using electroplating.

Additional Topics Beyond the syllabus: In addition to the prescribed laboratory experiments, students must complete the following two activities during the semester, which include using virtual laboratory simulations to perform selected practicals and analyze the results. These activities are additional to the laboratory syllabus and will help students develop practical, analytical, and digital skills.

10	Virtual lab experiments beyond the syllabus		2Hrs
	a. Determination of organic carbon content in soil.		
	b. Determination of available nitrogen content in soil by the Kjeldahl Method.		2Hrs

Note:

1. Chemistry Laboratory Induction and Safety practices(CLISP): CLISP (Chemistry Laboratory Induction and Safety Programme) shall be conducted for every batch prior to the commencement of the experiment sessions.
2. Virtual Lab Experiments: The prescribed virtual laboratory experiments shall be performed by all students as part of the practical course under the guidance of the respective Subject Coordinator.

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SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)	
Reference Books:	
1. Vogels Text book of Qualitative Chemical Analysis by J. Mendham, R.C, Denny, J.D.Barnes, M.J.K.Thomas, 6 e, Pearson Education ltd. 2. Applied Chemistry Theory and Practice by O.P. Virmani and A.K.Narula, 2e, New age International (P) Ltd.	
Text Books:	
1. Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd. 2. Engineering Chemistry by O. G. Palanna, Tata Magraw Hill Education Pvt. Ltd. 3. Textbook of Engineering Chemistry by Dr. Sunita Rattan, S. K. Kataria& Sons Publisher.	
WEB LINKS AND VIDEO LECTURES (E-RESOURCES)	
1. https://chem.nju.edu.cn/ upload/article/files/b5/6f/01f0f2434d708df797208aea2613/83f2b441-65ee-44a6-ac47-ed21db462c5d.pdf. 2. https://edisciplinas.usp.br/pluginfile.php/5955761/mod_resource/content/1/CORROSION_ANDCORROSION_CONTROL_An_Intro%20%20Revie%20and%20Uhlig.pdf 3. MOOC / NPTEL/YouTube Links: https://nptel.ac.in/courses/113104082	

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BASIC ELECTRICAL ENGINEERING (BEE)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601ESC105	CIE	40 M
TEACHING HRS. / WK	02		
PRACTICAL HRS./WK	02	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
A fundamental understanding of mathematics, physics, and electrical, electronic, and electromagnetic technologies is required.			
COURSE OBJECTIVES			
1. COBJ1: To develop a systematic understanding of fundamental electrical and electromagnetic principles underlying DC/AC circuits, magnetic circuits and electrical machines 2. COBJ2: To develop the ability to analyse electrical circuits and evaluate the performance of electrical equipment through calculation, measurement and simulation. 3. COBJ3: To introduce elementary power systems, electrical faults, electrical data acquisition and AI applications in electrical engineering, highlighting their relevance to modern engineering practice.			
COURSE OUTCOMES			
After completion of this course, student will be able to: CO1: Apply fundamental principles of magnetic circuits and electromagnetic induction in electrical engineering applications and laboratory practice. CO2: Analyse single-phase AC series R-L-C circuits using appropriate electrical parameters and phasor relationships. CO3: Analyse balanced three-phase AC systems and single-phase transformer performance under different loading conditions. CO4: Apply Kirchhoff's Laws, Superposition Theorem and Thevenin's Theorem to solve DC electrical networks. CO5: Explain the working principles and applications of DC motors, elementary power systems, electrical faults, and AI applications in electrical engineering.			
COURSE CONTENTS			

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UNIT-I: ELECTROMAGNETISM:

(A) Magnetic Circuit: Concept of flux density, field strength, permeability, MMF, reluctance, their units, and relationships. Comparison of Electric and Magnetic Circuit. Simple series magnetic circuit. Force on current carrying conductor placed in magnetic field, Fleming's left-hand rule.

(B) Electromagnetic Induction: Faradays Laws of electromagnetic induction, Fleming's right-hand rule, statically and dynamically induced emf, self and mutual inductance, coefficient of coupling (Theory only)

UNIT-II: A.C. CIRCUITS -I:

(A) AC Fundamental:

Representation of Sinusoidal Waveforms, Concept of cycle, period, frequency, instantaneous, peak, average and RMS values, peak factor, and form factor. Phase, Phase difference, concept of lagging, leading and in phase quantities, phasor representation.

(B) Single Phase AC Series Circuits:

Performance analysis of AC circuits consisting of Pure R, L, C and RL, RC, RLC Series circuits. Concept of active, reactive, and apparent power, Impedance triangle and power triangle.

UNIT-III: A.C. CIRCUITS -II:

(A) Poly Phase Circuit:

Concept of three-phase AC symmetrical system, phase sequence, balanced and unbalanced load. Voltage, current and power relations in three phase balanced star and delta connected loads along with phasor diagrams.

(B) Single Phase Transformer:

Construction, working principle, EMF equation, transformation ratio, rating, types, losses, regulation and efficiency at different loading conditions.

UNIT-IV: D.C. CIRCUITS:

(A) D.C. Networks and circuit reduction techniques:

Types of Voltage and current sources, Classification of electrical networks, simplifications of networks using series-parallel combinations and star delta transformation technique.

(B) Kirchhoff's Laws and Theorems:

Kirchhoff's Laws, their applications for network solutions using loop analysis, Superposition theorem, Thevenin's Theorem.

UNIT-V: INTRODUCTION TO ELECTRICAL MACHINES, POWER SYSTEMS AND AI IN ELECTRICAL ENGINEERING:

(A) D.C. Motor:

Construction, working principle, types (Shunt and Series), voltage equation, characteristics and Applications.

(B) Introduction to Electrical Power Systems and Faults:

Overview of elementary power system showing stages such as Generation, Transmission, and Distribution of electrical energy. (Single Line Diagram and components only). Electrical Faults and Abnormal Conditions: Open Circuit, Short Circuit, Overload and Underload.

(C) Electrical Data Acquisition and AI Applications:

Introduction to sensors, smart meters and digital instruments for electrical measurements; basic visualization and interpretation of energy data; introduction to AI applications in energy consumption prediction, anomaly detection, smart energy monitoring

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SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)
Reference Books: 1. E. Hughes, Electrical and Electronics Technology, Pearson, 2010. 2. H. Cotton, “Electrical Technology”, 7th Edition, CBS Publications and distributors. 3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 4. E. Fitzgerald, Electric Machinery, TMH Publications. 5. M. G. Say, Alternating Current Machines, CBS Publishers. 6. Nagrath and Kothari, Electrical Machines, TMH Publications Text Books: 1. B. L. Theraja, Electrical Technology, Vol. – I & II, S. Chand & Co. 2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering,” Tata McGraw Hill, 4th Edition, 2019. Bhattacharya. 3. V. K. Mehta, “Basic Electrical Engineering”, S. Chand and Company Ltd., New Delhi. <i>Introduction to AI in Electrical Engineering *TBD</i>
WEB LINKS AND VIDEO LECTURES (E-RESOURCES)
Online Resources: Basic Electrical Technology, IIT Kharagpur, Prof. N.K. De, Prof. G.D. Roy, Prof. T.K. Bhattacharya https://nptel.ac.in/courses/108105053

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BASIC ELECTRICAL ENGINEERING LAB (BEEL)			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
Guidelines for Laboratory/ TW Assessment: 1. Continuous assessment of laboratory work is to be done based on overall performance and Laboratory performance of student. 2. Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage. 3. Suggested parameters for overall assessment as well as each Laboratory assignment include- timely completion, performance, efficiency, punctuality, and neatness. 4. Detailed Rubric of Evaluation will be applicable as per Exam Policy.			
LIST OF EXPERIMENTS / ASSIGNMENTS			
Part A – All 3 experiments are Compulsory 1. To study safety precautions while working on electrical systems, handling of various equipment's such as rheostat, multi-meter, ammeters, voltmeters, watt meters etc. 2. Study of wiring materials, switch board and different wiring schemes. (Simple wiring & staircase wiring). 3. Study of Batteries: Lead Acid and Lithium Battery. Part B – Any 1 Experiment out of 2 can be conducted 1. To measure steady state response of series RL and RC circuits experimentally. 2. Direct Loading test on single phase transformer. Part C – Any 2 Experiment out of 3 can be conducted 1. To verify Kirchhoff's laws experimentally. 2. To verify Superposition Theorem experimentally. 3. To verify Thevenin's Theorem experimentally. Part D – Simulation based Activity: Learning through virtual laboratory – Any 2 Activities out of 4 can be conducted 1. Virtual Lab 1: To verify KVL and KCL: https://bes-iitr.vlabs.ac.in/exp/kirchhoff-law/simulation.html 2. Virtual Lab 2: To get familiarize with the electrical devices : https://bes-iitr.vlabs.ac.in/exp/electrical-equipments/simulation.html 3. Virtual Lab 3: To study the efficiency of the single phase transformer : https://bes-iitr.vlabs.ac.in/exp/single-phase-transformer/simulation.html 4. Virtual Lab 4: Demonstration of cut section of D.C. Machine: https://bee-iitk.vlabs.ac.in/exp/cut-out-sections-machines/simulation.html			

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ENGINEERING DRAWING (ED)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601ESC107	CIE	40 M
TEACHING HRS. / WK	02		
PRACTICAL HRS./WK	02	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
• Knowledge of elementary geometry, geometric constructions, and basic mathematics. • Fundamental understanding of scales, measurements, and coordinate systems. • Basic spatial visualization and imagination skills for interpreting engineering objects			
COURSE OBJECTIVES			
1. To develop spatial visualization and imagination skills for interpreting engineering objects. 2. To develop proficiency in applying projection principles for graphical representation of engineering objects. 3. To develop skills in preparing engineering drawings using conventional and CAD-based methods.			
COURSE OUTCOMES			
Upon successful completion of the course, the learner will be able to: CO1 - Apply projection method to represent points and lines using the first-angle method of projection. CO2 – Apply projection method to draw projections of planes. CO3 - Construct standard engineering curves and lateral surface developments of common engineering solids CO4 - Apply orthographic projection principles to generate 2D and sectional views of engineering objects. CO5 - Apply visualization skills to draw isometric projections from given orthographic views.			
COURSE CONTENTS			
UNIT 1: FUNDAMENTALS OF ENGINEERING DRAWING AND PROJECTION OF LINES			
Introduction to Engineering Drawing, drawing instruments, drawing sheet layouts, types of lines, dimensioning. Theory of projection, projection of points, lines, lines inclined to both reference planes using the first-angle projection method.			
UNIT 2: PROJECTION OF PLANES			
Introduction to plane, types of planes, projection of planes, and projection of planes inclined to both reference planes - restricted to planes resting on the Horizontal Plane			

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UNIT 3: ENGINEERING CURVES AND DEVELOPMENT OF LATERAL SURFACES

ENGINEERING CURVES

Engineering Curves and Development of Lateral Surfaces

Engineering Curves

Construction of conic sections Ellipse, Parabola and Hyperbola using the directrix-focus and rectangle method (Ellipse and parabola), helix on a cylinder, cycloid, involute and Archimedean spiral.

Development of Lateral Surfaces

Introduction, development of the lateral surfaces of right circular cylinder, cone and solids such as prism and pyramid.

UNIT 4: ORTHOGRAPHIC PROJECTION

Introduction to orthographic projection, first-angle and third-angle methods of projection, obtaining orthographic projections of given solid by using first angle method of projection, sectional orthographic projections.

UNIT 5: ISOMETRIC PROJECTION

Introduction to isometric projection, isometric and natural scale, construction of isometric views from the given orthographic views.

Guidelines for Practical Evaluation: Students shall complete the prescribed sheets on A2-size drawing sheets. Students shall also demonstrate any two assigned problems using CAD software.

List of Sheets:

1. Solve and construct two problems on the projection of lines.
2. Construct two problems on the projection of planes.
3. Solve one problem on engineering curves and develop the lateral surfaces of a given standard solid.
4. Generate orthographic projections (2D views) for two given engineering components using first-angle projection.
5. Construct isometric views for two given objects from their corresponding orthographic views.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Madsen, D. P. and Madsen, D. A., (2016), "Engineering Drawing and design", Delmar Publishers Inc., USA
2. Bhatt, N. D., (2018), "Machine Drawing", Charotar Publishing House, Anand, India
3. Dhawan, R. K., (2000), "A Textbook of Engineering Drawing", S. Chand, New Delhi
4. Luzadder, W. J. and Duff, J. M., (1992), "The Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics for Design and Production", Peachpit Press, USA

Text Books:

1. Bhatt, N. D. and Panchal, V. M., (2016), "Engineering Drawing", Charotar Publication, Anand, India
2. K. Venugopal, K, (2015), "Engineering and Graphics", New Age International, New Delhi
3. Jolhe, D. A., (2015), "Engineering Drawing with introduction to AutoCAD", Tata McGraw

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Hill, New Delhi 4. Rathnam, K., (2018), “A First Course in Engineering Drawing”, Springer Nature Singapore Pte. Ltd., Singapore
WEB LINKS AND VIDEO LECTURES (E-RESOURCES)
MOOC / NPTEL/YouTube Links: NPTEL Course: Engineering Graphics and Design https://onlinecourses.nptel.ac.in/noc21_me128/preview NPTEL Course: Introduction and Geometric Construction https://archive.nptel.ac.in/content/storage2/courses/112103019/module1/lec3/1.html NPTEL Course: Computer Aided Design and Manufacturing” https://archive.nptel.ac.in/courses/112/102/112102101/

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PROBLEM SOLVING USING PYTHON (PSP)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601PCC114	CIE	40 M
TEACHING HRS. / WK	02		
Practical Hrs./WK	02	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Basics of Computers and Basic Mathematics Fundamentals of Programming Languages			
COURSE OBJECTIVES			
CO1: To introduce problem-solving concepts and the basics of Python programming. CO2: To understand Python data types, decision-making, and looping statements. CO3: To learn functions and string operations for developing Python programs. CO4: To understand file handling and the use of Python built-in libraries. CO5: To learn the fundamentals of object-oriented programming using Python.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Understand problem-solving techniques and write basic Python programs. CO2: Use Python data types, decision-making, and looping statements to solve problems. CO3: Develop Python programs using functions and string operations. CO4: Perform file handling operations and use Python libraries in programs. CO5: Develop simple object-oriented programs using classes and objects in Python.			
COURSE CONTENTS			
UNIT 1: PROBLEM SOLVING, PROGRAMMING AND PYTHON PROGRAMMING: General Problem Solving Concepts- Problem solving in everyday life, Types of problems, problem solving with computers, problem Solving steps. Basics of Python Programming: Features of Python, History and Future of Python, Applications of Pythons, Writing and executing Python program, Literal constants, variables and identifiers, I/O operation, Comments, Reserved words, Indentation, good programming practices.			
UNIT 2: ADVANCED DATA TYPES AND FLOW CONTROL Advanced Data Types in Python: List, Tuple, Set, Dictionary. Flow Control and Loops: Decision Making: if statement, if...else statement, if..elif ..else statement, Nested if statement; Loops : while loop , for loop, range() function, continue and break statement, while and for loop with else statement, pass statement			
UNIT 3: FUNCTIONS AND STRINGS Need for functions, Function: definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string.			

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Strings and Operations: concatenation, appending, multiplication and slicing. Strings are immutable, string formatting operators, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings.

UNIT 4: FILE HANDLING AND PYTHON LIBRARIES

Introduction, File path, Types of files, Modes of file, Attributes of file object, Opening and Closing files, Reading and Writing files.

Basics of Python Built-in Libraries: Introduction to modules, import, from import, as keyword, math Library, random Library, datetime Library, numpy and pandas.

