



B. Tech - Mechanical Engineering Course Structure (BT25)
Applicable From 2025-26 Admitted Batch Structure Breakup

S. No	Category	Breakup of credits (Total 160 credits)
1	Humanities and Social Sciences including Management courses (HSMC)	7
2	Basic Sciences Courses (BS)	24
3	Engineering Sciences courses including Workshop, Drawing basics of electrical/mechanical/computer etc.(ES)	26
4	Professional Core courses (PC)	59
5	Professional Electives (PE)	18
6	Open Electives (OE)	9
7	Project work, Seminar and Internship in industry or elsewhere (PS)	17
8	Mandatory Courses	0
	TOTAL	160



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S. No.	Course Code	Course Title	Course Area	Hours Per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
Theory Courses										
1	2510001	Matrices and Calculus	BS	3	1	0	4	40	60	100
2	2510008	Advanced Engineering Physics	BS	3	0	0	3	40	60	100
3	2510502	C Programming and Data Structures	ES	3	0	0	3	40	60	100
4	2510301	Engineering Drawing and Computer Aided Drafting	ES	2	0	2	3	40	60	100
5	2510010	English for Skill Enhancement	HS	3	0	0	3	40	60	100
Laboratory Courses										
6	2510071	Advanced Engineering Physics Lab	BS	0	0	2	1	40	60	100
7	2510572	C Programming and Data Structures Lab	ES	0	0	2	1	40	60	100
8	2510371	Engineering Workshop	ES	0	0	2	1	40	60	100
9	2510073	English Language and Communication Skills Lab	HS	0	0	2	1	40	60	100
Value Added Course										
10		Foreign Language	*VAC	0	0	0	0	-	-	-
		Induction Programme	-	-	-	-	-	-	-	-
Total Credits				14	1	10	20	320	540	900

***VAC - Satisfied/Unsatisfied**

Students can choose any one of the foreign language from the given list

- i) 25X0FL1 French
- ii) 25X0FL2 German
- iii) 25X0FL3 Spanish
- iv) 25X0FL4 Korean



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I YEAR II SEMESTER

S. No	Course Code	Course Title	Course Area	Hours Per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
Theory Courses										
1	2520002	Ordinary Differential Equations and Vector Calculus	BS	3	0	0	3	40	60	100
2	2520011	Applied Chemistry	BS	3	0	0	3	40	60	100
3	2520503	Python Programming	ES	3	0	0	3	40	60	100
4	2520202	Elements of Electrical and Electronics Engineering	ES	3	0	0	3	40	60	100
5	2520302	Engineering Mechanics	ES	3	0	0	3	40	60	100
6	2520316	Material Science and Metallurgy	PC	3	0	0	3	40	60	100
Laboratory Courses										
1	2520076	Chemistry Lab for Engineers	BS	0	0	2	1	40	60	100
2	2520575	Python Programming Lab	ES	0	0	2	1	40	60	100
3	2520272	Elements of Electrical and Electronics Engineering Lab	ES	0	0	2	1	40	60	100
Value Added Course										
1	2520026	Yoga & Inner Engineering	*VAC	0	0	0	0	-	-	-
Total Credits				18	0	6	21	360	540	900

***MC - Satisfied/Unsatisfied**



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III SEMESTER

S. No.	Course Code	Course Title	Course Area	Hours Per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2530007	Probability, Statistics and Complex Variables	BS	3	0	0	3	40	60	100
2	2530303	Thermodynamics	ES	3	0	0	3	40	60	100
3	2530317	Mechanics of Solids	PC	3	0	0	3	40	60	100
4	2530318	Production Technology	PC	3	0	0	3	40	60	100
5	2530319	Fluid Mechanics and Hydraulic Machines	PC	3	0	0	3	40	60	100
6	2530EXL1	Design Thinking and Ideation	PS	0	0	2	1	40	60	100
		Labs								
7	2530075	Computational Mathematics Lab	PC	0	0	2	1	40	60	100
8	2530375	Production Technology Lab	PC	0	0	2	1	40	60	100
9	2530376	Material Science and Mechanics of Solids Lab	PC	0	0	2	1	40	60	100
10	2530377	Fluid Mechanics and Hydraulic Machines Lab	PC	0	0	2	1	40	60	100
Total Credits				15	0	10	20	400	600	1000



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IV SEMESTER

S. No.	Course Code	Course Title	Course Area	Hours Per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2540320	Kinematics of Machinery	PC	3	0	0	3	40	60	100
2	2540321	Thermal Engineering - I	PC	3	0	0	3	40	60	100
3	2540322	Design of Machine Elements	PC	3	0	0	3	40	60	100
4	2540323	Instrumentation and Control Systems	PC	3	0	0	3	40	60	100
5	2540EXL3	Innovation and Entrepreneurship	ES	2	0	0	2	40	60	100
		Laboratory								
1	2540378	Conventional and Computer Aided Machine Drawing	PC	0	0	2	1	40	60	100
2	2540379	Instrumentation and Control Systems Lab	PC	0	0	2	1	40	60	100
3	2540380	Thermal Engineering-I Lab	PC	0	0	2	1	40	60	100
4	2540577	Java Programming Lab	ES	1	0	2	2	40	60	100
		Skill Development								
1	2540395	Data Analytics and Python for Engineers	SD	0	0	2	1	40	60	100
1	2540028	Indian Knowledge System	HS	1	0	0	1	40	60	100
Total Credits				17	0	8	21	440	660	1100



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I - I



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COURSE CONTENT

MATRICES AND CALCULUS								
I Semester: CE/ CSD/ CSE/ CSM/ ECE/ EEE/ ME								
Course Code	Category	Hours/ Week			Credits	Maximum Marks		
2510001	Basic sciences	L	T	P	C	CIA	SEE	Total
		3	1	0	4	40	60	100
Contact Classes:45	Tutorial Classes:15	Practical Classes: Nil			Total Classes:60			
Prerequisites: Mathematics courses of 10+2 year of study.								