UNIT 5: OBJECT ORIENTED PROGRAMMING

Features of Object oriented programming-classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and encapsulation. class method and self-argument, __init__() method, __del__() method, Built in function to check, Get, Set and Delete class attribute, Garbage collection.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978 0132492645
2. Romano Fabrizio, "Learning Python", Packt Publishing Limited, ISBN: 9781783551712, 1783551712
3. Paul Barry, "Head First Python- A Brain Friendly Guide", SPD O'Reilly, 2nd Edition, ISBN:978-93-5213-482-3
4. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, ISBN 10:9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
5. Jeeva Jose, P. Sojan Lal, "Introduction to Computing & Problem Solving with Python", Khanna Computer Book
6. Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978 9382609810

Text Books: 1. Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, ISBN 13: 978-0-19-948017-6

2. R. Nageswara Rao, "Core Python Programming", Dreamtech Press; Second edition ISBN10:938605230X,

ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

Youtube/NPTEL Links

<https://www.youtube.com/watch?v=keYxU7Ou754&list=PLIt9A5yCuugkrHMpgndt59e0PPUqjyQ6&index=6->

<https://youtu.be/tA42nHmMEK>

[w?eN](#)

<https://nptel.ac.in/courses/106104074> <https://nptel.ac.in/courses/106106182>

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PROBLEM SOLVING USING PYTHON LAB			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Basic knowledge of computer fundamentals and operating systems.			
COURSE OBJECTIVES			
CO1: To introduce problem-solving concepts and the basics of Python programming. CO2: To understand Python data types, decision-making, and looping statements. CO3: To learn functions and string operations for developing Python programs. CO4: To understand file handling and the use of Python built-in libraries. CO5: To learn the fundamentals of object-oriented programming using Python.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Understand problem-solving techniques and write basic Python programs. CO2: Use Python data types, decision-making, and looping statements to solve problems. CO3: Develop Python programs using functions and string operations. CO4: Implement file handling operations and Python libraries in programs. CO5: Apply Object-oriented programs using classes and objects in Python.			
LIST OF ASSIGNMENTS			
List of Laboratory Experiments (Perform any eight programs) 1. To calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions. 2. Program to demonstrate operation on lists. 3. Program to find whether the given number is even or odd. 4. Program to print the multiplication table of n, where n value is entered by user. 5. Program to find whether the given number is an Armstrong number or not. 6. Program to demonstrate string operations. 7. Program to perform all operation (addition, multiplication, subtraction, division) by using user defined function 8. Program to calculate factorial of number using user defined function. 9. Perform Python program that reads a text file and calculates the total number of characters, words, lines, and the frequency of a user-specified word. 10. Program to access class variable using class object. 11. Program to generate and display the Fibonacci series			

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SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629
2. Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978 0132492645
3. Romano Fabrizio, "Learning Python", Packt Publishing Limited, ISBN: 9781783551712, 1783551712
4. Paul Barry, "Head First Python- A Brain Friendly Guide", SPD O'Reilly, 2nd Edition, ISBN:978-93-5213-482-3
5. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, ISBN 10:9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
6. Jeeva Jose, P. Sojan Lal, "Introduction to Computing & Problem Solving with Python", Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978 9382609810

Text Books:

1. Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, ISBN 13: 978-0-19-948017-6
2. R. Nageswara Rao, "Core Python Programming", Dreamtech Press; Second edition ISBN10:938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

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PROFESSIONAL COMMUNICATION SKILLS			
Course Type: Ability Enhancement Course			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601AEC109	TW	25 M
TEACHING HRS. / WK	02		
CREDITS	02		
PREREQUISITES			
English - Basic knowledge of Listening, Speaking, Reading, and Writing (LSRW) skills, and readiness to participate in classroom discussions, presentations, teamwork, and other interactive activities.			
COURSE OBJECTIVES			
1. To introduce the basic concepts of self-confidence, effective communication, active listening, and presentation skills. 2. To explain the importance of time management, teamwork, leadership, interpersonal skills, and professional communication. 3. To apply career readiness and stress management strategies for effective career planning, employability, and personal well-being.			
COURSE OUTCOMES			
On successful completion of the course, students will be able to 1. Define the concepts of self-confidence, effective communication, active listening, and presentation skills. 2. Explain the importance of time management, teamwork, leadership, interpersonal, and professional communication skills. 3. Apply career readiness and stress management strategies to improve employability, career planning, and personal well-being.			
COURSE CONTENTS			
UNIT 1: FOUNDATIONS OF PERSONAL AND COMMUNICATION SKILLS: Introduction: Soft skills Introduction, what are soft skills, Need for soft skills Module 1: Self-Awareness and Personal Development: Strengths and weaknesses, goal setting, growth mindset, confidence building. Module 2: Communication Skills: Basics of communication, verbal and non-verbal communication, active listening, questioning skills, barriers to communication, effective speaking, professional vocabulary. Lab Activity 1: Self-Assessment and personal development through SWOT Analysis Lab Activity 2: Practice of effective communication and active listening skills, Role-Play activities.			
UNIT 2: EFFECTIVE TIME MANAGEMENT AND PROBLEM SOLVING Module 3: Presentation and Public Speaking: Presentation structure, introduction and conclusion,			

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body language, voice modulation, overcoming stage fear, use of visual aids, technical presentation

Module 4: Time Management Importance of Time Management, Ways to manage time in work, Time Management for the Multi tasker Time management and Problem solving.

Lab Activity 3: Preparation and delivery of an effective technical presentation.

Lab Activity 4: Time management and priority planning activity.

UNIT 3: PROFESSIONAL DEVELOPMENT AND EMOTIONAL WELL-BEING

Module 5: Teamwork and Interpersonal Skills Team building, collaboration, empathy, respect, conflict management, leadership basics, Functions and responsibilities of leadership, peer interaction, group activities.

Module 6: Professional and Workplace Communication

Professional etiquette, email etiquette, telephone etiquette, time management, work ethics, workplace behaviours, problem-solving and decision-making.

Lab Activity 5: Team building and leadership skills through group activities.

Lab Activity 6: Practice of professional communication and workplace etiquettes.

UNIT 4: PERSONAL BRANDING AND EMPLOYABILITY

Module 7: Career Readiness and Employability Skills

Resume preparation, Linked In profile basics, interview skills, group discussion, aptitude awareness, personal branding, internship and career planning.

Lab Activity 7: Practice of professional communication and workplace etiquettes.

Lab Activity 8: Career readiness through resume, group discussion and mock interview.

UNIT 5: PERSONAL WELL-BEING AND STRESS MANAGEMENT

Module 8: Stress Management & Emotional Well being

Introduction to stress, causes and types of stress, recognizing signs of stress, acknowledging and accepting stress, common student stressors, stress management techniques, relaxation and breathing exercises, time management, maintaining work-life balance, developing healthy habits.

Activity 9: Identification and management of stress for personal well-being.

Activity 10: Campus to Career Communication Challenge

Activity 11: Professional Development Portfolio and Action Plan

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Developing Communication Skills by Krishna Mohan & Meera Banerji (Macmillan)
2. Business Correspondence and Report Writing, R. C. Sharma & Krishna Mohan (Tata McGraw Hill)
3. Sasikumar et al. A Course in Listening and Speaking. New Delhi: Foundation Books, 2005.
4. Tony Lynch, Study Listening. Cambridge: Cambridge UP, 2004.

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Text Books:

1. Communication Skills for Engineers by S. Mishra & C. Muralikrishna (Pearson)
2. Communication Skills for Technical Students by T.M. Farhatullah (Orient Longman)
3. Written Communication in English by Saran Freeman (Orient Longman)
4. Essential English Grammar (Elementary & Intermediate) Raymond Murphy (CUP)
5. Communication for Business: A Practical Approach by Shirley Tailor (Longman)
6. Psychology of Adjustment and Stress(F.Y.B.A, Sem.-I) SPPU-Text(English), Dr. Ganesh Lokhande,
Dr. Laxman Shitole(India).

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

NPTEL course:

1. Prof. Binod Mishra, IIT Roorkee, Soft Skill, nptel.ac.in/courses/109107121
2. Prof. T. Ravichandran, IIT Kanpur, Developing Soft Skills and Personality,
nptel.ac.in/courses/109104107

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INDIAN KNOWLEDGE SYSTEM (IKS)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601 IKS 115	TW	25 M
TEACHING HRS. /WK	02		
CREDITS	02		
PREREQUISITES			
Basic awareness of Indian history and culture and willingness to participate in classroom discussions, presentations and interactive learning activities.			
COURSE OBJECTIVES			
1. To introduce students to the foundational concepts of Indian knowledge systems and their significance. 2. To familiarize students with key dates in Indian history and the historical timeline. 3. To explore significant scientific achievements in ancient India and analyze scientific texts and inventions. 4. To examine the role of engineering in ancient India and its contributions to metallurgy, materials science, and architectural techniques. 5. To provide an overview of Indian philosophical systems and their relevance.			
COURSE OUTCOMES			
On completion of this course, learners will be able to- 1. CO 1 - Understand the significance and historical context of Indian knowledge systems. 2. CO 2 - Comprehend Indian philosophical concepts, scientific achievements, and their interplay. 3. CO 3 - Analyze and compile the Scientific achievements, texts and inventions; mathematics and astronomy. 4. CO 4 - Recognize the role of engineering in ancient India and its impact on architecture and materials. 5. CO 5- Apply ancient Indian engineering principles in modern practices while considering cultural and environmental aspects. .			
COURSE CONTENTS			

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UNIT 1: FOUNDATIONS OF INDIAN KNOWLEDGE SYSTEM AND HISTORICAL CONTEXT

Key dates and historical timeline

- Historical context and development of Indian knowledge traditions
- Vedic Period
- Vedas and their significance

UNIT 2: INDIAN PHILOSOPHICAL SYSTEMS

Overview of Indian philosophical systems and their relevance

- Relationship between philosophical thought, knowledge, values and life
- Six Schools of Indian Philosophy
- Gurukul System in Ancient India

UNIT 3: SCIENTIFIC ACHIEVEMENTS IN ANCIENT INDIA

Significant scientific achievements

- Scientific texts and inventions
- Development of scientific thought
- Contributions to Mathematics and Astronomy

UNIT 4: .ENGINEERING IN ANCIENT INDIA

Role of engineering in Ancient India

- Contributions to metallurgy and materials science
- Engineering practices and technological knowledge
- Medicines in Ancient India

UNIT 5: A. ARCHITECTURE, MATERIALS AND MODERN RELEVANCE

Architectural techniques

- Impact of ancient engineering on architecture and materials
- Application of ancient Indian engineering principles in modern practices
- Cultural and environmental aspects

B. GLOBAL INFLUENCE, REVIEW AND CONCLUSION

Global influence of Indian knowledge traditions

- Review of major concepts and contributions
- Contemporary relevance and applications
- Conclusion and overall learning synthesis

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LIST OF ACTIVITIES

Sr.	Unit	Activity	Brief Description
1	Unit 1	Timeline & IKS Concept Map	Prepare a visual timeline and concept map of major IKS periods, developments and domains.
2	Unit 2	Six Schools – Group Discussion	Groups present key ideas of the six schools of Indian philosophy and their relevance to life.
3	Unit 3	Ancient India Science Gallery	Posters/models on mathematics, astronomy, scientific texts and inventions.
4	Unit 4	Heritage Engineering Case Study	Case study on metallurgy, materials, engineering practices or medicines in ancient India.
5	Unit 5	Traditional Knowledge to Modern Solution	Propose a culturally and environmentally responsible modern application of an ancient practice.
6	Units 1–5	IKS Quiz & Reflection	Interactive quiz followed by reflection on links among history, science, engineering and values.

A. STUDENT-CENTRIC ACADEMIC ACTIVITIES

B. GUEST LECTURE / EXPERT INTERACTION PLAN

Sr. No.	Proposed Guest Lecture	Suggested Resource Person
1	IKS and Indian Knowledge Tradition	IKS scholar / faculty expert
2	Scientific & Mathematical Heritage of Ancient India	Historian of science / mathematics / astronomy expert
3	Ancient Indian Engineering, Metallurgy & Architecture	Civil / materials / heritage engineering expert
4	Traditional Knowledge & Sustainable Modern Practices	Sustainability / heritage practitioner

C. CO-ALIGNED ACTIVITY SUMMARY

CO	CO Focus	Mapped Activities / Lectures	Suggested Evidence
CO1	Historical context and significance of IKS	Timeline, concept map, quiz/reflection	Understanding + communication
CO2	Philosophical concepts and interplay with knowledge/values	Six Schools discussion + guest interaction	Discussion + presentation
CO3	Scientific achievements,	Science Gallery + expert	Analysis + compilation

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	texts, mathematics and astronomy	lecture + quiz	
CO4	Engineering, architecture and materials	Heritage case study + expert lecture	Case-study analysis
CO5	Application of ancient principles in modern practice	Modern solution project + sustainability lecture	Application + problem solving

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS/ E-RESOURCES)

Reference Books

1. **Mahadevan, B., Bhat, V. R. & Nagendra Pavana, R. N.** *Introduction to Indian Knowledge System: Concepts and Applications*. PHI Learning Pvt. Ltd., 2022.
2. **Kapil Kapoor.** *Indian Knowledge Traditions: An Introduction*.
— Useful for understanding Indian intellectual traditions, philosophy, language and knowledge frameworks.
3. **Kim Plofker.** *Mathematics in India: 5000 Years of History*. Princeton University Press.
— Particularly useful for the **ancient Indian mathematics and astronomy** component.
4. **George Gheverghese Joseph.** *The Crest of the Peacock: Non-European Roots of Mathematics*. Princeton University Press.
— Useful for studying India's contributions to mathematics in a broader historical context.
5. **D. P. Chattopadhyaya (Ed.).** *History of Science, Philosophy and Culture in Indian Civilization*. Centre for Studies in Civilizations.

Textbooks

1. **Indian Knowledge Systems (IKS) Division, Ministry of Education, Government of India** – Official IKS resources, initiatives, lectures, publications and educational material.
2. **AICTE Indian Knowledge Systems resources** – Curriculum-related material, webinars, lectures and resources for higher-education learners.
3. **SWAYAM / SWAYAM Plus** – Online courses and learning material related to Indian heritage, philosophy, science, culture and traditional knowledge.
4. **IGNCA – Indira Gandhi National Centre for the Arts** – Digital resources on Indian cultural heritage, traditional knowledge, arts, literature and civilisation.
5. **Digital Library of India / Internet Archive – selected authentic historical texts** – Useful for accessing digitized classical and historical sources for student assignments and case studies.

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INTEGRATED PERSONALITY DEVELOPMENT			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601CC116	TW	25 M
TEACHING HRS. / WK	02		
CREDITS	02		
		TOTAL	25 M
PREREQUISITES			
Basic Communication skill, Self Awareness, Growth Mindset and willingness to participate in classroom discussions and other interactive activities.			
COURSE OBJECTIVES			
1. To understand the importance of soft skills and their role in personal, academic, and professional success. 2. To impart self-awareness, emotional intelligence, and self-confidence to manage emotions effectively and build positive relationships. 3. To cultivate a positive attitude and growth mindset by embracing continuous learning, resilience, and adaptability.			
COURSE OUTCOMES			
On the successful completion of the course, students will be able to CO1: Understand the role of self-awareness, positive attitude, growth mindset, resilience, and adaptability in everyday life. CO2: Impart knowledge of decision-making, adaptability, and personal, social, and professional etiquette. CO3: Apply the key elements of personal growth such as goal setting, self-discipline, financial Awareness, and holistic development. CO4: Demonstrate effective verbal, non-verbal and written communication skills by applying active listening ,questioning, clarity, confidence, presentation and public-speaking techniques in academic and professional situation. CO5: Develop a personal career and professional development plan incorporating SMART goals, Employability skills, ethical responsibility, problem-solving, teamwork, and continuous improvement.			
COURSE CONTENTS			

UNIT 1:SELF-AWARENESS AND POSITIVE MINDSET

Module 1: Self-Awareness: Self-awareness, knowing yourself, identifying strength and areas of improvement, self-confidence, understanding and managing emotions, empathy, Managing Situational Reactions.

Module 2: Positive Attitude and Growth Mindset: Positive thinking and growth mindset, Reflecting on Experiences, Resilience, Adapting to change, continuous learning.

UNIT 2: LIFE SKILLS AND PERSONAL DEVELOPMENT

Module 3: Decision Making and Problem Solving: Understanding problems, logical and creative thinking, decision making steps, finding solutions, understanding the effects of decisions, handling difficult situations, basic critical thinking.

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Module 4: Personal Development through Adaptability: Open-minded Thinking, adapting to new situations, handling uncertainty, Learning from different experiences.

Module 5: Professional, Personal and Social Etiquettes: Personal grooming, professional appearance, body language, good manners, workplace behaviors, respect for others, cultural understanding, responsible professional behavior.

UNIT 3: DIGITAL FOOTPRINT, RESPONSIBLE CITIZENSHIP AND HOLISTIC DEVELOPMENT

Module 6: Digital existence and Responsible citizenship: Positive digital identity, responsible use of social media, online behavior, digital footprint, privacy and basic cybersecurity, Digital citizenship.

Module 7: Personal Growth and Life Skills: Setting Personal goals, good habits, self-discipline, work life balance, basic financial awareness and budgeting, daily decision making, personal development plan, Holistic development.

UNIT 4: COMMUNICATION, COLLABORATION AND INTERPERSONAL SKILLS

Module 8: Effective Communication Skills: Basics of effective communication , verbal and non-verbal communication ,active listening and asking effective questions , speaking with clarity and confidence , developing presentation and public-speaking skills , overcoming hesitation and communication barriers .

Module 9: Teamwork and Interpersonal Relationships: Understanding teamwork and collaboration, Building trust and positive relationships, conflict management and resolution, giving and receiving constructive feedback, leadership and team participation, developing cooperation and mutual support.

UNIT 5: CAREER READINESS AND PROFESSIONAL EXCELLENCE

Module 10: Career Awareness and Goal Setting: Understanding career opportunities in engineering, identifying personal interests, Setting SMART academic and career goals, creating a personal development plan, developing employability skills.

Module 11: Professional readiness and workplace skills: Interview preparation and interview etiquette, Group discussions and teamwork, Workplace communication and professionalism, time management and meeting deadlines, Workplace ethics and responsibility, developing a problem-solving and solution-oriented approach.

Sr.No.	Name Of Activity
1.	My Strengths & Improvement Areas – Prepare a personal SWOT analysis.
2.	Self-Confidence Activity – “Three Things I Am Good At” sharing exercise.
3	Situational Reaction Activity – Discuss and role-play appropriate responses to challenging situations.
4.	Positive Thinking Challenge – Convert negative statements into positive and constructive ones.

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5.	Resilience Case Study – Analyse stories of people who overcame difficulties.
6.	Decision-Making Tree – Create a decision tree for a real-life problem.
7.	Change Management Activity – Discuss how students react when plans suddenly change.
8.	Open-Mindedness Debate – Discuss a topic from two different perspectives.
9.	Workplace Etiquette Role Play – Practise punctuality, teamwork, meetings, phone etiquette, and workplace behaviour.
10.	Social Media Do's and Don'ts – Create a responsible social-media-use poster.
11.	Digital Identity Activity – Design a positive and professional online identity.
12.	Work-Life Balance Wheel – Assess time spent on study/work, health, family, hobbies, and rest.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Covey, Stephen R. The 8th Habit: From Effectiveness to Greatness. Free Press.
2. Maxwell, John C. Developing the Leader Within You 2.0. HarperCollins Leadership.
3. Cottrell, Stella. Critical Thinking Skills: Effective Analysis, Argument and Reflection. Palgrave Macmillan.
4. de Bono, Edward. Lateral Thinking: Creativity Step by Step. Harper Perennial.
5. Goleman, Daniel. Working with Emotional Intelligence. Bantam Books.
6. Clear, James. Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones. Avery.