Course Overview:

This course provides a strong mathematical foundation for all engineering branches by covering matrix theory, linear algebra, eigenvalues and eigenvectors, functions of single and several variables, special functions, and multiple integrals. It equips students to model and solve real-world engineering problems, analyze system consistency using matrix rank, and apply calculus and matrices in simulations, color image processing, and optimization.

Course Objectives:

1. Types of matrices and their properties, concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
2. Concept of eigen values, eigen vectors and reduction of quadratic form to canonical form by orthogonal transformation.
3. Geometrical approach to the mean value theorems and their application to the mathematical problems. Evaluation of improper integrals using Beta and Gamma functions.
4. Partial differentiation, concept of total derivative and finding maxima and minima of function of two and three variables.
5. Evaluation of multiple integrals and their applications.

Course Outcomes: After Completion of the Course, Students should be able to

1. Recall the concepts of rank, Echelon form, Normal form, and the properties of non singular matrices.
2. Explain the process of finding eigenvalues and eigenvectors of a matrix and their role in diagonalization.
3. Relate Beta and Gamma functions to standard integrals and solve related problems.
4. Apply Euler's theorem and compute total derivatives for multivariable functions.
5. Use methods for changing variables in double and triple integrals, including transformations to polar, spherical, and cylindrical coordinates.

UNIT-I: Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations, L-U decomposition method.

UNIT-II: Eigen values and Eigen vectors

Eigen values, Eigen vectors and their properties (without proof), Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT-III: Calculus

Mean value theorems: Rolle's Theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series (without proofs).

Beta and Gamma functions and their applications (properties without proof).

UNIT-IV: Multivariable Calculus (Partial Differentiation and applications)

Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence-independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration)

Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple Integrals, Change of variables (Cartesian to polar) for double and triple integrals (Cartesian to Spherical and Cylindrical polar coordinates). Applications: Areas (by double integrals) and volumes (by triple integral).

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

REFERENCEBOOKS:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dassand Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

ELECTRONIC RESOURCES:

1. <https://www.youtube.com/watch?v=9B-1H5POaOE>
2. <https://www.youtube.com/watch?v=UXqfV-mI61M>
3. <https://www.youtube.com/watch?v=q6LnRouvdws&t=7s>
4. https://www.youtube.com/watch?v=tk0Ix_za8Ew
5. https://www.youtube.com/watch?v=zd6o3wOSu_0

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Definitions and terminology
4. Assignments
5. Model question paper–I
6. Model question paper–II
7. Lecture notes
8. E-Learning Readiness Videos (ELRV)



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COURSE CONTENT

ADVANCED ENGINEERING PHYSICS								
I Semester: CE / CSD / CSM / ECE / EEE / ME								
II Semester: CSE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
25X0008	Basic Science	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 48			
Prerequisites: Intermediate Physics								

Course Overview:

Advanced Engineering Physics bridges fundamental principles with modern technology. It integrates quantum mechanics, crystal structures, and material characterization to explain matter at the atomic scale. This knowledge is essential for designing materials, from semiconductors to quantum computing components. The field applies these principles to functional technologies like dielectrics and magnetic materials for electronics and energy storage. It also harnesses lasers and optical fibers for communication and sensing. This integrated understanding equips engineers to solve complex problems and drive innovation in sectors such as nanotechnology, renewable energy, and environmental systems.

Course Objectives:

1. Understand fundamental concepts of quantum mechanics and their applications in solids.
2. Study the basics of quantum computing, quantum gates and quantum algorithms.
3. Classify the crystal structures, defects and material characterization techniques like XRD and SEM.
4. Learn the properties and applications of magnetic as well dielectric materials.
5. Explore the working likewise applications of lasers and fibre optics in modern technology.

Course Outcomes: After Completion of the Course, Students should be able to

1. Illustrate the concepts of quantum mechanics for explaining particle behaviour and energy band formation in solids.
2. Understand quantum computing concepts, quantum gates and basic quantum algorithms.
3. Identify crystal structures, defects and XRD and SEM techniques for material characterization.
4. Classify magnetic and dielectric materials and their applicability in engineering contexts.
5. Explain the principles of lasers and fibre optics and their applications across various fields in scientific practices.

UNIT - I: Quantum Mechanics

Introduction to quantum physics, Blackbody radiation (Qualitative), Photoelectric effect, de-Broglie Hypothesis, Matter waves, Heisenberg uncertainty principle, Eigen values and Eigen functions, Schrödinger's time independent wave equation, Physical significance of wave function, Particle in a 1D box, Bloch's theorem (qualitative), Kronig-Penney model (qualitative), Effective mass of electron.