Text Books:

1. Goleman, Daniel. Emotional Intelligence: Why It Can Matter More Than IQ. Bantam Books.
2. Carnegie, Dale. How to Win Friends and Influence People. Simon & Schuster.
3. Covey, Stephen R. The 7 Habits of Highly Effective People. Simon & Schuster.
4. Dweck, Carol S. Mindset: The New Psychology of Success. Ballantine Books.
5. Sharma, Meenakshi Raman & Sangeeta Sharma. Technical Communication: Principles and Practice. Oxford University Press.

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HOLISTIC HEALTH, VALUES & WELLNESS			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601CC110	CIE	25 M
TEACHING HRS. / WK	02	TW	25 M
		TOTAL	50 M
CREDITS	02		
PRE_REQUISITE			
No prerequisite required.			
COURSE OBJECTIVES			
1. To develop awareness of physical and mental health. 2. To promote physical fitness, sportsmanship and teamwork. 3. To develop human values, ethics and responsibility. 4. To promote holistic wellness and balanced living. 5. To develop digital literacy, safety and responsible technology use.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: 1. Apply healthy practices for physical and mental well-being. 2. Demonstrate physical fitness, teamwork and sportsmanship. 3. Apply human values and ethical behaviour in daily life. 4. Practice wellness strategies for a balanced lifestyle. 5. Use digital technologies safely, responsibly and ethically.			
COURSE CONTENTS			
UNIT 1: HEALTH – UNDERSTANDING PHYSICAL AND MENTAL WELL-BEING			
Concept and importance of health, Physical, mental, emotional and social health, Healthy lifestyle and daily habits, Balanced diet and nutrition, Sleep, hygiene and personal care, Stress and basic stress-management techniques. Activity: Personal Health Assessment – Prepare a daily health checklist covering food, water, sleep, exercise and personal hygiene.			
UNIT 2: SPORTS – PHYSICAL FITNESS, TEAMWORK AND SPORTSMANSHIP			
Importance of sports and physical activities, Basic components of physical fitness, Indoor and outdoor games, Exercise, yoga and recreational activities, Teamwork, discipline and leadership, Sportsmanship.			

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Activity: Sportsmanship Chart: Prepare a chart showing the qualities of a good sportsperson.

Or

Team Game Activity: Conduct a group game and assess teamwork and leadership.

UNIT 3: VALUES – DEVELOPING ETHICAL AND RESPONSIBLE BEHAVIOR

Meaning and importance of human values, Honesty, integrity, respect and responsibility, Self-discipline, social responsibility, Professional ethics and values for engineers.

Activity: Ethical Case Study – Discuss a real-life or engineering-related ethical situation and suggest a responsible solution.

UNIT 4: WELLNESS – BUILDING A BALANCED AND HEALTHY LIFESTYLE

Concept of wellness, Physical, mental, emotional and social wellness, Time management and work-life balance, Mindfulness, relaxation and positive thinking, Self-awareness and personal development, Healthy habits and personal wellness planning.

Activity: Wellness Plan – Prepare a one-week personal wellness plan including exercise, sleep, study, relaxation and social activities.

UNIT 5: DIGITAL LITERACY – SAFE, SMART AND RESPONSIBLE USE OF TECHNOLOGY

Meaning and importance of digital literacy, Effective use of digital tools and online resources, Identifying reliable information and misinformation, Cyber safety, privacy, passwords and online scams, Healthy screen-time habits, Responsible use of social media and AI tools

Activity: Digital Safety Awareness Chart – Prepare a chart highlighting common fake information, phishing messages, online scams, unsafe digital practices, and preventive measures.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference book

1. Gordon Edlin and Eric Golanty, *Health & Wellness*, Jones & Bartlett Learning.
2. Dr. Kulbir Singh, *Health and Wellness*, Friends Publications (India).
3. *Introduction to Health (OER)*, Texas Wesleyan University.
4. *Fundamentals of Nursing*, OpenStax – Health and Wellness.
5. World Health Organization (WHO) – Health and Well-Being resources.

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DESIGN THINKING IDEATION LAB			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601VSL112	TW	25 M
PRACTICAL HRS. /WK	02		
		TOTAL	25 M
CREDITS	02		
COURSE OBJECTIVES			
1. Understand the core principles of design thinking and its role in engineering. 2. Analyze and solve complex problems. 3. Develop creative solutions to problem. 4. Evaluate and analysis design concepts and prototypes. 5. Demonstrate effective communication and collaboration in multidisciplinary teams.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1 Identify and define problems from a user's perspective. CO2 Apply empathy and observation to gain insights into user needs and behaviors CO3 Generate innovative ideas and solutions through brainstorming and ideation. CO4 Analyze and test design solutions to refine and improve them. CO5 Present and communicate design ideas effectively using visual aids and storytelling			
COURSE CONTENTS			
UNIT 1: INTRODUCTION TO DESIGN THINKING • Introduction to design thinking and its importance • User observation Assignment 1: Problem identification UNIT 2: IDEA GENERATION • Techniques for idea generation • Selection of the most appropriate solution Assignment 2: Idea generation and selection UNIT 3: PROTOTYPING • Introduction to prototypes and their importance • Creating prototypes to validate design concepts Assignment 3: Prototyping UNIT 4: ANALYSIS AND EVALUATION • Assessment of prototype as per user requirement • Incorporate user feedback and modifications Assignment 4: Methodology UNIT 5: PRESENTATION • Team presentation and role distribution			

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- Visual communication and storytelling
- Assignment 5: Presentation

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Design Thinking: Understanding How Designers Think and Work by Nigel Cross
2. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by Tim Brown
3. Design Thinking for Visual Communication" by Ranjan Nayar and Jaidip Subedi
4. The Design of Everyday Things" by Don Norman "Design Thinking: Creativity and Innovation" by S. Balaram
5. Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days" by Jake Knapp
6. Creative Confidence: Unleashing the Creative Potential Within Us All" by Tom Kelley and David Kelley (with a foreword by Ratan Tata).

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MANUFACTURING PRACTICE WORKSHOP			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Basic knowledge of engineering materials and tools Practical exposure to the manufacturing process, including the use of hand and power tools. Familiar with safety norms and the use of personal protective equipment (PPE) in a workshop setting.			
COURSE OBJECTIVES			
1.To understand the construction and working of machine tools and functions of its parts. 2.To develop the skill through hands-on practices using hand tools, power tools, electrical / electronic parts, programming tools, machine tools in manufacturing and assembly shops leading to understanding of a production process. 3. To understand workshop layout and safety norms.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Explain safety norms and factory layout of workshop. CO2: Produce a job using appropriate hand tools, cutting tools, machine tools, electronics and electrical parts. Develop a program of CNC machine. CO3: Demonstrate construction, working and functions of machine tools and their parts.			
Student must perform any six jobs/experiment out of eight.			
Experiment / Job			

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- 1. Safety considerations in workshop:** Safety rules and guidelines, Metal working shop safety precautions, Safety devices used in workshop, potentials hazard present in workshop.
- 2. Layout of Workshop/Factory:** Different sections of workshop, importance of respective locations of sections with respect to each other, area of different sections, plot of layout.
- 3. To develop a mechanical component by fitting, welding, drilling, riveting operations:** Measuring tools used in workshop, cutting tools used in workshop, finishing tools used in workshop, methods of filing, drilling operation, riveting operation, types of welding, part drawing.

OR

- To identify the peripherals of a computer, components in a CPU and its functions**
: Computer Assembly - Motherboard , Processor, RAM, SMPS, SSD/HDD, Cooling fan, Cabinet
- 4. Introduction to Advance machine tools (CNC, VMC):** Construction features of CNC, advantages and limitations, elements of CNC, principles of CNC.
 - 5. Introduction to 3D Printing:** Construction features of 3D printing, advantages and limitations, elements of 3D printing, principles of 3D printing.
 - 6. To write program on CNC to develop any mechanical component:** Process planning, tool selection, cutting process parameters planning, job and tool set up planning, machining path planning, part program writing, part program proving, ISO standards for coding, coordinate function, feed function, speed function, tool function, comments, preparatory functions (G codes), Miscellaneous functions (M codes)
 - 7. Basic Electrical wiring / Electronic soldering and disordering :** Execute staircase wiring (two-way switch), series/parallel lamp circuits, and a basic plug socket connection on a wooden board.

OR

Assemble a simple through-hole circuit (e.g., LED indicator with resistor, or a basic 555 timer blinker) on a perf board. Practice safe soldering and desoldering techniques.

- 8. Robotics and IoT :** Arduino Based Sensor Interface, LED, Push button, Temperature sensor, Ultrasonic sensor, Simple programming.

Learning Resources:

Reference Books:

1. John, K. C., (2024), "Mechanical Workshop Practice, Prentice Hall Publication, New Delhi.
2. Hazra and Chaudhary, Workshop Technology-I & II, Media promoters & Publisher Pvt. Ltd.

Text Books:

Workshop/Manufacturing practices (with lab manual), Khanna Publishing House, 2023

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GROUP-II (MECHANICAL & CIVIL ENGINEERING)

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Group-II (Mechanical & Civil Engineering)

CALCULUS & LINEAR ALGEBRA (CLA)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601BSC101	CIE	40 M
TEACHING HRS. / WK	03		
TUTORIAL HRS./WK	01	ESE	60 M
CREDITS	04	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Limits, continuity and differentiation, Maxima minima of functions of one variable, Matrix Algebra			
COURSE OBJECTIVES			
To develop fundamental knowledge and problem-solving skills in differential calculus, multivariable calculus, and linear algebra, and to apply these mathematical concepts and techniques to solve engineering and real-world problems			
COURSE OUTCOMES			
After successful completion of the course, students will be able to			
CO1: Determine the rank of a matrix and solve systems of linear equations to model electric network and traffic flow problems.			
CO2: Compute eigenvalues and eigenvectors of a matrix and apply the Cayley-Hamilton theorem to diagonalize matrices for machine learning applications.			
CO3: Analyze the behavior of functions using mean value theorems and series expansions to estimate errors in function approximations.			
CO4: Apply partial differentiation techniques, including Euler's theorem and the chain rule, to solve problems involving composite and homogeneous functions.			
CO5: Apply Jacobians and Lagrange's method of undetermined multipliers to solve problems involving coordinate transformations and optimization of multivariable functions.			
COURSE CONTENTS			
UNIT-I: MATRICES AND SYSTEM OF LINEAR EQUATIONS:		(10 Hrs)	
Rank of a Matrix, Echelon Form of Matrix, Consistency of System of Linear Equations and its Applications in Electric Networks and Traffic Flow problems, Linear dependence and independence of vectors, Orthogonal Matrix.			
UNIT-II: EIGENVALUES, EIGENVECTORS AND DIAGONALIZATION:			
Characteristic equations, Cayley Hamilton theorem (Without proof) and its applications, Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Application of Eigen values and eigen vectors in Machine learning.			

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UNIT-III: DIFFERENTIAL CALCULUS:

Indeterminate Forms, Rolle's Theorem, Cauchy Mean Value Theorem (Without proof), Lagrange's Mean value theorem (Without proof), Taylor's Series and Maclaurin's Series, Expansion of functions using standard expansions, Error estimation using Taylor series.

UNIT-IV: PARTIAL DIFFERENTIATION

Introduction to functions of several variables, Partial Derivatives, Euler's Theorem on Homogeneous functions, Partial derivatives of Composite Function and Total Derivative using Chain Rule.

UNIT V: APPLICATIONS OF PARTIAL DIFFERENTIATION:

Jacobian and its properties, Partial derivatives of implicit function and functional dependence using Jacobian, Applications of Jacobian in transformation of coordinates, Error and Approximations, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

LIST OF TUTORIAL ASSIGNMENTS

1. Activity-I (Pre-requisite revision)
2. Matrices and System of Linear Equations
3. Eigen Values, Eigen Vectors and Diagonalization
4. Differential Calculus
5. Partial Differentiation
6. Applications of Partial Differentiation
7. Activity -II (Self learning): Case study / Solving problems using software NumPy / SciPY / Scilab / R Programming / MATLAB

Tutorial for the subject will be conducted in the batches with activity-based learning. Tutorials must be written in the Tutorial book for uniform representation among students. Term work consists of tutorials and activities.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th Edition.
3. Applications to Linear Algebra by Gilbert Strang, 4th Edition, Brooks/Cole Thomson Learning
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson).
5. Applied Mathematics (Vol. I & Vol. II) by P. N. Wartikar and J. N. Wartikar, Vidyarthi Griha Prakashan, Pune.

Text Books:

1. H. K. Das, "Advanced Engineering Mathematics", S Chand Publication
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, New Delhi.
3. D. C. Lay, S. R. Lay, J. J. McDonald, "Linear Algebra and Its Applications", Pearson

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WEB LINKS AND VIDEO LECTURES (E-RESOURCES)
Online Resources: 1. NPTEL Course on “Engineering Mathematics-I” https://nptel.ac.in/courses/111105121/ 2. NPTEL Course on “Basic Calculus-1” https://nptel.ac.in/courses/111/106/111106146/ 3. NPTEL Course on “Basic Linear Algebra” https://nptel.ac.in/courses/111/101/111101115/
ACTIVITY BASED LEARNING (SUGGESTED ACTIVITIES IN CLASS)
Activity Based Learning: 1. Collaborative and Individual Problem based learning 2. Think Pair Share 3. Surprise Test, Open Book Test 4. Quiz 5. Seminar / Presentation 6. Use of ICT

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APPLIED PHYSICS (AP)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601BSC117	CIE	40 M
TEACHING HRS. / WK	02		
TUTORIAL HRS./WK	01	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
A fundamental understanding of mathematics, physics, and electrical, electronic and electromagnetic technologies is required. Introduction to astrophysics and aerospace. Basic knowledge of nanoscience and basic semiconductor physics.			
COURSE OBJECTIVES			
The objective of the course is to impart the knowledge of fundamentals of physics through hands-on experiments and extend it to relevant engineering applications.			
COURSE OUTCOMES			
After successful completion of the course, students will be able to CO1: Explain phenomena of interference in thin films, polarization, law of Malus and applications such as anti-reflection coating, liquid crystal display (LCD). CO2: Develop the understanding of the working principle of lasers, optical fibers, and extend it to fiber optic communication. CO3: Deduce Schrödinger's wave equations and apply it to problems on bound states by summarizing fundamentals of quantum physics. CO4: Understand basic concepts, manufacturing methods, and applications of nanochips, and compare nanochips with microchips. Describe the principles and engineering applications of superconductors, ultrasonic generators, and piezoelectric generators in manufacturing quality testing. CO5: Understand celestial coordinate systems, astronomical distance measurements, and multi-wavelength observation methods to explain foundational astronomical concepts and telescope working principles.			

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COURSE CONTENTS

UNIT 1: WAVE OPTICS

Interference in thin films of uniform thickness, conditions for maxima and minima for reflected system; Conditions for maxima and minima for wedge shaped films (qualitative), engineering applications – anti-reflecting coating (ARC), determination of optical flatness; Numerical problems on thin films and wedge shaped films; Types of polarization: unpolarized, polarized, plane polarized light (PPL), circularly polarized light (CPL) and elliptically polarized light (EPL), Malus's law and related numerical problems; Engineering applications of polarization: liquid crystal display (LCD), communication and radar.

UNIT 2: PHOTONICS

Laser: Spontaneous and stimulated emission, population inversion, pumping, active medium and active center, resonant cavity; Engineering applications of laser (IT, medical, industry).

Optical fibers: Critical angle, acceptance angle, acceptance cone, numerical aperture, total internal reflection and propagation of laser; Classification of optical fibers: single mode and multimode, step index and graded index; Attenuation: attenuation coefficient, causes of attenuation; Advantages of optical fiber communication; Numerical problems on parameters of optical fiber.

UNIT 3: QUANTUM PHYSICS

de Broglie hypothesis of matter waves, de Broglie wavelength for a particle accelerated by KE 'E' and a charged particle accelerated by PD 'V', properties of matter waves; Wave function and probability density, mathematical conditions for wave function, problems on de Broglie wavelength; Need and significance of Schrödinger's equations, Schrödinger's time-independent and time-dependent equations; Energy of a particle enclosed in a rigid box and related numerical problems; Quantum mechanical tunneling, alpha particle decay, principle and applications of scanning tunneling microscope (STM); Principles of quantum computing: concept of qubit, superposition and entanglement, potential applications of quantum computing.

UNIT 4: MODERN APPLICATIONS OF PHYSICS

Nanochips and physics: Basics of nanochips, types, methods of manufacturing, applications, nanochips vs microchips.

Superconductor and applications: Basics of superconductor applications (only qualitative), bullet train (overview and technological aspect or correlation of physics)

Ultrasonic generator and its application in quality testing: Piezoelectric generator - construction and working, applications in quality testing.