UNIT - II: Quantum Computing

Introduction, Concept of quantum computer, Linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Classical bits, Qubits: single and multiple Qubit system, Bloch's sphere, Entanglement, Quantum gates, Evolution of quantum systems, Quantum measurements, Challenges and advantages of quantum computing over classical computation, Quantum computing system for information processing, Quantum algorithms: Deutsch-Jozsa, Grover.

UNIT - III: Crystallography & Materials Characterization

Introduction, Unit cell, space lattice, basis, lattice parameters, Crystal structures, Bravais lattices, Packing factor: SC, BCC, FCC; Miller indices, Inter-planar distance, Defects in crystals (Qualitative): point defects, line defects, surface defects and volume defects. Bragg diagram and working principle of X-ray diffraction (XRD), Scanning electron microscopy (SEM).

UNIT - IV: Magnetic and Dielectric Materials

Introduction to magnetic materials, Origin of magnetic moment, Classification of magnetic materials, Hysteresis, Weiss domain theory of ferromagnetism, soft and hard magnetic materials, Magneto Resistance, Synthesis of magnetic materials using sol-gel method, Applications: Magnetic hyperthermia for cancer treatment, Magnets for EV, Giant Magneto Resistance (GMR) device.

Introduction to dielectric materials, Types of polarization (qualitative): Electronics, ionic & orientation, Ferroelectric, Piezoelectric, Pyro electric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM) and fire sensor..

UNIT - V: Laser and Fibre Optics

Introduction to Laser, three quantum processes - Stimulated Absorption, Spontaneous emission, Stimulated Emission Characteristics of laser, Einstein coefficients and their relations, Meta stable state, Population inversion, Pumping, Lasing action, Ruby laser, He-Ne laser, Semiconductor diode laser, Applications: Bar code scanner.

Introduction to fibre optics, Total internal reflection, Construction of optical fibre, Acceptance angle, Numerical aperture, Classification of optical fibres, Losses in optical fibre, Applications: Optical fibre for communication system, Sensor for structural health monitoring.

TEXT BOOKS:

1. TVS Arun Murthy & MN Avadhanulu," Advanced Engineering Physics", S. Chand Publications.
2. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2nd Edition, 2022.
3. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson Publication, 2019.
4. A.P. Siva Kumar, Y Subba Reddy, "Introduction to Quantum Technologies and applications".
5. M. N. Avadhanulu, P. G. Kshirsagar & TVS Arun Murthy "A Text book of Engineering Physics", S. Chand Publications, 11th Edition 2019.
6. S O Pillai "Solid State Physics", New Age International Private Limited, 8th Edition, 2018.

REFERENCE BOOKS:

1. Quantum Physics, H.C.Verma, TBS Publication, 2nd Edition 2012.
2. Elementary Solid-State Physics, S.L.Gupta and V.Kumar, PragathiPrakashan, 2019.

3. A.K. Bhandhopadhyaya -Nano Materials, NewAgeInternational,1stEdition,2007.
4. Engineering Physics, S P Basavaraj, 2005 Edition.
5. Engineering Physics by Gupta and Gour, DhanpatRai Publications, 2016 (Reprint).
6. Vishal Sahani, Quantum Computing, McGraw Hill Education, 2007 Edition

ELECTRONIC RESOURCES:

- <https://shijuinpallotti.wordpress.com/wp-content/uploads/2019/07/optical-fiber-communications-principles-and-pr.pdf>
- https://www.geokniga.org/bookfiles/geokniga-crystallography_0.pdf
- <https://dpbck.ac.in/wp-content/uploads/2022/10/Introduction-to-Solid-State-PhysicsCharles-Kittel.pdf>
- <https://www.thomaswong.net/introduction-to-classical-and-quantum-computing-1e4p.pdf>
- <https://www.fi.muni.cz/usr/gruska/qbook1.pdf>
- <https://profmcruz.wordpress.com/wp-content/uploads/2017/08/quantum-computation-and-quantum-information-nielsen-chuang.pdf>
- <https://www.youtube.com/watch?v=hJ71IAWx3o>
- https://youtu.be/4CbU_NtQjLg?si=BBd1A4dxxeQE_klA
- <https://youtu.be/7mjBVRxaCT0?si=lqRSboepRZl8mTrS>
- <https://youtu.be/rhw7QDp1scY?si=89-Msq6jBRf51OZf>
- https://youtu.be/_NvS9l_8j-w?si=TgfnbfUwbiFOmxRz
- https://youtu.be/RSeMfAoXqQw?si=C5qvwDkF5giq_1f1
- <https://youtu.be/nFROY70WbDc?si=87KoX22vuErTIBhY>
- https://youtu.be/36UQSzYPTm4?si=LKUsBrP7Kx_0Gaf2

MATERIALS ONLINE:

1. Course template
2. Concept Video topics and Certificate Course in mindluster
3. Assignments
4. Cognitive Assessment Resource Bank
5. Lecture notes
6. E-Learning Readiness Videos (ELRV)



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COURSE CONTENT

C PROGRAMMING AND DATA STRUCTURES								
I Semester: CE / ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
2510502	Foundation	3	0	0	3	40	60	100
		Contact Classes: 45			Tutorial Classes: Nil		Practical Classes: Nil	
Prerequisites: Nil								

Course Overview:

The course provides a comprehensive introduction to C programming and fundamental data structures. It begins with basic concepts of computer systems, software development, and the structure of C programs, including data types, operators, and expressions. Control structures, functions, recursion, and arrays are emphasized to develop structured and modular programming skills. The course further covers pointers, strings, dynamic memory management, and derived data types such as structures and unions. Fundamental sorting and searching techniques are introduced to enhance problem-solving abilities. Finally, core data structures like linked lists, stacks, and queues are studied to enable efficient data organization and manipulation.