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UNIT 5: ASTROPHYSICS

Brief history of astronomy (geocentric universe, heliocentric universe); Co-ordinate systems (celestial sphere, horizon, equatorial, ecliptic co-ordinate systems); Various windows in astronomy (multi-wavelength astronomy), 21-cm line and its importance in astronomy; Astronomical distances: astronomical unit (AU), light year, parsec, distance measurement in astronomy-stellar parallax and other methods; Telescopes: basic construction, working and principle.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Introduction to Solid State Physics, *C. Kittel*, Wiley and Sons.
2. Quantum Mechanics, *A. K. Ghatak, S. Lokanathan*, Laxmi Publications.
3. Nanotechnology: Principles and Practices, *S. K. Kulkarni*, Capital Publishing.
4. Physics for Scientists and Engineers with Modern Physics, *Serway and Jewett*, Cengage Publications.
5. Fundamental Astronomy – Ed. *H. Karttunen, P. Kroger, H. Oja et al.*, 1987, Springer-Verlag, Berlin.

Text Books:

1. A Textbook of Engineering Physics, *M. N. Avadhanulu, P. G. Kshirsagar* and *TVS Arun Murthy*, S. Chand Publications.
2. Engineering Physics, *R. K. Gaur* and *S. L. Gupta*, Dhanpat Rai Publications.
3. Optics, *Ajoy Ghatak*, Tata McGraw Hill.
4. Astrophysics Stars and Galaxies – *Prof. K. D. Abhyankar*, Universities Press.
5. ISRO: A Personal History, *R. Aravamudan*, HarperCollins India.
6. An Introduction to Modern Astrophysics, *B. W. Carroll* and *D. A. Ostlie*, Cambridge University Press.

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APPLIED PHYSICS LABORATORY (APL)			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Basic knowledge of physics, laboratory dos and don'ts, laboratory safety practices and safe handling of optical, electrical and electronic equipment, fundamentals of mechanics, waves and oscillations, geometrical and wave optics, interference, diffraction and polarization, basic semiconductor physics, electrostatics and electromagnetism, elementary electrochemical and electronic measurements, simple mathematical calculations, graphical data analysis and basic computer skills.			
COURSE OBJECTIVES			
1. To provide these basic concepts to resolve engineering and technological problems. 2. After completing this course, students will be able to appreciate and use the methodologies to analyze and design a wide range of engineering systems. 3. To use various techniques for measurement, calculation, control and analysis of engineering problems based on the principles of optics, ultrasonics, acoustics, quantum physics, superconductivity, laser, physics of nanoparticles, and semiconductor physics. 4. To understand the recent trends and advances in technology, this requires precise control over the dynamics of macroscopic engineering systems. 5. Basic sciences like Physics also invoke manipulation of processes over micro- and even nano-scale level as there is a growing demand of solid understanding of principles of basic sciences. 6. Physics provides the basic ideas and gives the solution for developing mathematical and analytical abilities with higher precision.			
COURSE OUTCOMES			
CO1: Apply the principles of interference, diffraction, polarization and double refraction to investigate the optical properties of materials and determine relevant physical parameters. CO2: Analyze the characteristics of diffraction gratings, optical instruments, lasers and optical fibers to determine wavelength, resolving power, geometrical parameters and transmission characteristics. CO3: Characterize semiconductor and optoelectronic devices by analyzing their electrical and temperature-dependent properties and determine parameters such as band gap, Hall coefficient, carrier concentration, fill factor and efficiency. CO4: Perform experiments involving magnetic materials and ultrasonic waves to determine magnetic susceptibility, velocity of ultrasonic waves and related material properties. CO5: Develop proficiency in experimental techniques, data acquisition, graphical analysis, error estimation and interpretation of results using appropriate laboratory instruments and basic computational tools.			
COURSE CONTENTS			

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1. LIST OF EXPERIMENTS (Any 8)

2. Experiment based on Newton's rings (determination of wavelength of monochromatic light, determine radius of curvature of plano-convex lens).
3. To determine position of diffraction minima by studying diffraction at a single slit.
4. To determine the unknown wavelength by using a plane diffraction grating.
5. To find out the resolving power of a diffraction grating/telescope.
6. To verify Malus's law.
7. Any experiment based on double refraction (determination of refractive indices, identification of types of crystal).
8. Any experiment based on Laser (thickness of wire, determination of number of lines on grating surface).
9. To study I-V characteristics of solar cell and determine parameters (fill factor and efficiency).
10. To determine the bandgap of a given semiconductor.
11. To determine Hall coefficient and charge carrier density.
12. Temperature dependent characteristics of semiconductor laser.
13. Ultrasonic Interferometer: Determination of velocity of ultrasonic waves in given liquid and find its compressibility.
14. Estimating Star Temperatures (Wien's Law)
15. Demonstrating Stellar Parallax (Distance Measurement)
16. Retrograde Motion of Mars (Planetary Dynamics)

LEARNING RESOURCES

Textbooks:

1. Engineering Physics, Avadhanulu, Kshirsagar, S. Chand Publications.
2. A textbook of optics – N Subrahmanyam and Brij Lal, S. Chand Publications.
3. Engineering Physics, Gaur, Gupta, Dhanpat Rai and Sons Publications.
4. Concept of Physics, H. C. Verma, Bharati Bhavan Publications.

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BASIC ELECTRONICS ENGINEERING (BXE)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601ESC119	CIE	30 M
TEACHING HRS. / WK	03		
TUTORIAL HRS./WK	01	ESE	60 M
CREDITS	04	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Basic Physics, Basic Digital Electronics, Mathematics.			
COURSE OBJECTIVES			
1. To understand the working principles of PN junction diode and Special purpose diodes. 2. To study the operating principle and applications of Bipolar Junction Transistors & MOSFET. 3. To learn the concepts of various logic gates, digital circuits, Microprocessor & Controller. 4. To understand the concepts of Opamp, its applications and electronic Instruments. 5. To know the methods of measurement of physical parameters using sensors and transmission with			
COURSE OUTCOMES			
After successful completion of the course, students will be able to CO1: Know about the working of active and passive components. CO2: Understand the working of BJT & MOSFET, their characteristics & compare. CO3: Learn logic gates & realization of the digital circuits. CO4: Understand the functioning of Opamp and electronic instruments. CO5: Identify different electronics sensors and understand basic communication system.			
COURSE CONTENTS			
UNIT-I: INTRODUCTION TO ELECTRONICS Introduction to active and passive components. P-N Junction Diode: P-N Junction diode construction and its working in forward and reverse bias conditions, V-I characteristics of P-N junction Diode, Diode as a switch, Half wave rectifier, Full wave and Bridge rectifier. Special purpose diodes: Light Emitting Diode (LED) and photo diode along with V- I characteristics and their applications.			
UNIT-II: TRANSISTORS (BJT & MOSFET) Bipolar Junction Transistor: Construction, type, Operation, V-I Characteristics in common emitter mode, Transistor CE configurations (CE, CB, CC comparison only), BJT as switch and Common Emitter (CE) amplifier. Enhancement Metal Oxide Semiconductor Field Effect Transistors (EMOSFET): Construction, Types, Operation, V-I characteristics, MOSFET as switch & amplifier.			

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UNIT-III: DIGITAL CIRCUITS

Number System: Introduction of Binary, Decimal, Octal, Hexadecimal, Conversion of Binary to Decimal, Decimal to Binary, Binary addition.

Logic Gates - AND, OR, NOT, XOR, XNOR. Universal Gates – NAND, NOR. De-Morgan's theorem.

Introduction to Microprocessor and Microcontroller (Only block diagram and explanation). Basics of Arduino.

UNIT-IV: OPERATIONAL AMPLIFIER AND ELECTRONIC INSTRUMENTS

Operational amplifier: Functional block diagram of operational amplifier, Ideal & practical values of performance parameters, Op-amp applications: Inverting, Non-inverting amplifier.

Electronic Instruments: Block diagram of Digital Multimeter, Function Generator, Digital Storage Oscilloscope (DSO), DC power supply.

UNIT V: SENSORS AND COMMUNICATION SYSTEMS

Need Classification of sensors: Active/Passive Sensors, Selection Criteria/Characteristics of sensor. Motion Sensors (LVDT), Temperature Sensors (Thermocouple, RTD), Mechanical Sensors (Strain Gauge). Block diagram of IoT based Data Acquisition and Automation System.

Communication Systems: Block Diagram, Communication Media: Wired and Wireless, Electromagnetic Spectrum, Cellular concept, Block diagram of GSM system, Introduction of 5G mobile network.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Digital Fundamentals by Thomas. L. Floyd, 11th Edition, Pearson
2. Mobile Communication by J. Schiller, 2nd Edition, Pearson
3. Sensors Handbook, by S. Soloman, 2nd Edition.
4. CMOS Circuit Design, Layout & Simulation, by Baker, 2nd Edition, Wiley IEEE Press

Text Books:

1. Electronics Devices by Thomas. L. Floyd, 9th Edition, Pearson
2. Modern Digital Electronics by R. P. Jain, 4th Edition, Tata McGraw Hill
3. Electronic Instrumentation by H. S. Kalsi, 3rd Edition, Tata McGraw Hill
4. Sensors and Transducers by D. Patnabis, 2nd Edition, PHI
5. Electronic Communication Systems by Kennedy & Davis, 4th Edition, Tata McGraw Hill
6. Mobile Wireless communication by M. Schwartz, Cambridge University Press.

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WEB LINKS AND VIDEO LECTURES (E-RESOURCES)	
Online Resources: e-Books: https://www.pearson.com/en-us/subject-catalog/p/electronic-devices-electron-flow-version/P200000001048 MOOC / NPTEL/YouTube Links: 1. https://nptel.ac.in/courses/117103063 2. https://nptel.ac.in/courses/117103064 3. https://archive.nptel.ac.in/courses/106/105/106105166/	

ELECTRONICS ENGINEERING LAB (EEL)			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Fundamental understanding of mathematics, physics, electronic, and sensor technologies is required.			
COURSE OBJECTIVES			
4. To impart the fundamental knowledge of Electronic Engineering to all the students of various disciplines. 5. To provide the comprehensive basics about Analog and Digital components and circuits. 6. To impart the knowledge of Introduction to use various sensors and components for application.			
COURSE OUTCOMES			
After successful completion of this course, students will be able to, CO1: Understand basics of electronics components. CO2: Construct and test basic electronic circuits, and perform experimental verification of fundamental electronic circuits digital and analog. CO3: Conduct experimental studies of components with graphical representation. CO4: Explain the operating principles of logic gates and perform experimental verification. CO5: Learn how to use virtual Lab and perform experimental verification.			
COURSE CONTENTS			
PART-A: LIST OF EXPERIMENTS (Any 9) 2. Study Electronic Components: Study of Active and Passive components i. Resistors (Fixed & Variable), Calculation of resistor value using color code. ii. Capacitors (Fixed & Variable) iii. Inductors, Calculation of inductor value using color code. iv. Devices such as Diode, BJT, MOSFET, various IC packages			

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v. Switches & Relays.

11. 2. Measurements using various measuring instruments:

- i. Setup CRO and function generator for measurement of AC & DC voltages and frequency
- ii. Measure Voltage, Resistance using digital Multimeter. Also use Multimeter to check diode, BJT.

12. V-I characteristics of P-N Junction Diode (Study the datasheets of typical PN junction diode)

13. Rectifier circuits: Implement DC Regulated Power Supply using bridge rectifier & diodes.

14. Build and test Common Emitter (CE) BJT Amplifier Circuit.

- i. Calculate the Gain of CE Amplifier

15. Linear applications of Op-amp:

- i. Build inverting and non-inverting amplifier using op-amp (Study the data sheet of typical Op-Amp 741)

16. Test and verify the truth tables of:

- i. Basic and Universal Gates (Study the datasheets of respective ICs)
- ii. Half & Full Adder

17. Study of transducers/sensor (Any 3)

18. Build and test any circuit using BJT/MOSFET/Op-Amp/Logic Gates using any one sensor.

19. Case Study of any one electronics appliances with block diagram, specification etc.

20. Virtual Lab experiments based on digital circuit/sensor application.

<https://sl-coep.vlabs.ac.in/Introduction.html>

<https://de-iitr.vlabs.ac.in/List%20of%20experiments.html>

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ENGINEERING MECHANICS			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	26-01-ESC-121	CIE	40 M
TEACHING HRS. / WK	02		
TUTORIAL HRS./WK	01	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
A fundamental understanding of Basic Calculus, Trigonometry, Geometrical expressions and physics.			
COURSE OBJECTIVES			
1. To learn the basic concept of force systems and resultant of forces in two dimensions. 2. To solve problems involving equilibrium of concurrent and general force systems, reaction of statically determinate beams and member forces in plane trusses. 3. To determine the centroid and moment of inertia of composite sections and to solve practical examples involving friction. 4. To determine the geometric components of motion for rectilinear and curvilinear motion of a particle. 5. To use Newton's laws and energy principles for analyzing rectilinear and curvilinear motion of a particle.			
COURSE OUTCOMES			
After successful completion of the course, students will be able to CO1: Understand the basic concept of forces, moments and couples in two-dimensional force system. CO2: Apply concept of free body diagram for static equilibrium in two-dimensional force system and analyze the reactions and member forces of statically determinate beams and trusses respectively. CO3: Solve the problems involving Centroid and Moment of inertia of composite section along with practical examples involving friction. CO4: Describe the rectilinear and curvilinear motion of a particle. CO5: Apply Newton's second law, work energy and impulse momentum principles for particles.			
COURSE CONTENTS			
UNIT-I: FORCE SYSTEMS Introduction and Fundamental Laws of Mechanics, Derived laws of Mechanics, Force systems, Resolution and Composition of forces, Free Body Diagram, Resultant of Coplanar Concurrent force systems, Moment of force, Couple, Varignon's theorem, Resultant of Coplanar General force systems.			
UNIT-II: EQUILIBRIUM OF STRUCTURES Equilibrium, Lame's theorem, Equilibrium of concurrent, parallel and general force systems in a plane. Types of supports, loads and beams. Reactions for statically determinate beams. Trusses –Static determinacy, Analysis of plane trusses using method of joints.			

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UNIT III: CENTROID, MOMENT OF INERTIA AND FRICTION

Introduction, centroid of basic figures, centroid of composite figure, moment of inertia of simple geometrical figures, parallel axis theorem, perpendicular axis theorem (polar moment of inertia), moment of inertia of composite figures.

Friction – Introduction, coefficient of friction, angle of friction, angle of repose, friction on inclined plane, ladder friction and belt friction.

UNIT IV: KINEMATICS

Introduction, basic concept, rectilinear motion: horizontal and vertical motion with constant acceleration, variable acceleration, curvilinear motion: rectangular components, normal and tangential components, motion of projectile.

UNIT V: KINETICS

Introduction, D'Alembert's principle of dynamic equilibrium and its application to rectilinear and curvilinear motion, Conservative and non-conservative forces, Work energy principle, conservation of energy, Impulse momentum principle, Impact – types, coefficient of restitution.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. R. K. Rajput, *Engineering Mechanics*, Laxmi Publications.
2. R. S. Khurmi, *Applied Mechanics*, S. Chand Publications.
3. S. Timoshenko and D. H. Young, *Engineering Mechanics*, McGraw-Hill.

Text Books:

1. R. C. Hibbeler, *Engineering Mechanics: Statics & Dynamics*, Pearson Education.
2. Beer and Johnston, *Vector Mechanics for Engineers – Statics and Dynamics*, McGraw-Hill.
3. S. S. Bhavikatti, *Engineering Mechanics*, New Age International.
4. A. K. Tayal, *Engineering Mechanics*, Umesh Publications.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

Online Resources:

Engineering Mechanics lecture series by Prof. K. Ramesh – IIT Madras

https://www.youtube.com/playlist?list=PLyqSpQzTE6M_MEUdn1izTMB2yZgP1NLfs

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MECHANICS LABORATORY (ML)			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
A fundamental understanding of Basic Calculus, Trigonometry, Geometrical expressions and physics.			
COURSE OBJECTIVES			
1. To impart the fundamental knowledge of Applied Mechanics to all the students of various disciplines. 2. To provide the comprehensive basics about force systems and equilibrium. 3. To impart the knowledge of and applications of friction. 4. To understand particle motion and impact of bodies.			
COURSE OUTCOMES			
Course Outcome: CO1: Construct a concurrent force system in two dimensions and determine the resultant graphically CO2: Determine the reactions of determinate beams and verify equilibrium of three force system. CO3: Calculate the coefficient of friction for various surfaces. CO4: Calculate the coefficient of restitution and understand the aspects of projectile motion.			
COURSE CONTENTS			
PART-A: LIST OF EXPRIMENTS (Any 8) 1. Verification of the Polygon law of forces. 2. To find support reaction of beam 3. To verify Lami's theorem 4. To determine coefficient of friction 5. To simulate Projectile motion 6. Determination of coefficient of restitution PART B: Assignment on each unit comprising of at least five application-level problems.			
SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)			
REFERENCE BOOKS 1. R. K. Rajput, <i>Engineering Mechanics</i> , Laxmi Publications. 2. R. S. Khurmi, <i>Applied Mechanics</i> , S. Chand Publications. 3. S. Timoshenko and D. H. Young, <i>Engineering Mechanics</i> , McGraw-Hill TEXTBOOKS 4. R. C. Hibbeler, <i>Engineering Mechanics: Statics & Dynamics</i> , Pearson Education. 5. Beer and Johnston, <i>Vector Mechanics for Engineers – Statics and Dynamics</i> , McGraw-Hill. 6. S. S. Bhavikatti, <i>Engineering Mechanics</i> , New Age International. 7. A. K. Tayal, <i>Engineering Mechanics</i> , Umesh Publications.			