Course Objectives:

Introduce the importance of programming, C language constructs, program development, data structures, searching and sorting.

Course Outcomes: After completion of the course, student should be able to

1. Illustrate the fundamental elements as variables, control structures, loops, and functions to interpret program flow in solving engineering problem statements.
2. Develop programs using arrays, strings, and modular programming, recursive functions, structures concepts to implement data processing tasks in business applications.
3. Summarize the concepts of pointers, scope of variables, and parameter passing mechanisms in the role of system-level programming.
4. Make use of linear data structures lists, stacks, and queues in algorithmic problem formulation.
5. Implement singly, circular, and doubly linked lists to solve dynamic memory management and data manipulation problems.

UNIT - I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development

Introduction to C Language — Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output

Structure of a C Program — Operators, Bit-wise operators, Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Statements.

UNIT - II

Statements – if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Recursion.

Designing Structured Programs- Functions, basics, user defined functions, inter function communication, standard functions.

Arrays – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays.

UNIT - III

Pointers – Introduction, Pointers for inter function communication, pointers to pointers, compatibility, **Pointer Applications** – Passing an array to a function, Memory allocation functions, array of pointers **Strings** – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion.

UNIT - IV

Derived types – The Typedef, enumerated types, Structures – Declaration, definition and initialization of structures, accessing structures, operations on structures, complex structures. Unions – Referencing unions, initializers, unions and structures.

Sorting- selection sort, bubble sort, insertion sort,

Searching-linear and binary search methods.

UNIT – V

Data Structures — Introduction to Data Structures, abstract data types, Linear list — singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

TEXT BOOKS:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCE BOOKS:

1. C & Data structures – P. Padmanabham, 3rd Edition, B.S. Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
4. C for Engineers and Scientists, H. Cheng, McGraw-Hill International Edition
5. Data Structures using C — A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein, Pearson Education / PHI
6. C Programming & Data Structures, E. Balagurusamy, TMH.
7. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press
8. C & Data structures – E V Prasad and N B Venkateswarlu, S. Chand & Co.

ELECTRONIC RESOURCES:

1. <https://www.geeksforgeeks.org/c/c-programming-language/>
2. <https://www.programiz.com/c-programming>
3. <https://www.w3schools.com/c/>
4. <https://www.codechef.com/learn/course/c>

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. PowerPoint presentation
11. E-Learning Readiness Videos (ELRV)



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COURSE CONTENT

ENGINEERING DRAWING AND COMPUTER AIDED DRAFTING								
I Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2510301	Foundation	L	T	P	C	CIA	SEE	Total
		2	0	2	3	40	60	100
Contact Classes: 50	Tutorial Classes: Nil	Practical Classes: 50			Total Classes: 50			
Prerequisites: There are no prerequisites for this course.								

Course Overview:

Engineering Drawing and Computer Aided Drafting is a fundamental subject that trains students in the visualization and representation of engineering objects using both conventional methods and modern CAD tools. It begins with geometrical constructions, scales, and engineering curves such as conic sections and cycloidal curves. Students then progress to orthographic projections of points, lines, planes, and solids, including auxiliary and sectional views. The subject also introduces development of surfaces and isometric projections, enabling conversion between 2D and 3D representations. Overall, it builds essential skills in technical drawing, spatial visualization, and CAD, preparing learners for advanced design applications.

Course Objectives:

1. To introduce the fundamentals of engineering drawing and projection systems.
2. To develop skills in constructing orthographic, isometric, and sectional views.
3. To train students in interpreting and creating technical drawings using CAD tools.
4. To familiarize students with dimensioning standards and drafting conventions.
5. To bridge manual drafting techniques with computer-aided drafting practices.

Course Outcomes: After Completion of the Course, Students should be able to

1. Understand and apply the principles of orthographic and isometric projections.
2. Create sectional views and dimensioned drawings using BIS standards.
3. Use CAD software to generate 2D engineering drawings.
4. Visualize and construct solid models from 2D views.
5. Interpret and produce engineering drawings of mechanical components and assemblies for practical and industrial applications.

UNIT-I: Introduction to Engineering Graphics (Conventional)

Principles of Engineering Graphics and their Significance, Geometrical Constructions, Scales, Plain and Diagonal, Conic Sections (Ellipse, Parabola and Hyperbola) General method only. Cycloid, Epicycloid and Hypocycloid.

UNIT-II: Orthographic Projections (Conventional and Computer Aided)

Principles of Orthographic Projections, Conventions, Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer aided orthographic projections, points, lines and planes. Introduction to Computer aided drafting, views, commands.

UNIT - III Projections of Regular Solids (Conventional and Computer Aided)

Auxiliary Views, Sections or Sectional views of Right Regular Solids, Prism, Cylinder, Pyramid, Cone, Auxiliary views, Computer aided projections of solids, sectional views.

UNIT - IV: Development of Surfaces (Conventional)

Prism, Cylinder, Pyramid and Cone.

UNIT - V: Isometric Projections (Conventional and Computer Aided)

Principles of Isometric Projection, Isometric Scale, Isometric Views, Conventions, Isometric Views of Lines, Plane Figures, Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions. Conversion of orthographic projection into isometric view.

TEXTBOOKS:

1. Engineering Drawing, N. D. Bhatt, Charotar, 54th Edition, 2023.
2. Engineering Drawing and graphics Using AutoCAD, T. Jeyapoovan and Vikas, S. Chand and company Ltd., 3rdEdition,2010.

REFERENCE BOOKS:

1. Engineering Drawing, Basant Agrawal and C.M. Agrawal, McGraw Hill, 3rd Edition, 2019.
2. Engineering Graphics and Design, WILEY, John Wiley and Sons Inc, 3rdEdition, 2020.
3. Engineering Drawing, M. B. Shah and B.C. Rane, Pearson, 2nd Edition, 2009.
4. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford, 1st Edition, 2015.
5. Computer Aided Engineering Drawing, K. Balaveera Reddy, CBS Publishers, 2nd Edition, 2015.

ELECTRONIC RESOURCES:

1. <https://eg-dei.vlabs.ac.in/>
2. <https://eg-nitk.vlabs.ac.in/>
3. <https://www.autodesk.com/in/education/>

MATERIALS ONLINE:

Lab Manual



MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

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COURSE CONTENT

English for Skill Enhancement								
I Semester : CE / CSD / CSM / ECE / EEE / ME								
II Semester: CSE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
25X0010	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes Nil			Total Classes: 45			
Prerequisites: There are no prerequisites to take this course.								

Overview:

The course, aligned with the National Education Policy 2020, aims to develop students' proficiency in English by focusing on Listening, Speaking, Reading, and Writing (LSRW) skills. It emphasizes clear and effective communication for academic, personal, and professional needs while promoting cultural and value-based learning. Through a structured syllabus, interactive teaching methods, and authentic learning materials, students will enhance vocabulary, grammar, comprehension, and writing skills for lifelong learning.

Course Objectives: This course will enable the students to:

- Improve their vocabulary.
- Use appropriate sentence structures in their oral and written communication.
- Develop their reading and study skills.
- Equip students to write paragraphs, essays, précis and draft letters.
- Acquire skills for Technical report writing.

Course Outcomes: After successful completion of the course, students should be able to:

- Choose appropriate vocabulary in their oral and written communication
- Demonstrate their understanding of the rules of functional grammar and sentence structures.
- Develop comprehension skills from known and unknown passages.
- Write paragraphs, essays, précis and draft letters.
- Write abstracts and reports in various contexts.

UNIT – I (No of Hours = 7)

Theme: Perspectives

Lesson on 'The Generation Gap' by Benjamin M. Spock from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Words Often Misspelt - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Parts of Speech particularly Articles and Prepositions – Degrees of Comparison

Reading: Reading and Its Importance- Sub Skills of Reading – Skimming and Scanning.

Writing: Sentence Structures and Types -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing Precisely –Nature and Style of Formal Writing.

UNIT – II (No of Hours = 6)

Theme: Digital Transformation

Lesson on 'Emerging Technologies' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

- Vocabulary:** Homophones, Homonyms and Homographs
Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
Reading: Reading Strategies-Guessing Meaning from Context – Identifying Main Ideas – Exercises for Practice
Writing: Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence – Linkers and Connectives - Organizing Principles in a Paragraph – Defining- Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence - Essay Writing - Writing Introduction and Conclusion.

UNIT – III (No of Hours = 7)

- Theme:** **Attitude and Gratitude**
Poems on ‘Leisure’ by William Henry Davies and ‘Be Thankful’ - Unknown Author from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.
- Vocabulary:** Words Often Confused - Words from Foreign Languages and their Use in English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading: Sub-Skills of Reading – Identifying Topic Sentence and Providing Supporting Ideas - Exercises for Practice.
Writing: Format of a Formal Letter-Writing Formal Letters E.g., Letter of Complaint, Letter of Requisition, Job Application with CV/Resume –Difference between Writing a Letter and an Email - Email Etiquette.

UNIT – IV (No of Hours = 6)

- Theme:** **Entrepreneurship**
Lesson on ‘Why a Start-Up Needs to Find its Customers First’ by Pranav Jain from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.
- Vocabulary:** Standard Abbreviations in English – Inferring Meanings of Words through Context – Phrasal Verbs – Idioms.
Grammar: Redundancies and Clichés in Written Communication – Converting Passive to Active Voice and Vice-Versa.
Reading: Prompt Engineering Techniques– Comprehending and Generating Appropriate Prompts - Exercises for Practice
Writing: Writing Practices- Note Making-Précis Writing.