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BASIC PYTHON PROGRAMMING (BPP)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601ESC123	CIE	40 M
TEACHING HRS. / WK	02		
TUTORIAL HRS./WK	01	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Basics of Computers and Basic Mathematics.			
COURSE OBJECTIVES			
CO1: To Understand the fundamentals of problem solving and Python programming. CO2: To Learn Python data types, strings, and their operations for efficient data handling. CO3: To Apply decision-making and looping statements to solve programming problems. CO4: To Create Python programs using functions and understands variable scope. CO5: To introduce object-oriented programming concepts using Python classes and objects.			
COURSE OUTCOMES			
After successful completion of the course, students will be able to CO1: Describe problem-solving concepts and write basic Python programs using input, output, and syntax. CO2: Apply Python data types, strings, and built-in methods to process data CO3: Apply decision-making and looping constructs to solve simple computational problems CO4: Understand user-defined functions, lambda functions, and variable scope in Python programs. CO5: Create simple Python programs using classes and objects.			
COURSE CONTENTS			
UNIT-I: PROBLEM SOLVING, PROGRAMMING AND PYTHON PROGRAMMING General Problem Solving Concepts- Problem solving in everyday life, types of problems, problem solving steps. Program Design Tools: Algorithms, Flowcharts Basics of Python Programming: Features of Python, History and, Application of Python Literal constants, variables and identifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions. UNIT-II: ADVANCED DATA TYPES AND STRINGS Advanced Data Types in Python: List, Tuple, Set, Dictionary. Strings and Operations: concatenation, appending, multiplication and slicing. Strings are immutable, built in string methods. Slice operation, ord() and chr() functions, in and not in operators. FLOW CONTROL AND LOOPS			

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Flow Control and Loops: Decision Making: if statement, if...else statement, if..elif ..else statement, Nested if statement; Loops : while loop , for loop, range() function, continue and break statement, pass statement.

UNIT IV: FUNCTIONS

Need for functions, Function: definition, call, the return statement. Defining functions, Lambda or anonymous function, Scope of variables

UNIT V: Object Oriented Programming

Features of Object oriented programming-classes, objects, methods and message passing, inheritance, polymorphism, Reusability, data abstraction and encapsulation, documentation string, __init__()method, good programming practices, sample program of class and object.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

- 1.R. G. Dromey, “How to Solve it by Computer”, Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, “Problem Solving and Programming Concepts”, Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978 0132492645
2. Romano Fabrizio, “Learning Python”, Packt Publishing Limited, ISBN: 9781783551712, 1783551712
3. Paul Barry, “Head First Python- A Brain Friendly Guide”, SPD O’Reilly, 2nd Edition, ISBN:978-93-5213-482-3
4. Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education, ISBN 10:9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
5. Jeeva Jose, P. Sojan Lal, “Introduction to Computing & Problem Solving with Python”, Khanna Computer

Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978 9382609810

Text Books:

1. Reema Thareja, “Python Programming Using Problem Solving Approach”, Oxford University Press, ISBN 13: 978-0-19-948017-6
2. R. Nageswara Rao, “Core Python Programming”, Dreamtech Press; Second edition ISBN10:938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

Youtube/NPTEL Links

<https://www.youtube.com/watch?v=keYxU7Ou754&list=PLIt9A5yCuugkrHMPgndt59e0PPUqjyQ6&index=6->

<https://youtu.be/tA42nHmmEKw>

[?eN](https://youtu.be/tA42nHmmEKw)

<https://nptel.ac.in/courses/106104074> <https://nptel.ac.in/courses/106106182>

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PROBLEM SOLVING USING PYTHON LAB / BASIC PYTHON PROGRAMMING LAB			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Basic knowledge of computer fundamentals and operating systems.			
COURSE OBJECTIVES			
CO1: To introduce problem-solving concepts and the basics of Python programming. CO2: To understand Python data types, decision-making, and looping statements. CO3: To learn functions and string operations for developing Python programs. CO4: To understand file handling and the use of Python built-in libraries. CO5: To learn the fundamentals of object-oriented programming using Python.			
COURSE OUTCOMES			
Course Outcome: CO1: Understand problem-solving techniques and write basic Python programs. CO2: Use Python data types, decision-making, and looping statements to solve problems. CO3: Develop Python programs using functions and string operations. CO4: Implement file handling operations and Python libraries in programs. CO5: Apply Object-oriented programs using classes and objects in Python.			
COURSE CONTENTS			
List of Laboratory Experiments (Perform any eight programs) 1. To calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions. 2. Program to demonstrate operation on lists. 3. Program to find whether the given number is even or odd. 4. Program to print the multiplication table of n, where n value is entered by user. 5. Program to find whether the given number is an Armstrong number or not. 6. Program to demonstrate string operations. 7. Program to perform all operation (addition, multiplication, subtraction, division) by using user defined function 8. Program to calculate factorial of number using user defined function.			

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9. Perform Python program that reads a text file and calculates the total number of characters, words, lines, and the frequency of a user-specified word.
10. Program to access class variable using class object.
11. Program to generate and display the Fibonacci series

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978 0132492645
2. Romano Fabrizio, "Learning Python", Packt Publishing Limited, ISBN: 9781783551712, 1783551712
3. Paul Barry, "Head First Python- A Brain Friendly Guide", SPD O'Reilly, 2nd Edition, ISBN:978-93-5213-482-3
4. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, ISBN 10:9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
5. Jeeva Jose, P. Sojan Lal, "Introduction to Computing & Problem Solving with Python", Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978 9382609810

Text Books:

1. Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, ISBN 13: 978-0-19-948017-6
2. R. Nageswara Rao, "Core Python Programming", Dreamtech Press; Second edition ISBN10:938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

Youtube/NPTEL Links

<https://www.youtube.com/watch?v=keYxU7Ou754&list=PLIt9A5yCuugkrHMpgndt59e0PPUqiyQ6&index=6-https://youtu.be/tA42nHmMEKw?eN>

<https://nptel.ac.in/courses/106104074> <https://nptel.ac.in/courses/106106182>

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DIFFERENTIAL EQUATIONS AND INTEGRAL CALCULUS (DEIC)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	26-01-BSC-113	CIE	40 M
TEACHING HRS. / WK	03		
TUTORIAL	01	ESE	60 M
CREDITS	04	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Differentiation and Integration, Taylors and Maclaurins series, Differential equations.			
COURSE OBJECTIVES			
1.To make the students familiarize with Mathematical Modeling of physical systems using differential equations 2. To make the students familiarize with advanced techniques of integration, tracing of curves, multiple integrals and their applications. 3.The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Apply the effective mathematical tools to solve first order differential equations to model physical processes such as Newton’s law of cooling, electrical circuit etc. CO2: Determine the Fourier series representation and harmonic analysis of periodic continuous and discrete systems. CO3: Use advanced integration techniques such as Reduction formulae, Beta functions, Gamma functions, Differentiation under integral sign needed in evaluating multiple integrals and their applications. CO4: Draw Cartesian, Polar, Parametric curves for a given equation. CO5: Evaluate multiple integrals and its application to find area bounded by curves, volume bounded by surfaces.			
COURSE CONTENTS			
UNIT 1: FIRST ORDER DIFFERENTIAL EQUATION & ITS APPLICATIONS			
Exact differential equations, Equations reducible to exact form. Linear differential equations. Applications of Differential Equations to Orthogonal Trajectories, Newton’s Law of Cooling, Kirchhoff’s Law of Electrical Circuits UNIT-II: FOURIER SERIES: Definition, Dirichlet conditions, Full range Fourier series, Half range Fourier series and harmonic analysis.			

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UNIT III: INTEGRAL CALCULUS

Reduction Formulae of standard trigonometric functions, Beta function, Gamma functions, properties of Beta & Gamma function, Differentiation under integral sign.

UNIT IV: Curve Tracing

Tracing of Cartesian Curve, Tracing of Parametric curves, Tracing of Polar Curves, Rectification of curves.

UNIT V: Multiple Integration

Double Integration: Direct evaluation, limits are not given, transformation to polar & Change of order of integration, Triple integration and Applications

List of Tutorials:

1. Activity -I (Revision of Prerequisites)
2. First order Linear Differential equation and Applications
3. Full, Half range fourier series
4. Integral Calculus
5. Curve tracing
6. Multiple integration and Applications
7. Activity-II Case Study

Tutorial for the subject shall be engaged in minimum three batches per division and activity-based learning. Term work shall consist of five tutorials, one on each unit. Tutorials must be written in the Tutorial book for uniform representation among students.

Activity Based Learning:

1. Collaborative and Individual Problem based learning
2. Think Pair Share
3. Surprise Test, Open Book Test
4. Quiz
5. Seminar / Presentation
6. ICT- Slido / Kahoot etc.
7. Case study

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

REFERENCE BOOKS

1. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th Edition.
3. Applications to Linear Algebra by Gilbert Strang, 4th Edition, Brooks/Cole Thomson Learning
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson).
5. Applied Mathematics (Vol. I & Vol. II) by P. N. Wartikar and J. N. Wartikar, Vidyarthi Griha Prakashan, Pune.

Text Books:

1. H. K. Das, "Advanced Engineering Mathematics", S Chand Publication
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, New Delhi.
3. D. C. Lay, S. R. Lay, J. J. McDonald, "Linear Algebra and Its Applications", Pearson

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

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Online Resources:

1. NPTEL Course on “Engineering Mathematics-II”
<https://nptel.ac.in/courses/111105121/>
2. NPTEL Course on “Basic Calculus-2”
<https://nptel.ac.in/courses/111/106/111106146/>
3. NPTEL Course on Mathematics”
<https://nptel.ac.in/courses/111/101/111101115/>

ACTIVITY BASED LEARNING (SUGGESTED ACTIVITIES IN CLASS)

6. Flipped Classroom
7. Surprise / Open book Test
8. Online Interactive Tool
9. Collaborative and Individual Problem based learning.
10. Quizzes/Assignment

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APPLIED CHEMISTRY (AC)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601BSC118	CIE	40 M
TEACHING HRS. / WK	02		
TUTORIAL	01	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Basic understanding of chemistry including titrations, chemical reactions, acids and bases, electricity, heat and energy concepts, along with fundamental laboratory practices and basic computer skills.			
COURSE OBJECTIVES			
1: To acquire knowledge of water quality analysis, treatment methods, and electroanalytical techniques for chemical analysis. 2: To understand the properties and applications of specialty polymers, composites, and nanomaterials in engineering fields. 3: To study conventional and alternative fuels, corrosion mechanisms, and methods for corrosion prevention.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Understand the practical methods and techniques required for effective water quality monitoring. CO2: Select appropriate electro analytical techniques for understanding the materials. CO3: Demonstrate the structure and properties of advanced engineering materials for various technological applications. CO4: Analyze different types of conventional and alternative fuels for energy applications. CO5: Explain causes of corrosion and methods for minimizing corrosion.			
COURSE CONTENTS			
UNIT 1: WATER TREATMENT & SUSTAINABLE MANAGEMENT Impurities in water, Types of hardness of water, Units (mg, ppm), Analytical determination of water quality: Hardness (by EDTA method) and alkalinity, Numericals, Effects of hard water in boilers- scale, sludge, priming & foaming. Water treatment: i) Zeolite method and numericals ii) Ion Exchange method. Purification of water: Reverse osmosis (RO) & Electrodialysis cell, Sustainable water management systems: Water conservation and efficient water management, Recycling and circular water Management. UNIT-II: INSTRUMENTAL TECHNIQUES FOR CHEMICAL ANALYSIS Introduction: Reference electrode (SCE), indicator electrode (Glass electrode), EMF of cell & Nernst Equation. PH metry: Standardization of pH meter, Buffer & their types, pH metric titration of strong acid versus strong base, Applications. Conductometry: Factors affecting conductance, conductometric titration of strong acid versus strong			

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base, Applications.

UV Visible Spectroscopy: Lambertz -Beer Law, Types of electronic Transitions, Instrumentation of UV Visible Spectrophotometer (Double Beam), Terms used in UV spectroscopy & Applications.

UNIT III: SPECIALITY POLYMERS AND NANOTECHNOLOGY

Polymers: Introduction, Monomer & Functionality of monomers, Polymer classification based on thermal properties (Thermoplastic & Thermosetting)

Specialty polymers:

- 1.Engineering thermoplastic: Polycarbonate: Synthesis, Properties & Applications.
- 2.Biodegradable polymers: Introduction and environmental significance, Biopol & its Applications
- 3.Polymer Composites: Introduction, functions of phases, types & Applications.

Nanomaterials: Definition, size range and classification (0D, 1D, 2D, 3D), Carbon nanotubes (CNTs), Graphene, Application of nanomaterials.

UNIT IV: SUSTAINABLE ENERGY SYSTEMS AND DEVICES

Fuels-HCV, LCV and properties of Fuel, Determination of calorific value: Principle, construction and working of Bomb calorimeter & numericals.

Solid Fuel: Analysis of Coal-Proximate and Ultimate analysis, numericals.

Liquid fuels: Synthesis, properties, advantages and disadvantages of Power alcohol and Biodiesel.

Gaseous fuels: Hydrogen: Future Fuel, Production by steam reforming of methane.

A Green Fuels for sustainable energy solutions: Biohydrogen.

Fuel Cells-H₂-O₂ fuel cell, Polymer electrolyte membrane fuel cell.

Batteries: Introduction, classification, construction, working and applications of lithium-ion batteries.

UNIT V: CORROSION AND ITS PROTECTION

Introduction, Types of corrosion: Dry corrosion, mechanism of dry corrosion, types of oxide films.

Wet corrosion: Types (Galvanic & Concentration cell), Mechanism: Hydrogen evolution and Oxygen absorption,

Factors influencing corrosion rate (Nature of Metal & Environment).

Methods of corrosion control and prevention: Cathodic Protection (Sacrificial anode and Impressed current).Method to apply metallic coatings - Hot dipping & electroplating, Non- metallic coating - powder coating, Corrosion Resistant / Anti corrosive paints.

Additional topics beyond the Syllabus (Any Two per semester)

Students are required to complete any two of the following activities along with the prescribed laboratory experiments during semester. These activities will help improve their practical knowledge, analytical skills, problem-solving ability, and understanding of recent developments in Applied chemistry. The completed activities will be evaluated as part of the Best practices & will be evaluated based on the quality of work, understanding of the topic, presentation, and timely submission. Assessment will be carried out through indirect assessment methods, including the Course Exit Survey.

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- 1. Water Quality Analysis and Hardness Determination Using EDTA Method:** Collection of water samples from different sources and determination of hardness using the EDTA titration method, followed by recording of observations and calculation of hardness values, analysis of data using tables and graphs, and preparation of a short report based on results and conclusions.
- 2. Case Study on Sustainable Water Management and Rainwater Harvesting Systems:** Study of water conservation methods and rainwater harvesting systems, including their working principles and benefits, followed by preparation of a short report or presentation.
- 3. Study of Corrosion Prevention Methods and Protective Coatings:** Study of corrosion on different metals and corrosion control methods using paints and protective coatings, followed by comparison of results and preparation of a short report or presentation.
- 4. Virtual Laboratory Simulation of Chemical Analysis Experiments:** Virtual laboratory simulation of chemical analysis experiments, including observation recording, result analysis, and preparation of a short report or presentation.
- 5. Survey and Analysis of Water Conservation Practices in Society:** Survey on water saving methods used in homes or society, including data collection, analysis of results, and preparation of a short report or presentation.
- 6. Case Study on Solar Cell Technologies and Applications:** Study of solar cell technologies and their applications in daily life, including working principles and benefits of solar energy, followed by preparation of a short report or presentation.
- 7. Comparative Study of Fuel Cells and Conventional Batteries:** Comparison of fuel cells and conventional batteries based on working, efficiency, applications, advantages, and limitations, followed by preparation of a chart, report, or presentation.
- 8. Case Study on Polymer composites:** Compare two polymer composites based on their composition, properties, and engineering applications, and present the findings through a chart, infographic, or short presentation.
- 9. Energy Audit and Sustainable Energy Utilization Survey:** Study of electricity usage in classrooms or homes by identifying energy-consuming devices, analyzing their power consumption, and suggesting simple energy-saving measures, followed by preparation of a short report or presentation.
- 10. Survey and Analysis of Corrosion Prevention Practices in Society:** Students will survey metallic structures in their residence or society (gates, railings, pipelines, tanks, vehicles) to identify and classify corrosion type (uniform, pitting, galvanic, etc.), assess contributing environmental factors, and document existing protective measures (coatings, galvanization, cathodic protection). Based on their findings, students will prepare a technical report analyzing the corrosion mechanisms observed and recommending improved prevention methods.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

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REFERENCE BOOKS

1. Basic Concept of Analytical Chemistry, 2ed, S. M. Khopkar, New Age-International Publisher.
2. Instrumental Methods of Chemical Analysis, G. R. Chatwal & S. K. Anand, Himalaya Publishing House.
3. Spectroscopy of organic compounds, 2ed, P. S. Kalsi, New Age-International Ltd., Publisher.
4. Polymer Science, V. R. Gowarikar, N. V. Viswanathan, Jayadev Sreedhar, Wiley Eastern Limited.
5. Inorganic Chemistry, 5ed, Shriver and Atkins, Oxford University Press.
6. Fundamentals of Nanotechnology, G. L. Hornyak, J. J. Mooney, H. F. Tihale, J. Dutta, CRC press.
7. Corrosion Engineering by Mars G. Fontana.
8. Principles and Prevention of Corrosion by Denny A. Jones.