UNIT– V (No of Hours = 6)

- Theme:** **Integrity and Professionalism**
Lesson on ‘Professional Ethics’ from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.
- Vocabulary:** Technical Vocabulary and their Usage– One Word Substitutes – Collocations.
Grammar: Direct and Indirect Speech - Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)
Reading: Survey, Question, Read, Recite and Review (SQ3R Method) – Inferring the Meaning and Evaluating a Text- Exercises for Practice
Writing: **Report Writing - Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Technical Report.**

Note: *Listening and Speaking skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.*

- (Note: As the syllabus of English given in AICTE Model Curriculum-2018 for B.Tech First Year is **Open-ended**, besides following the prescribed textbook, it is required to prepare teaching/learning materials **by the**

teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.)

Prescribed Textbook

1. Board of Editors. 2025. *English for the Young in the Digital World*. Orient BlackSwan Pvt. Ltd.

References:

1. Swan, Michael. (2016). *Practical English Usage*. Oxford University Press. New Edition.
2. Karal, Rajeevan. 2023. *English Grammar Just for You*. Oxford University Press. New Delhi
3. 2024. *Empowering with Language: Communicative English for Undergraduates*. Cengage Learning India Pvt. Ltd. New Delhi
4. Sanjay Kumar & Pushp Lata. 2022. *Communication Skills – A Workbook*. Oxford Univeristy Press. New Delhi
5. Wood,F.T. (2007). *Remedial English Grammar*. Macmillan.
6. Vishwamohan, Aysha. (2013). *English for Technical Communication for Engineering Students*. Mc Graw-Hill Education India Pvt. Ltd.

Electronic Resources:

https://owl.purdue.edu/owl/general_writing/grammar/index.html?utm_source=chatgpt.com

https://www.ego4u.com/?utm_source=chatgpt.com

https://www.eslfast.com/?utm_source=chatgpt.com

https://learnenglish.britishcouncil.org/skills/reading?utm_source=chatgpt.com

Electronic Resources

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)



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COURSE CONTENT

ADVANCED ENGINEERING PHYSICS LAB								
I Semester: CE / CSD / CSM / ECE / EEE / ME								
II Semester: CSE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
25X0071	Basic Science	0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 30			Total Classes: 30			
Prerequisites: Intermediate Physics								

Course Overview:

Advanced Engineering Physics Lab course is to provide hands on experience for experiments in different areas of physics. This laboratory includes experiments involving, electrical, electromagnetism and optoelectronics. This course enhances student knowledge to apply the various physical concepts in current technology.

Course Objectives:

1. Capable of handling instruments related to the Hall effect Experiment and their measurements.
2. Understand the characteristics of various devices such as solar cell, lasers and optical fiber.
3. Apply the analytical techniques & graphical analysis for Stewart Gees, B-H curve.
4. Synthesize and study the physical properties of materials like semiconductors ferromagnetic and ferroelectric substances.
5. Develop intellectual communication skills through discussion on basic principles of scientific concepts in a group.

Course Outcomes: After Completion of the Course, Students should be able to

1. Demonstrate the Planck's constant using Photo electric effect and Apply the Hall effect and band gap measurement techniques to examine semiconductor properties
2. Determine key electrical, magnetic and optical properties of semiconductors and other functional materials.
3. Describe the steps involved in the Synthesis of magnetic nanomaterials using chemical methods.
4. Compare the variation of magnetic and electric field and the behaviours of hysteresis curve. Interpret data analysis.
5. Demonstrate working of laser systems, optical fiber and solar cell parameters through experimental study.

List of Experiments: (Any 8 experiments are to be performed)

1. Determination of work function and Planck's constant using photo electric effect
2. Determination of Hall coefficient and carrier concentration of a given semiconductor
3. Determination of energy gap of a semiconductor
4. Synthesis of magnetic (Fe_3O_4) nanoparticles using sol-gel method.
5. Study of B-H curve of a ferromagnetic material
6. Determination of magnetic field induction along the axis of a current carrying coil.
7. Determination of dielectric constant of a given material.
8. Study of V-I and P-I characteristics of solar cell.
9. Determination of wavelength of a laser using diffraction grating and to study of V-I & 55L-I characteristics of a given laser diode

10. Determination of numerical aperture of a given optical fibre and to determination of bending losses of a given optical fibre.

List of Experiments: (Any 8 experiments are to be performed)

1. To calculate the concentration of charge carriers in the sample using Hall effect -NITK, Surathkal Virtual Lab.
2. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss - IIT Kanpur Virtual Lab.
3. To calculate the beam divergence and spot size of the given laser beam - Amritha Viswa Vidya Peetham Virtual Lab
4. To study various crystals structures - Amritha Viswa Vidya Peetham Virtual Lab

ELECTRONIC RESOURCES

1. Kittel, Charles, and Paul McEuen. Introduction to solid state physics. John Wiley & Sons, 2018. <https://ph1-nitk.vlabs.ac.in/exp/hall-effect/references.html>.
2. Kasap S O., Principles of Electronic Materials and Devices, 3rd Ed, Mcgraw Hill, 2006). <https://bop2-iitk.vlabs.ac.in/exp/hysteresis-loss/references.html>.
3. Koechner, Walter. Solid-State Laser Engineering. Berlin: Springer, 2006. <https://lo-amrt.vlabs.ac.in/exp/laser-beam-divergence/references.html>.
4. Pillai, SO. Solid State Physics, City: New Age Publications (Academic), India, 2005. <https://ssp-amrt.vlabs.ac.in/exp/crystal-structure/references.html>
5. <https://youtu.be/Ujx68vgBk9w?si=c4k9V0aZvn9D46Dc>
6. https://youtu.be/rOhTZ5D_nGI?si=mN_eVtpLP7d4HNYA