TEXT BOOKS:

1. Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd.
2. Engineering Chemistry by O. G. Palanna, Tata Magraw Hill Education Pvt. Ltd.
3. Textbook of Engineering Chemistry by Dr. Sunita Rattan, S. K. Kataria & Sons Publisher.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

1. <https://chem.nju.edu.cn/upload/article/files/b5/6f/01f0f2434d708df797208aea2613/83f2b441-65ee-44a6-ac47-ed21db462c5d.pdf>.
2. https://edisciplinas.usp.br/pluginfile.php/5955761/mod_resource/content/1/CORROSION_ANDCORROSION_CONTROL_An_Intro%20%20Revie%20and%20Uhlig.pdf
3. MOOC / NPTEL/YouTube Links: <https://nptel.ac.in/courses/113104082>

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APPLIED CHEMISTRY LAB			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Basic knowledge of chemistry, laboratory dos and don'ts, hazardous chemicals and their safe handling, laboratory safety equipment, chemical reactions, acids and bases, concentration and titration methods, fundamental laboratory techniques, basic electrochemistry, simple mathematical calculations, graphical data analysis and elementary computer skills.			
COURSE OBJECTIVES			
1. To acquire knowledge of water quality analysis, treatment methods, and electroanalytical techniques for chemical analysis. 2. To understand the properties and applications of specialty polymers, composites, and nanomaterials in engineering fields. 3. To study conventional and alternative fuels, corrosion mechanisms and methods of corrosion prevention.CST			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Understand the practical approaches and techniques required for effective water quality monitoring. CO2: Select appropriate electro analytical techniques for understanding the materials. CO3: Demonstrate the structure and properties of advanced engineering materials for various technological applications. CO4: Analyze different types of conventional and alternative fuels for energy applications. CO5: Explain causes of corrosion, prevention methods and e-waste management.			
COURSE CONTENTS			
PART-A: LIST OF EXPERIMENTS			
Chemistry Laboratory Induction and Safety practices: Laboratory rules and dos and don'ts, safe handling of hazardous chemicals, use of PPE and safety equipment, chemical labels, safe storage and disposal of chemicals, emergency procedures, chemical spills, and first aid, proper use of laboratory instruments, and laboratory waste management and environmental safety.			
1. To determine total hardness of water by EDTA method. 2. To determine alkalinity of water. 3. To determine strength of strong acid using pH meter. 4. Titration of strong acid with strong base using conductometer. 5. To determine maximum wavelength of absorption of CuSO4/FeSO4/ KMnO4, verify Beer's law and find unknown concentration of given sample. 6. Preparation of urea-formaldehyde resin 7. Proximate analysis of coal.			

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8. Preparation of biodiesel from oil.
9. To coat copper and zinc on an iron plate using electroplating.

Additional Topics Beyond the syllabus: In addition to the prescribed laboratory experiments, students must complete the following two activities during the semester, which include using virtual laboratory simulations to perform selected practicals and analyze the results. These activities are additional to the laboratory syllabus and will help students develop practical, analytical, and digital skills.

10	Virtual lab experiments beyond the syllabus		2Hrs
	c. Determination of organic carbon content in soil.		
	d. Determination of available nitrogen content in soil by the Kjeldahl Method.		2Hrs

Note:

1. Chemistry Laboratory Induction and Safety practices(CLISP): CLISP (Chemistry Laboratory Induction and Safety Programme) shall be conducted for every batch prior to the commencement of the experiment sessions.
2. Virtual Lab Experiments: The prescribed virtual laboratory experiments shall be performed by all students as part of the practical course under the guidance of the respective Subject Coordinator.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Vogels Text book of Qualitative Chemical Analysis by J. Mendham, R.C, Denny, J.D.Barnes, M.J.K.Thomas, 6 e, Pearson Education ltd.
2. Applied Chemistry Theory and Practice by O.P. Virmani and A.K.Narula, 2e, New age International (P) Ltd.

Text Books:

1. Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd.
2. Engineering Chemistry by O. G. Palanna, Tata Magraw Hill Education Pvt. Ltd.
3. Textbook of Engineering Chemistry by Dr. Sunita Rattan, S. K. Kataria& Sons Publisher.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

1. <https://chem.nju.edu.cn/upload/article/files/b5/6f/01f0f2434d708df797208aea2613/83f2b441-65ee-44a6-ac47-ed21db462c5d.pdf>.
2. https://edisciplinas.usp.br/pluginfile.php/5955761/mod_resource/content/1/CORROSION_ANDCORROSION_CONTROL_An_Intro%20%20Revie%20and%20Uhlig.pdf
3. MOOC / NPTEL/YouTube Links: <https://nptel.ac.in/courses/113104082>

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FUNDAMENTS OF ELECTRICAL ENGINEERING			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601ESC120	CIE	40 M
TEACHING HRS. / WK	02		
TUTORIAL	01	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
A fundamental understanding of mathematics, physics, and electrical, electronic, and electromagnetic technologies is required.			
COURSE OBJECTIVES			
COBJ1: To develop a systematic understanding of fundamental electrical and electromagnetic principles underlying DC/AC circuits, magnetic circuits and electrical machines. COBJ2: To develop the ability to analyse electrical circuits and evaluate the performance of electrical equipment through calculation, measurement and simulation. COBJ3: To introduce elementary power systems, electrical machines, battery technologies and electric vehicles, highlighting their applications and relevance to modern engineering practice.			
COURSE OUTCOMES			
After completion of this course, student will be able to: CO1: Apply fundamental principles of magnetic circuits and electromagnetic induction to electrical engineering situations and laboratory practices. CO2: Analyse single-phase AC series R-L-C circuits using appropriate electrical parameters and phasor relationships. CO3: Analyse balanced three-phase AC systems and single-phase transformer performance under different loading conditions. CO4: Apply Kirchhoff's Laws, Superposition Theorem and Thevenin's Theorem to solve DC electrical networks. CO5: Explain the working principles and applications of DC motors, elementary power systems and electric vehicles, including battery systems.			
COURSE CONTENTS			
UNIT 1: ELECTROMAGNETISM (A) Magnetic Circuit: Concept of flux density, field strength, permeability, MMF, reluctance, their units, and relationships. Comparison of Electric and Magnetic Circuit. Simple series magnetic circuit. Force on current carrying conductor placed in magnetic field, Fleming's left-hand rule. (B) Electromagnetic Induction: Faradays Laws of electromagnetic induction, Fleming's right-hand rule, statically and dynamically induced emf, self and mutual inductance, coefficient of coupling (Theory only) UNIT-II: A.C. CIRCUITS -I: (A) AC Fundamental: Representation of Sinusoidal Waveforms, Concept of cycle, period, frequency, instantaneous, peak, average and RMS values, peak factor, and form factor. Phase, Phase			

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difference, concept of lagging, leading and in phase quantities, phasor representation.

(B) Single Phase AC Series Circuits:

Performance analysis of AC circuits consisting of Pure R, L, C and RL, RC, RLC Series circuits. Concept of active, reactive, and apparent power, Impedance triangle and power triangle.

UNIT III: A.C. CIRCUITS -II:

(A) Poly Phase Circuit:

Concept of three-phase AC symmetrical system, phase sequence, balanced and unbalanced load. Voltage, current and power relations in three phase balanced star and delta connected loads along with phasor diagrams.

(B) Single Phase Transformer:

Construction, working principle, EMF equation, transformation ratio, rating, types, losses, regulation and efficiency at different loading conditions.

UNIT IV: D.C. CIRCUITS:

(A) D.C. Networks and circuit reduction techniques:

Types of Voltage and current sources, Classification of electrical networks, simplifications of networks using series-parallel combinations and star delta transformation technique.

(B) Kirchhoff's Laws and Theorems:

Kirchhoff's Laws, their applications for network solutions using loop analysis, Superposition theorem, Thevenin's Theorem.

UNIT V INTRODUCTION TO ELECTRICAL MACHINES, POWER SYSTEMS AND EVS :

(A) D.C. Motor:

Construction, working principle, types (Shunt and Series), voltage equation, characteristics and Applications.

(B) Introduction to Electrical Power Systems:

Overview of elementary power system showing stages such as Generation, Transmission, and Distribution of electrical energy. (Single Line Diagram and components only). Concept of Insulation resistance (Theory only).

(C) Electric Vehicles:

Need, evolution, advantages, and types (BEV, HEV, PHEV). EV Architecture: Basic components and their functions.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

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REFERENCE BOOKS

1. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.
2. H. Cotton, "Electrical Technology", 7th Edition, CBS Publications and distributors.
3. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill,
4. E. Fitzgerald, Electric Machinery, TMH Publications.
5. M. G. Say, Alternating Current Machines, CBS Publishers.
6. Nagrath and Kothari, Electrical Machines, TMH Publications

TEXT BOOKS:

1. B. L. Theraja, Electrical Technology, Vol. – I & II, S. Chand & Co.
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering," Tata McGraw Hill, 4th Edition, 2019. Bhattacharya.
3. V. K. Mehta, "Basic Electrical Engineering", S. Chand and Company Ltd., New Delhi.

*Electrical Vehicle-----*TBD*

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

Online Resources:

Basic Electrical Technology, IIT Kharagpur, Prof. N.K. De, Prof. G.D. Roy, Prof. T.K. Bhattacharya <https://nptel.ac.in/courses/108105053>

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FUNDAMENTAL ELECTRICAL ENGINEERING LAB (FEEL)			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
Guidelines for Laboratory/ TW Assessment: 1. Continuous assessment of laboratory work is to be done based on overall performance and Laboratory performance of student. 2. Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage. 3. Suggested parameters for overall assessment as well as each Laboratory assignment include- timely completion, performance, efficiency, punctuality, and neatness. 4. Detailed Rubric of Evaluation will be applicable as per Exam Policy.			
LIST OF EXPRIMENTS / ASSIGNMENTS			
Part A – All 3 experiments are Compulsory 1. To study safety precautions while working on electrical systems, handling of various equipment's such as rheostat, multi-meter, ammeters, voltmeters, watt meters etc. 2. Study of wiring materials, switch board and different wiring schemes. (Simple wiring & staircase wiring). 3. Study of Batteries: Lead Acid and Lithium Battery.			
Part B – Any 1 Experiment out of 2 can be conducted 4. To measure steady state response of series RL and RC circuits experimentally. 5. Direct Loading test on single phase transformer.			
Part C – Any 2 Experiment out of 3 can be conducted 6. To verify Kirchhoff's laws experimentally. 7. To verify Superposition Theorem experimentally. 8. To verify Thevenin's Theorem experimentally.			
Part D – Simulation based Activity: Learning through virtual laboratory – Any 2 Activities out of 4 can be conducted 1. Virtual Lab 1: To verify KVL and KCL: https://bes-iitr.vlabs.ac.in/exp/kirchhoff-law/simulation.html 2. Virtual Lab 2: To get familiarize with the electrical devices : https://bes-iitr.vlabs.ac.in/exp/electrical-equipments/simulation.html 3. Virtual Lab 3: To study the efficiency of the single phase transformer : https://bes-iitr.vlabs.ac.in/exp/single-phase-transformer/simulation.html 4. Virtual Lab 4: Demonstration of cut section of D.C. Machine: https://bee-iitk.vlabs.ac.in/exp/cut-out-sections-machines/simulation.html			

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ENGINEERING GRAPHICS (EG)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	26-01ESC122	CIE	40 M
TEACHING HRS. / WK	02		
TUTORIAL	01	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
- Knowledge of elementary geometry, geometric constructions, and basic mathematics. - Fundamental understanding of scales, measurements, and coordinate systems. - Basic spatial visualization and imagination skills for interpreting engineering objects.			
COURSE OBJECTIVES			
1. Develop imagination of physical objects for engineering communication. 2. Develop the interpretation of drawing skills.			
COURSE OUTCOMES			
Upon successful completion of the course, the learner will be able to: CO1 - Apply projection method to represent points and lines using the first-angle method of projection. CO2 – Apply projection method to draw projections of planes. CO3 - Construct standard engineering curves and lateral surface developments of common engineering solids CO4 - Apply orthographic projection principles to generate 2D and sectional views of engineering objects. 5 - Apply visualization skills to draw isometric projections from given orthographic views.			
COURSE CONTENTS			
UNIT 1: FUNDAMENTALS OF ENGINEERING DRAWING AND PROJECTION OF LINES Introduction to Engineering Drawing, drawing instruments, drawing sheet layouts, types of lines, dimensioning. Theory of projection, projection of points, lines, lines inclined to both reference planes using the first-angle projection method, free hand sketching.			
UNIT-II: PROJECTION OF PLANES Introduction to plane, types of planes, projection of planes, and projection of planes inclined to both reference planes (Resting on HP & VP).			
UNIT III: ENGINEERING CURVES AND DEVELOPMENT OF LATERAL SURFACES ENGINEERING CURVES Engineering Curves Construction of conic sections Ellipse, Parabola and Hyperbola using the directrix-focus and rectangle method (Ellipse and parabola), helix on a cylinder/Cone, cycloid, involute and Archimedean spiral.(1,1.5 etc. Convolutions)			

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Development of Lateral Surfaces

Introduction to development of the lateral surfaces & its industrial applications. Draw the developments of lateral surfaces for cut section of cone, Pyramid & Prisms etc.

UNIT IV: ORTHOGRAPHIC PROJECTION

Introduction to orthographic projection, first-angle and third-angle methods of projection, obtaining orthographic projections of given solid by using first angle method of projection, sectional orthographic projections.

UNIT V: ISOMETRIC PROJECTION

Introduction to isometric projection, isometric and natural scale, construction of isometric views from the given orthographic views.

Guidelines for Practical Evaluation: Students shall complete the prescribed sheets on A2-size drawing sheets. Students shall also demonstrate any two assigned problems using CAD software.

List of Sheets:

1. Solve and construct two problems on the projection of lines.
2. Construct two problems on the projection of planes.
3. Solve one problem on engineering curves and develop the lateral surfaces of a given standard solid.
4. Generate orthographic projections (2D views) for two given engineering components using first-angle projection.
5. Construct isometric views for two given objects from their corresponding orthographic views.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Madsen, D. P. and Madsen, D. A., (2016), "Engineering Drawing and design", Delmar Publishers Inc., USA
2. Bhatt, N. D., (2018), "Machine Drawing", Charotar Publishing House, Anand, India
3. Dhawan, R. K., (2000), "A Textbook of Engineering Drawing", S. Chand, New Delhi
4. Luzadder, W. J. and Duff, J. M., (1992), "The Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics for Design and Production", Peachpit Press, USA

Text Books:

1. Bhatt, N. D. and Panchal, V. M., (2016), "Engineering Drawing", Charotar Publication, Anand, India
2. K. Venugopal, K, (2015), "Engineering and Graphics", New Age International, New Delhi
3. Jolhe, D. A., (2015), "Engineering Drawing with introduction to AutoCAD", Tata McGraw Hill, New Delhi
4. Rathnam, K., (2018), "A First Course in Engineering Drawing", Springer Nature Singapore Pte. Ltd., Singapore

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WEB LINKS AND VIDEO LECTURES (E-RESOURCES)
Online Resources: MOOC / NPTEL/YouTube Links: NPTEL Course: Engineering Graphics and Design https://onlinecourses.nptel.ac.in/noc21_me128/preview NPTEL Course: Introduction and Geometric Construction https://archive.nptel.ac.in/content/storage2/courses/112103019/module1/lec3/1.html NPTEL Course: Computer Aided Design and Manufacturing” https://archive.nptel.ac.in/courses/112/102/112102101/

PROBLEM SOLVING USING PYTHON (PSP)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601PCC114	CIE	40 M
TEACHING HRS. / WK	02		
PRACTICAL HRS./WK	02	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Basics of Computers and Basic Mathematics			
Fundamentals of Programming Languages			
COURSE OBJECTIVES			
CO1: To introduce problem-solving concepts and the basics of Python programming.			
CO2: To understand Python data types, decision-making, and looping statements.			
CO3: To learn functions and string operations for developing Python programs.			
CO4: To understand file handling and the use of Python built-in libraries.			
CO5: To learn the fundamentals of object-oriented programming using Python.			
COURSE OUTCOMES			
After completion of this course, student shall be able to:			
CO1: Understand problem-solving techniques and write basic Python programs.			
CO2: Use Python data types, decision-making, and looping statements to solve problems.			
CO3: Develop Python programs using functions and string operations.			
CO4: Perform file handling operations and use Python libraries in programs.			
CO5: Develop simple object-oriented programs using classes and objects in Python.			
COURSE CONTENTS			

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UNIT 1: PROBLEM SOLVING, PROGRAMMING AND PYTHON PROGRAMMING:

General Problem Solving Concepts- Problem solving in everyday life, Types of problems, problem solving with computers, problem Solving steps.

Basics of Python Programming: Features of Python, History and Future of Python, Applications of Python, Writing and executing Python program, Literal constants, variables and identifiers, I/O operation, Comments, Reserved words, Indentation, good programming practices.

UNIT 2: ADVANCED DATA TYPES AND FLOW CONTROL

Advanced Data Types in Python: List, Tuple, Set, Dictionary.

Flow Control and Loops: Decision Making: if statement, if...else statement, if..elif ..else statement, Nested if statement; Loops : while loop , for loop, range() function, continue and break statement, while and for loop with else statement, pass statement

UNIT 3: FUNCTIONS AND STRINGS

Need for functions, Function: definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string.

Strings and Operations: concatenation, appending, multiplication and slicing. Strings are immutable, string formatting operators, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings.

UNIT 4: FILE HANDLING AND PYTHON LIBRARIES

Introduction, File path, Types of files, Modes of file, Attributes of file object, Opening and Closing files, Reading and Writing files.

Basics of Python Built-in Libraries: Introduction to modules, import, from import, as keyword, math Library, random Library, datetime Library, numpy and pandas.

UNIT 5: OBJECT ORIENTED PROGRAMMING

Features of Object oriented programming-classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and encapsulation. class method and self-argument, __init__() method, __del__() method, Built in function to check, Get, Set and Delete class attribute, Garbage collection.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978 0132492645
2. Romano Fabrizio, "Learning Python", Packt Publishing Limited, ISBN: 9781783551712, 1783551712
3. Paul Barry, "Head First Python- A Brain Friendly Guide", SPD O'Reilly, 2nd Edition, ISBN:978-93-5213-482-3
4. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, ISBN 10:9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
5. Jeeva Jose, P. Sojan Lal, "Introduction to Computing & Problem Solving with Python", Khanna Computer Book
6. Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978 9382609810

Text Books:

Ajeenkya D Y Patil School of Engineering Lohegaon, Pune
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1. Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, ISBN 13: 978-0-19-948017-6
2. R. Nageswara Rao, "Core Python Programming", Dreamtech Press; Second edition ISBN10:938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

Youtube/NPTEL Links

<https://www.youtube.com/watch?v=keYxU7Ou754&list=PLIt9A5yCuugkrHMpgndt59e0PPUqjyQ6&iindex=6->

<https://youtu.be/tA42nHmmEKw?eN>

<https://nptel.ac.in/courses/106104074> <https://nptel.ac.in/courses/106106182>

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PROBLEM SOLVING USING PYTHON LAB			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Basic knowledge of computer fundamentals and operating systems.			
COURSE OBJECTIVES			
CO1: To introduce problem-solving concepts and the basics of Python programming. CO2: To understand Python data types, decision-making, and looping statements. CO3: To learn functions and string operations for developing Python programs. CO4: To understand file handling and the use of Python built-in libraries. CO5: To learn the fundamentals of object-oriented programming using Python.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Understand problem-solving techniques and write basic Python programs. CO2: Use Python data types, decision-making, and looping statements to solve problems. CO3: Develop Python programs using functions and string operations. CO4: Implement file handling operations and Python libraries in programs. CO5: Apply Object-oriented programs using classes and objects in Python.			
LIST OF ASSIGNMENTS			
List of Laboratory Experiments (Perform any eight programs) 1. To calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions. 2. Program to demonstrate operation on lists. 3. Program to find whether the given number is even or odd. 4. Program to print the multiplication table of n, where n value is entered by user. 5. Program to find whether the given number is an Armstrong number or not. 6. Program to demonstrate string operations. 7. Program to perform all operation (addition, multiplication, subtraction, division) by using user defined function 8. Program to calculate factorial of number using user defined function. 9. Perform Python program that reads a text file and calculates the total number of characters, words, lines, and the frequency of a user-specified word. 10. Program to access class variable using class object. 11. Program to generate and display the Fibonacci series			

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SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)	
Reference Books:	
7.	R. G. Dromey, “How to Solve it by Computer”, Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629
8.	Maureen Spankle, “Problem Solving and Programming Concepts”, Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978 0132492645
9.	Romano Fabrizio, “Learning Python”, Packt Publishing Limited, ISBN: 9781783551712, 1783551712
10.	Paul Barry, “Head First Python- A Brain Friendly Guide”, SPD O’Reilly, 2nd Edition, ISBN:978-93-5213-482-3
11.	Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education, ISBN 10:9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
12.	Jeeva Jose, P. Sojan Lal, “Introduction to Computing & Problem Solving with Python”, Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978 9382609810
Text Books:	
1.	Reema Thareja, “Python Programming Using Problem Solving Approach”, Oxford University Press, ISBN 13: 978-0-19-948017-6
2.	R. Nageswara Rao, “Core Python Programming”, Dreamtech Press; Second edition ISBN10:938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

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PROFESSIONAL COMMUNICATION SKILLS			
Course Type: Ability Enhancement Course			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601AEC109	TW	25 M
TEACHING HRS. / WK	02		
CREDITS	02		
PREREQUISITES			
English - Basic knowledge of Listening, Speaking, Reading, and Writing (LSRW) skills, and readiness to participate in classroom discussions, presentations, teamwork, and other interactive activities.			
COURSE OBJECTIVES			
1. To introduce the basic concepts of self-confidence, effective communication, active listening, and presentation skills. 2. To explain the importance of time management, teamwork, leadership, interpersonal skills, and professional communication. 3. To apply career readiness and stress management strategies for effective career planning, employability, and personal well-being.			
COURSE OUTCOMES			
On successful completion of the course, students will be able to 1. Define the concepts of self-confidence, effective communication, active listening, and presentation skills. 2. Explain the importance of time management, teamwork, leadership, interpersonal, and professional communication skills. 3. Apply career readiness and stress management strategies to improve employability, career planning, and personal well-being.			
COURSE CONTENTS			
UNIT 1: FOUNDATIONS OF PERSONAL AND COMMUNICATION SKILLS:			
Introduction: Soft skills Introduction, what are soft skills, Need for soft skills			
Module 1: Self-Awareness and Personal Development: Strengths and weaknesses, goal setting, growth mindset, confidence building.			
Module 2: Communication Skills: Basics of communication, verbal and non-verbal communication, active listening, questioning skills, barriers to communication, effective speaking, professional vocabulary.			
Lab Activity 1: Self-Assessment and personal development through SWOT Analysis			
Lab Activity 2: Practice of effective communication and active listening skills, Role-Play activities.			
UNIT 2: EFFECTIVE TIME MANAGEMENT AND PROBLEM SOLVING			
Module 3: Presentation and Public Speaking: Presentation structure, introduction and conclusion, body language, voice modulation, overcoming stage fear, use of visual aids, technical presentation			

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Module 4: Time Management Importance of Time Management, Ways to manage time in work, Time Management for the Multi tasker Time management and Problem solving.

Lab Activity 3: Preparation and delivery of an effective technical presentation.

Lab Activity 4: Time management and priority planning activity.

UNIT 3: PROFESSIONAL DEVELOPMENT AND EMOTIONAL WELL-BEING

Module 5: Teamwork and Interpersonal Skills Team building, collaboration, empathy, respect, conflict management, leadership basics, Functions and responsibilities of leadership, peer interaction, group activities.

Module 6: Professional and Workplace Communication

Professional etiquette, email etiquette, telephone etiquette, time management, work ethics, workplace behaviours, problem-solving and decision-making.

Lab Activity 5: Team building and leadership skills through group activities.

Lab Activity 6: Practice of professional communication and workplace etiquettes.

UNIT 4: PERSONAL BRANDING AND EMPLOYABILITY

Module 7: Career Readiness and Employability Skills

Resume preparation, Linked In profile basics, interview skills, group discussion, aptitude awareness, personal branding, internship and career planning.

Lab Activity 7: Practice of professional communication and workplace etiquettes.

Lab Activity 8: Career readiness through resume, group discussion and mock interview.

UNIT 5: PERSONAL WELL-BEING AND STRESS MANAGEMENT

Module 8: Stress Management & Emotional Well being

Introduction to stress, causes and types of stress, recognizing signs of stress, acknowledging and accepting stress, common student stressors, stress management techniques, relaxation and breathing exercises, time management, maintaining work-life balance, developing healthy habits.

Activity 9: Identification and management of stress for personal well-being.

Activity 10: Campus to Career Communication Challenge

Activity 11: Professional Development Portfolio and Action Plan

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

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Reference Books:

1. Developing Communication Skills by Krishna Mohan & Meera Banerji (Macmillan)
2. Business Correspondence and Report Writing, R. C. Sharma & Krishna Mohan (Tata McGraw Hill)
3. Sasikumar et al. A Course in Listening and Speaking. New Delhi: Foundation Books, 2005.
4. Tony Lynch, Study Listening. Cambridge: Cambridge UP, 2004.

Text Books:

1. Communication Skills for Engineers by S. Mishra & C. Muralikrishna (Pearson)
2. Communication Skills for Technical Students by T.M. Farhatullah (Orient Longman)
3. Written Communication in English by Saran Freeman (Orient Longman)
4. Essential English Grammar (Elementary & Intermediate) Raymond Murphy (CUP)
5. Communication for Business: A Practical Approach by Shirley Tailor (Longman)
6. Psychology of Adjustment and Stress (F.Y.B.A, Sem.-I) SPPU-Text(English), Dr. Ganesh Lokhande, Dr. Laxman Shitole (India).

WEB LINKS AND VIDEO LECTURES (E-RESOURCES)

NPTEL course:

1. Prof. Binod Mishra, IIT Roorkee, Soft Skill, nptel.ac.in/courses/109107121
2. Prof. T. Ravichandran, IIT Kanpur, Developing Soft Skills and Personality, nptel.ac.in/courses/109104107

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INDIAN KNOWLEDGE SYSTEM (IKS)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601 IKS 115	TW	25 M
TEACHING HR. S/WK	02		
CREDITS	02		
PREREQUISITES			
Basic awareness of Indian history and culture and willingness to participate in classroom discussions, presentations and interactive learning activities.			
COURSE OBJECTIVES			
6. To introduce students to the foundational concepts of Indian knowledge systems and their significance. 7. To familiarize students with key dates in Indian history and the historical timeline. 8. To explore significant scientific achievements in ancient India and analyze scientific texts and inventions. 9. To examine the role of engineering in ancient India and its contributions to metallurgy, materials science, and architectural techniques. 10. To provide an overview of Indian philosophical systems and their relevance.			
COURSE OUTCOMES			
On completion of this course, learners will be able to- 2. CO 1 - Understand the significance and historical context of Indian knowledge systems. 3. CO 2 - Comprehend Indian philosophical concepts, scientific achievements, and their interplay. 4. CO 3 - Analyze and compile the Scientific achievements, texts and inventions; mathematics and astronomy. 5. CO 4 - Recognize the role of engineering in ancient India and its impact on architecture and materials. 6. CO 5- Apply ancient Indian engineering principles in modern practices while considering cultural and environmental aspects.			
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COURSE CONTENTS			

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UNIT 1: FOUNDATIONS OF INDIAN KNOWLEDGE SYSTEM AND HISTORICAL CONTEXT

Key dates and historical timeline

- Historical context and development of Indian knowledge traditions
- Vedic Period
- Vedas and their significance

UNIT 2: INDIAN PHILOSOPHICAL SYSTEMS

Overview of Indian philosophical systems and their relevance

- Relationship between philosophical thought, knowledge, values and life
- Six Schools of Indian Philosophy
- Gurukul System in Ancient India

UNIT 3: SCIENTIFIC ACHIEVEMENTS IN ANCIENT INDIA

Significant scientific achievements

- Scientific texts and inventions
- Development of scientific thought
- Contributions to Mathematics and Astronomy

UNIT 4: .ENGINEERING IN ANCIENT INDIA

Role of engineering in Ancient India

- Contributions to metallurgy and materials science
- Engineering practices and technological knowledge
- Medicines in Ancient India

UNIT 5: A. ARCHITECTURE, MATERIALS AND MODERN RELEVANCE

Architectural techniques

- Impact of ancient engineering on architecture and materials
- Application of ancient Indian engineering principles in modern practices
- Cultural and environmental aspects

B. GLOBAL INFLUENCE, REVIEW AND CONCLUSION

Global influence of Indian knowledge traditions

- Review of major concepts and contributions
- Contemporary relevance and applications
- Conclusion and overall learning synthesis

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List of Activities

Sr.	Unit	Activity	Brief Description
1	Unit 1	Timeline & IKS Concept Map	Prepare a visual timeline and concept map of major IKS periods, developments and domains.
2	Unit 2	Six Schools – Group Discussion	Groups present key ideas of the six schools of Indian philosophy and their relevance to life.
3	Unit 3	Ancient India Science Gallery	Posters/models on mathematics, astronomy, scientific texts and inventions.
4	Unit 4	Heritage Engineering Case Study	Case study on metallurgy, materials, engineering practices or medicines in ancient India.
5	Unit 5	Traditional Knowledge to Modern Solution	Propose a culturally and environmentally responsible modern application of an ancient practice.
6	Units 1–5	IKS Quiz & Reflection	Interactive quiz followed by reflection on links among history, science, engineering and values.

A. STUDENT-CENTRIC ACADEMIC ACTIVITIES

B. GUEST LECTURE / EXPERT INTERACTION PLAN

Sr. No.	Proposed Guest Lecture	Suggested Resource Person
1	IKS and Indian Knowledge Tradition	IKS scholar / faculty expert
2	Scientific & Mathematical Heritage of Ancient India	Historian of science / mathematics / astronomy expert
3	Ancient Indian Engineering, Metallurgy & Architecture	Civil / materials / heritage engineering expert
4	Traditional Knowledge & Sustainable Modern Practices	Sustainability / heritage practitioner

C. CO-ALIGNED ACTIVITY SUMMARY

CO	CO Focus	Mapped Activities / Lectures	Suggested Evidence
CO1	Historical context and significance of IKS	Timeline, concept map, quiz/reflection	Understanding + communication
CO2	Philosophical concepts and interplay with knowledge/values	Six Schools discussion + guest interaction	Discussion + presentation
CO3	Scientific achievements, texts, mathematics and astronomy	Science Gallery + expert lecture + quiz	Analysis + compilation

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CO4	Engineering, architecture and materials	Heritage case study + expert lecture	Case-study analysis
CO5	Application of ancient principles in modern practice	Modern solution project + sustainability lecture	Application + problem solving
SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS/ E-RESOURCES)			

Reference Books

2. **Mahadevan, B., Bhat, V. R. & Nagendra Pavana, R. N.** *Introduction to Indian Knowledge System: Concepts and Applications*. PHI Learning Pvt. Ltd., 2022.
3. **Kapil Kapoor.** *Indian Knowledge Traditions: An Introduction*.
— Useful for understanding Indian intellectual traditions, philosophy, language and knowledge frameworks.
4. **Kim Plofker.** *Mathematics in India: 5000 Years of History*. Princeton University Press.
— Particularly useful for the **ancient Indian mathematics and astronomy** component.
5. **George Gheverghese Joseph.** *The Crest of the Peacock: Non-European Roots of Mathematics*. Princeton University Press.
— Useful for studying India's contributions to mathematics in a broader historical context.
6. **D. P. Chattopadhyaya (Ed.).** *History of Science, Philosophy and Culture in Indian Civilization*. Centre for Studies in Civilizations.

Textbooks

2. **Indian Knowledge Systems (IKS) Division, Ministry of Education, Government of India** – Official IKS resources, initiatives, lectures, publications and educational material.
3. **AICTE Indian Knowledge Systems resources** – Curriculum-related material, webinars, lectures and resources for higher-education learners.
4. **SWAYAM / SWAYAM Plus** – Online courses and learning material related to Indian heritage, philosophy, science, culture and traditional knowledge.
5. **IGNCA – Indira Gandhi National Centre for the Arts** – Digital resources on Indian cultural heritage, traditional knowledge, arts, literature and civilisation.
6. **Digital Library of India / Internet Archive – selected authentic historical texts** – Useful for accessing digitized classical and historical sources for student assignments and case studies.

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INTEGRATED PERSONALITY DEVELOPMENT			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601CC116	TW	25 M
TEACHING HRS. / WK	02		
CREDITS	02		
		TOTAL	25 M
PREREQUISITES			
Basic Communication skill, Self Awareness, Growth Mindset and willingness to participate in classroom discussions and other interactive activities.			
COURSE OBJECTIVES			
1. To understand the importance of soft skills and their role in personal, academic, and professional success. 2. To impart self-awareness, emotional intelligence, and self-confidence to manage emotions effectively and build positive relationships. 3. To cultivate a positive attitude and growth mindset by embracing continuous learning, resilience, and adaptability.			
COURSE OUTCOMES			
On the successful completion of the course, students will be able to CO1: Understand the role of self-awareness, positive attitude, growth mindset, resilience, and adaptability in everyday life. CO2: Impart knowledge of decision-making, adaptability, and personal, social, and professional etiquette. CO3: Apply the key elements of personal growth such as goal setting, self-discipline, financial Awareness, and holistic development. CO4: Demonstrate effective verbal, non-verbal and written communication skills by applying active listening ,questioning, clarity, confidence, presentation and public-speaking techniques in academic and professional situation. CO5: Develop a personal career and professional development plan incorporating SMART goals, Employability skills, ethical responsibility, problem-solving, teamwork, and continuous improvement. .			
COURSE CONTENTS			
UNIT 1:SELF-AWARENESS AND POSITIVE MINDSET Module 1: Self-Awareness: Self-awareness, knowing yourself, identifying strength and areas of improvement, self-confidence, understanding and managing emotions, empathy, Managing Situational Reactions. Module 2: Positive Attitude and Growth Mindset: Positive thinking and growth mindset, Reflecting on Experiences, Resilience, Adapting to change, continuous learning. UNIT 2: LIFE SKILLS AND PERSONAL DEVELOPMENT Module 3: Decision Making and Problem Solving: Understanding problems, logical and creative thinking, decision making steps, finding solutions, understanding the effects of decisions, handling difficult situations, basic critical thinking. Module 4: Personal Development through Adaptability: Open-minded Thinking, adapting to new situations, handling uncertainty, Learning from different experiences.			

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Module 5: Professional, Personal and Social Etiquettes: Personal grooming, professional appearance, body language, good manners, workplace behaviors, respect for others, cultural understanding, responsible professional behavior.