MATERIALS ONLINE:

1. Course template
2. AEP Lab Manual
3. Open-ended experiments
4. e-Learning Readiness Videos (ELRV)



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COURSE CONTENT

C PROGRAMMING & DATA STRUCTURES LAB								
I Semester: CE / ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2510572	Foundation	L	T	P	C	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 30			Total Classes: 30			
Prerequisites: NIL								

Course Overview:

This course focuses on developing strong problem-solving and programming skills using the C language through a wide range of practical programs. Students learn to apply control structures, functions, recursion, arrays, strings, and structures to solve mathematical, logical, and real-world problems. The course covers core algorithms such as searching, sorting, and matrix operations, along with string processing and pattern generation. Emphasis is given to modular programming, user-defined functions, and efficient logic building. Learners also gain hands-on experience with dynamic data structures including linked lists, stacks, and queues using arrays and pointers. Overall, the course strengthens analytical thinking and lays a solid foundation for advanced programming and data structures.

Course Objectives:

Introduce the importance of programming, C language constructs, program development, data structures, searching and sorting.

Course Outcomes:

1. Execute C programs using variables, control structures, loops, and functions to demonstrate program flow in solving engineering problems.
2. Develop modular programs using arrays, strings, recursion, and structures to perform data processing operations in business scenarios.
3. Illustrate the use of pointers, parameter passing techniques, and scope rules through experiments in system-level program development.
4. Implement linear data structures as stacks and queues in algorithmic solutions for real-time applications.
5. Construct programs for singly, circular, and doubly linked lists to handle dynamic memory allocation and data manipulation tasks.

List of Experiments:

1. Write a C program to find the sum of individual digits of a positive integer.

2. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C program to find the roots of a quadratic equation.
5. Write a C program to find the factorial of a given integer.
6. Write a C program to find the GCD (greatest common divisor) of two given integers.
7. Write a C program to solve Towers of Hanoi problem.
8. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use Switch Statement)
9. Write a C program to find both the largest and smallest number in a list of integers.
10. Write a C program that uses functions to perform the following:
 - i) Addition of Two Matrices
 - ii) Multiplication of Two Matrices
11. Write a C program that uses functions to perform the following operations:
 - i) To insert a sub-string in to a given main string from a given position.
 - ii) To delete n Characters from a given position in a given string.
12. Write a C program to determine if the given string is a palindrome or not
13. Write a C program that displays the position or index in the string S where the string T begins, or - 1 if S doesn't contain T.
14. Write a C program to count the lines, words and characters in a given text.
15. Write a C program to generate Pascal's triangle.
16. Write a C program to construct a pyramid of numbers.
17. Write a C program that uses functions to perform the following operations:
 - i) Reading a complex number
 - ii) Writing a complex number
 - iii) Addition of two complex numbers
 - iv) Multiplication of two complex numbers(Note: represent complex number using a structure.)
18. Write a C program that uses functions to perform the following operations on singly linked list.:
 - i) Creation
 - ii) Insertion
 - iii) Deletion
 - iv) Traversal
19. Write C programs that implement stack (its operations) using
 - i) Arrays
 - ii) Pointers
20. Write C programs that implement Queue (its operations) using
 - i) Arrays
 - ii) Pointers
21. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order
 - i) Bubble sort
 - ii)

Selection sort iii) Insertion sort

22. Write C programs that use functions to perform the following searching operations for a Key value in a given list of integers:
- i) Linear search
 - ii) Binary search

TEXT BOOKS:

1. C Programming & Data Structures, B.A. Forouzan and R. F. Gilberg, Third Edition, Cengage Learning.
2. Let us C, Yeswanth Kanitkar
3. C Programming, Balaguruswamy.

ELECTRONIC RESOURCES:

1. <https://www.geeksforgeeks.org/c/c-programming-language/>
2. <https://www.programiz.com/c-programming>
3. <https://www.w3schools.com/c/>
4. <https://www.codechef.com/learn/course/c>
5. <https://ds1-iiith.vlabs.ac.in/exp/linked-list/singly-linked-list/sllpractice.html>
6. <https://ds1-iiith.vlabs.ac.in/exp/linked-list/doubly-linked-list/dllpractice.html>
7. <https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/stacks/stackarrays.html>
8. <https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/queues/queuesarrays.html>

MATERIALS ONLINE:

1. **Lab Manual**



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COURSE CONTENT

ENGINEERING WORKSHOP								
I Semester : CE / CSD / CSM / ECE / EEE / ME								
II Semester: CSE								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
25X0371	Foundation	0	0	2	1	40	60	100
		Practical Classes: 30			Total Classes: 30			
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 30			Total Classes: 30			
Prerequisites: There are no prerequisites to take this course.								

Course Overview:

This course introduces basic workshop practices through carpentry, fitting, tin-smithy, blacksmithy, house wiring, and welding operations. Students learn various tools, safety practices, and step-by-step manufacturing processes used in traditional and modern workshops. Carpentry and fitting cover common joints and fitting operations used in product fabrication and assembly. Tin-smithy and blacksmithy expose students to sheet-metal work and the oldest metal forming methods. House wiring and arc welding develop understanding of electrical installations and metal joining techniques for practical engineering applications.