UNIT 3: DIGITAL FOOTPRINT, RESPONSIBLE CITIZENSHIP AND HOLISTIC DEVELOPMENT

Module 6: Digital existence and Responsible citizenship: Positive digital identity, responsible use of social media, online behavior, digital footprint, privacy and basic cybersecurity, Digital citizenship.

Module 7: Personal Growth and Life Skills: Setting Personal goals, good habits, self-discipline, work life balance, basic financial awareness and budgeting, daily decision making, personal development plan, Holistic development.

UNIT 4: COMMUNICATION, COLLABORATION AND INTERPERSONAL SKILLS

Module 8: Effective Communication Skills: Basics of effective communication , verbal and non-verbal communication ,active listening and asking effective questions , speaking with clarity and confidence , developing presentation and public-speaking skills , overcoming hesitation and communication barriers .

Module 9: Teamwork and Interpersonal Relationships: Understanding teamwork and collaboration, Building trust and positive relationships, conflict management and resolution, giving and receiving constructive feedback, leadership and team participation, developing cooperation and mutual support.

UNIT 5: CAREER READINESS AND PROFESSIONAL EXCELLENCE

Module 10: Career Awareness and Goal Setting: Understanding career opportunities in engineering, identifying personal interests, Setting SMART academic and career goals, creating a personal development plan, developing employability skills.

Module 11: Professional readiness and workplace skills: Interview preparation and interview etiquette, Group discussions and teamwork, Workplace communication and professionalism, time management and meeting deadlines, Workplace ethics and responsibility, developing a problem-solving and solution-oriented approach.

Sr.No.	Name Of Activity
1.	My Strengths & Improvement Areas – Prepare a personal SWOT analysis.
2.	Self-Confidence Activity – “Three Things I Am Good At” sharing exercise.
3	Situational Reaction Activity – Discuss and role-play appropriate responses to challenging situations.
4.	Positive Thinking Challenge – Convert negative statements into positive and constructive ones.
5.	Resilience Case Study – Analyse stories of people who overcame difficulties.
6.	Decision-Making Tree – Create a decision tree for a real-life problem.

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7.	Change Management Activity – Discuss how students react when plans suddenly change.
8.	Open-Mindedness Debate – Discuss a topic from two different perspectives.
9.	Workplace Etiquette Role Play – Practise punctuality, teamwork, meetings, phone etiquette, and workplace behaviour.
10.	Social Media Do's and Don'ts – Create a responsible social-media-use poster.
11.	Digital Identity Activity – Design a positive and professional online identity.
12.	Work-Life Balance Wheel – Assess time spent on study/work, health, family, hobbies, and rest.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Covey, Stephen R. The 8th Habit: From Effectiveness to Greatness. Free Press.
2. Maxwell, John C. Developing the Leader Within You 2.0. HarperCollins Leadership.
3. Cottrell, Stella. Critical Thinking Skills: Effective Analysis, Argument and Reflection. Palgrave Macmillan.
4. de Bono, Edward. Lateral Thinking: Creativity Step by Step. Harper Perennial.
5. Goleman, Daniel. Working with Emotional Intelligence. Bantam Books.
6. Clear, James. Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones. Avery.

Text Books:

1. Goleman, Daniel. Emotional Intelligence: Why It Can Matter More Than IQ. Bantam Books.
2. Carnegie, Dale. How to Win Friends and Influence People. Simon & Schuster.
3. Covey, Stephen R. The 7 Habits of Highly Effective People. Simon & Schuster.
4. Dweck, Carol S. Mindset: The New Psychology of Success. Ballantine Books.
5. Sharma, Meenakshi Raman & Sangeeta Sharma. Technical Communication: Principles and Practice. Oxford University Press.

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SYSTEMS IN MECHANICAL ENGINEERING (SME)			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601PCC125	CIE	40 M
TEACHING HRS. / WK	02		
Practical Hrs./WK	02	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Basic understanding of fundamental concepts of Physics, Mathematics.			
COURSE OBJECTIVES			
1. To impart fundamental concepts of energy conversion devices and thermal engineering principles. 2. To familiarize students with automobile classification, powertrain systems, and modern electric/hybrid vehicle technologies. 3. To introduce the fundamental concepts of conventional manufacturing processes. 4. To develop an understanding of basic engineering mechanisms and their practical applications in domestic appliances			
COURSE OUTCOMES			
Upon successful completion of the course, the learner will be able to: CO1: Describe conventional and non-conventional energy conversion processes and thermal power plant performance. CO2: Apply fundamental laws of thermodynamics and heat transfer to solve basic thermal engineering problems. CO3: Illustrate various basic parts and transmission system of a road vehicle. CO4: Select appropriate manufacturing processes for producing given engineering components. CO5: Explain the working principles of kinematic mechanisms used in everyday household applianceshousehold appliances.			
COURSE CONTENTS			

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UNIT 1: INTRODUCTION TO ENERGY SOURCES AND ITS CONVERSION

Energy sources, conventional (Thermal, Hydropower, Nuclear) and non-conventional energy sources (Solar, Geothermal, Wind, Hydrogen, Biomass, Tidal). Numericals on efficiency calculation of thermal power plant, Grades of energy

UNIT 2: INTRODUCTION TO THERMAL ENGINEERING

Laws of thermodynamics, Heat engine, heat pump, refrigerator (Simple numerical), Modes of heat transfer: conduction, convection and radiation. Fourier's law, Newton's law of cooling, Stefan Boltzmann's law, Simple numericals on heat transfer, Two stroke and four stroke engine.

UNIT 3: VEHICLES AND THEIR SPECIFICATIONS

Classification of automobile, Specifications of different vehicles, Power train system in vehicle, Fuel injection system and fuel supply system, Study of power transmission system, clutch, gear box. Introduction of chassis layouts, Introduction of Electric and Hybrid Vehicles.

UNIT 4: INTRODUCTION TO MANUFACTURING

Conventional Manufacturing Processes: Casting, Forging, Metal forming (Drawing, Extrusion, etc.), Sheet metal working, Metal joining, etc. Metal Cutting processes and Machining operations- Turning, Milling and Drilling, etc.

UNIT 5: ENGINEERING MECHANISMS AND THEIR APPLICATIONS IN DOMESTIC APPLIANCES

Introduction to basic mechanisms, 4 bar chain mechanism and slider crank mechanism, Compressors- Refrigerator, Water cooler, Split AC unit, Pumps - Water pump for overhead tanks, Blower - Vacuum cleaner, Kitchen Chimney, Motor - Fans, Exhaust fans, Washing machines, Springs - Door closure, door locks, etc. Gears - Wall clocks, watches, Printers, etc.

List of Experiments (Any 8):

1. Demonstration of energy conversion devices.
2. Demonstration of IC Engine
3. Demonstration of power train system in the vehicle.
4. Demonstration of machine tool.
5. Demonstration of a domestic refrigerator or window air conditioner.
6. Demonstration of automobile transmission systems.
7. Demonstration of EV components.
8. Case Study on Specifications of Passenger Car.
9. Case Study on Mechanical Systems Used in Washing Machines and Kitchen Chimneys.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

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Reference Books:

1. Khan, B. H., "Non-Conventional Energy Sources, Tata McGraw-Hill Publisher Co. Ltd.
2. Boyle, Godfrey, "Renewable Energy", 2nd Ed., Oxford University Press
3. Khurmi, R.S. ,and Gupta, J. K., "A Textbook of Thermal Engineering", S. Chand & Sons
4. Incropera, F. P. and Dewitt, D.P., (2007), "Fundamentals of Heat and Mass Transfer, 6th Ed., John Wiley and Sons, USA

Text Books:

1. Nag, P. K., "Engineering Thermodynamics," Tata McGraw-Hill Publisher Co. Ltd.
2. Chaudhari and Hajra, "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers, Mumbai
3. Agrawal, Basant and Agrawal, C. M., (2008), "Basics of Mechanical Engineering", John Wiley and Sons, USA
4. Rajput, R.K., (2007), "Basic Mechanical Engineering", Laxmi Publications Pvt. Ltd.
5. Pravin Kumar, (2018), " Basic Mechanical Engineering, 2nd Ed.", Pearson (India) Ltd.
6. Moran, M. J., Shapiro, H. N., Boettner, D. D., and Bailey, M. "Fundamentals of Engineering Thermodynamics", Wiley
7. Surinder Kumar, (2011), "Basic of Mechanical Engineering", Ane Books Pvt. Ltd. New Delhi

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FUNDAMENTALS OF CIVIL ENGINEERING			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	26-01-PCC-124	CIE	40 M
TEACHING HRS. / WK	02		
Practical Hrs./WK	02	ESE	60 M
CREDITS	03	TW	25 M
		TOTAL	125 M
PREREQUISITES			
Fundamental understanding of Science and Environmental Studies			
COURSE OBJECTIVES			
Course Objectives: 1. To provide knowledge of basic areas in Civil Engineering and Planning. 2. To build conceptual knowledge of building components. 3. To provide knowledge of field measurements and levelling instruments for field survey. 4. To understand the infrastructure development and the role of a civil engineer for sustainable development. 5. To build basic knowledge of water supply, water treatment and role of engineer in environmental.			
COURSE OUTCOMES			
On completion of this course, the students will be able to CO1: Describe the basic areas of civil engineering and the role of civil engineer in the society. CO2: Make use of the surveying techniques and to solve problems related with levelling. CO3: Explain the types and uses of building material, different components of a building and types of foundations. CO4: Describe the role of civil engineer in transportation. CO5: Explain the basic concepts of water supply, water treatment and role of engineer in environmental..			
COURSE CONTENTS			
UNIT 1: INTRODUCTION TO CIVIL ENGINEERING Areas in civil engineering Introduction to infrastructure development in India, sustainable development goals, smart city concept, Role and responsibilities of civil engineer in the construction. UNIT 2: SURVEYING AND LEVELLING Objectives and principles of surveying, types of surveying: chain and compass surveying, Instruments used: chain, tape, ranging rod, compass, dumpy level. Introduction to modern surveying equipment: EDM, Laser, Total Station, DGPS Levelling: Terms, levelling instruments, types of levelling, finding Reduced Levels by height of instrument method. Applications of surveying in civil engineering projects. UNIT 3: MATERIALS AND CONSTRUCTION Conventional and Advance construction materials, Planning: Principles of planning Introduction to function of Substructure and Superstructure.			

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Fundamental requirements of masonry – Types of masonry

UNIT 4: TRANSPORT SYSTEMS

Introduction, history and development of transportation, Modes of Transportation (Air, water and road)

Highway engineering: Types of pavement, cross-section, and components of road..

UNIT 5: BASICS OF ENVIRONMENTAL ENGINEERING

Overview of Water Treatment: various unit operations in water treatment plant Physio chemical characteristics of water, drinking water standards as per IS 10500:2012. Overview of Waste Water Treatment plant and unit operations, Characteristics of domestic waste water, Reuse and recycling of treated wastewater. Introduction to solid waste management. Role of environmental engineer in sustainable development

TERMWORK:

List of Activities (All activities are Compulsory)

1. Making poster on various areas in Civil Engineering (A3 Size sheet)
2. Surveying: Finding R.L using Height of instrument method.
3. Demonstrate the various types of bonds in Brick Masonry.
4. Draw cross section of Highway. (A3 size sheet)
5. Site visit to domestic Packaged Water Treatment Plant or Packaged Waste Water Treatment Plant.
6. Site Visit on any ongoing construction site.

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers (2011)
2. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England (2011).
3. McKay, W. B. and McKay, J. K., Building Construction, Vol. 1 to 4, Pearson India Education Services. (2013).
4. National Building Code –Bureau of Indian Standards 2016.

Text Books:

1. Rangwala, S.C and Dalal, K.B, Building Construction, Charotar Publishing House.
2. Surveying and Levelling by Kanitkar, Kulkarni – Pune Vidyarthi Prakashan
3. Building Planning and Built Environment by Shah, Kale, Patki – TaTa McGraw Hill
4. Basic Civil Engineering by S. S. Bhavikatti, New Age publications.

Online Resources:

Introduction to Civil Engineering Profession, NPTEL, IIT Madras
https://youtube.com/playlist?list=PLyqSpQzTE6M_SM0Lrnzk2dJFwElh0Ebhu&si=XjY0AQhe_Ju8RMY7

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DESIGN THINKING IDEATION LAB			
COURSE DETAILS		EVALUATION SCHEME	
COURSE CODE	2601VSL112	TW	25 M
PRACTICAL HRS. / WK	02		
		TOTAL	25 M
CREDITS	02		
COURSE OBJECTIVES			
6. Understand the core principles of design thinking and its role in engineering. 7. Analyze and solve complex problems. 8. Develop creative solutions to problem. 9. Evaluate and analysis design concepts and prototypes. 10. Demonstrate effective communication and collaboration in multidisciplinary teams.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1 Identify and define problems from a user's perspective. CO2 Apply empathy and observation to gain insights into user needs and behaviors CO3 Generate innovative ideas and solutions through brainstorming and ideation. CO4 Analyze and test design solutions to refine and improve them. CO5 Present and communicate design ideas effectively using visual aids and storytelling			
COURSE CONTENTS			
UNIT 1: INTRODUCTION TO DESIGN THINKING • Introduction to design thinking and its importance • User observation Assignment 1: Problem identification			
UNIT 2: IDEA GENERATION • Techniques for idea generation • Selection of the most appropriate solution Assignment 2: Idea generation and selection			
UNIT 3: PROTOTYPING • Introduction to prototypes and their importance • Creating prototypes to validate design concepts Assignment 3: Prototyping			
UNIT 4: ANALYSIS AND EVALUATION • Assessment of prototype as per user requirement • Incorporate user feedback and modifications Assignment 4: Methodology			
UNIT 5: PRESENTATION			

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- Team presentation and role distribution
- Visual communication and storytelling

Assignment 5: Presentation

SUGGESTED LEARNING RESOURCES (TEXT / REFERENCE BOOKS)

Reference Books:

1. Design Thinking: Understanding How Designers Think and Work by Nigel Cross
2. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by Tim Brown
3. Design Thinking for Visual Communication" by Ranjan Nayar and Jaidip Subedi
4. The Design of Everyday Things" by Don Norman "Design Thinking: Creativity and Innovation" by S. Balam
5. Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days" by Jake Knapp
6. Creative Confidence: Unleashing the Creative Potential Within Us All" by Tom Kelley and David Kelley (with a foreword by Ratan Tata).

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MANUFACTURING PRACTICE WORKSHOP			
COURSE DETAILS		EVALUATION SCHEME	
PRACTICAL HRS. / WK	02	TW	25 M
CREDITS	01		
PREREQUISITES			
Basic knowledge of engineering materials and tools Practical exposure to the manufacturing process, including the use of hand and power tools. Familiar with safety norms and the use of personal protective equipment (PPE) in a workshop setting.			
COURSE OBJECTIVES			
1.To understand the construction and working of machine tools and functions of its parts. 2.To develop the skill through hands-on practices using hand tools, power tools, electrical / electronic parts, programming tools, machine tools in manufacturing and assembly shops leading to understanding of a production process. 3. To understand workshop layout and safety norms.			
COURSE OUTCOMES			
After completion of this course, student shall be able to: CO1: Explain safety norms and factory layout of workshop. CO2: Produce a job using appropriate hand tools, cutting tools, machine tools, electronics and electrical parts. Develop a program of CNC machine. CO3: Demonstrate construction, working and functions of machine tools and their parts.			
Student must perform any six jobs/experiment out of eight.			
Experiment / Job			

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- 1. Safety considerations in workshop:** Safety rules and guidelines, Metal working shop safety precautions, Safety devices used in workshop, potentials hazard present in workshop.
- 2. Layout of Workshop/Factory:** Different sections of workshop, importance of respective locations of sections with respect to each other, area of different sections, plot of layout.
- 3. To develop a mechanical component by fitting, welding, drilling, riveting operations:** Measuring tools used in workshop, cutting tools used in workshop, finishing tools used in workshop, methods of filing, drilling operation, riveting operation, types of welding, part drawing.

OR

- To identify the peripherals of a computer, components in a CPU and its functions**
: Computer Assembly - Motherboard , Processor, RAM, SMPS, SSD/HDD, Cooling fan, Cabinet
- 4. Introduction to Advance machine tools (CNC, VMC):** Construction features of CNC, advantages and limitations, elements of CNC, principles of CNC.
 - 5. Introduction to 3D Printing:** Construction features of 3D printing, advantages and limitations, elements of 3D printing, principles of 3D printing.
 - 6. To write program on CNC to develop any mechanical component:** Process planning, tool selection, cutting process parameters planning, job and tool set up planning, machining path planning, part program writing, part program proving, ISO standards for coding, coordinate function, feed function, speed function, tool function, comments, preparatory functions (G codes), Miscellaneous functions (M codes)
 - 7. Basic Electrical wiring / Electronic soldering and disordering :** Execute staircase wiring (two-way switch), series/parallel lamp circuits, and a basic plug socket connection on a wooden board.

OR

Assemble a simple through-hole circuit (e.g., LED indicator with resistor, or a basic 555 timer blinker) on a perf board. Practice safe soldering and desoldering techniques.

- 8. Robotics and IoT :** Arduino Based Sensor Interface, LED, Push button, Temperature sensor, Ultrasonic sensor, Simple programming.

Learning Resources:

Reference Books:

1. John, K. C., (2024), "Mechanical Workshop Practice, Prentice Hall Publication, New Delhi.
2. Hazra and Chaudhary, Workshop Technology-I & II, Media promoters & Publisher Pvt. Ltd.

Text Books:

Workshop/Manufacturing practices (with lab manual), Khanna Publishing House, 2023