Course Objectives:

1. To Study of different hand operated power tools, uses and their demonstration.
2. To gain a good basic working knowledge required for the production of various engineering products.
3. To provide hands on experience about use of different engineering materials, tools, equipment's and processes those are common in the engineering field.
4. To develop a right attitude, team working, precision and safety at work place.
5. It explains the construction, function, use and application of different working tools, Equipment and machines

Course Outcomes:

After Completion of the Course, Students should be able to

1. Explain the design and model different prototypes in the carpentry trade such as Cross lap joint, Dove tail joint. (L4)
2. Demonstrate the design and model various basic prototypes in the trade of fitting such as Straight fit, V- fit. (L4)
3. Understand to make various basic prototypes in the trade of Tin smithy such as rectangular tray, and open Cylinder. (L4)
4. Demonstrate the design and model various basic prototypes in the trade of Welding. (L4)
5. Explain to make various basic prototypes in the trade of Black smithy such as J shape, and S shape. (L4)

UNIT – 1: CARPENTRY & FITTING

- **Carpentry** – Introduction, Carpentry tools, sequence of operations and applications (T-

Lap Joint, Dovetail Joint, Mortise & Tenon Joint)

- **Fitting** – Introduction, fitting tools, sequence of operations and applications (V- Fit, Dovetail Fit & Semi-circular fit)

Learning Outcomes: Students should be able to,

- Understand the trade of carpentry and fitting. (L2)
- Explain the tools involved in manufacturing operations. (L3)
- Evaluate the applications of carpentry and fitting. (L4)

UNIT – 2 TIN SMITHY AND BLACKSMITHY

- **Tin-Smithy** –Introduction, Tin smithy tools, sequence of operations and applications (Square Tin, Rectangular Tray & Conical Funnel).
- **Blacksmith**-Introduction, Blacksmith tools, sequence of operations and applications (Round to Square, Fan Hook and S-Hook) Understand the oldest manufacturing methods. (L2)

Learning Outcomes: Students should be able to,

- Understand the oldest manufacturing methods. (L2)
- Describe the sequence of operations involved. (L3)
- Explain the safety precautions and tools usage. (L4)

UNIT – 3 HOUSE WIRING AND WELDING

- **House-wiring** – Introduction, Electrical wiring tools, sequence of operations and applications (Parallel & Series, Two-way Switch and Tube Light)
- **Welding Practice** – Introduction, electrode, welding tools, and sequence of operations. Advantages and applications (Arc Welding)

Learning Outcomes:

- Students should be able to,
- Discuss the topic of House Wiring(L3)
- Explain Safety precautions of welding (L4)

TEXTBOOKS:

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal / Anuradha.

REFERENCE BOOKS:

1. Work shop Manual – P. Kannaiah/ K. L. Narayana/ SciTech
2. Workshop Manual / Venkat Reddy/ BSP

ELECTRONIC RESOURCES:

1. <https://www.youtube.com/watch?v=czqxcwYzr7E>
2. <https://www.youtube.com/watch?v=0wgHWeuX4pc>
3. <https://www.youtube.com/watch?v=X3cLoNjMmxc>

4. <https://www.youtube.com/watch?v=j-xk2FvcAz4&list=PLoeKEfFsoDPQVwJUUwLITprairDw15IkW>

MATERIALS ONLINE:

1. Lab Manual
2. Open Ended Experiments



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COURSE CONTENT

ENGLISH LANGUAGE AND COMMUNICATIONS SKILLS LAB								
I Semester : CE / CSD / CSM / ECE / EEE / ME								
II Semester: CSE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
25X0073	Foundation	L	T	P	C	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 30			Total Classes: 30			
Prerequisites: There are no prerequisites to take this course.								

Course Overview:

The **English Language and Communication Skills (ELCS) Lab** focuses on listening and speaking skills, particularly on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives

1. To enable students, develop their active listening skills
2. To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds
3. To improve their pronunciation and neutralize accent
4. To enable students express themselves fluently and appropriately
5. To practice speaking in social and professional contexts

Course Outcomes:

After successful completion of the course, student should be able to:

1. **Identify** key information while listening to spoken texts.
2. **Interpret** the speaker's intention from the speech.
3. **Apply** pronunciation techniques to improve intelligibility.
4. **Demonstrate** fluency, clarity, and confidence while speaking.
5. **Use** English effectively in real-life situations.

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:

- a. **Computer Assisted Language Learning (CALL) Lab** which focusses on listening skills
- b. **Interactive Communication Skills (ICS) Lab** which focusses on speaking skills

The following course content is prescribed for the **English Language and Communication Skills Lab**.

Exercise – I

CALL Lab:

Instruction: Speech Sounds-Listening Skill - Importance – Purpose - Types- Barriers- Active Listening

Practice: Listening to Distinguish Speech Sounds (Minimal Pairs) - Testing Exercises

ICS Lab:

- ❖ Diagnostic Test – Activity titled ‘Express Your View’

Instruction: Spoken and Written language - Formal and Informal English - Greetings - Introducing Oneself and Others

Practice: Any Ice-Breaking Activity

Exercise – II**CALL Lab:**

Instruction: Listening vs. Hearing - Barriers to Listening

Practice: Listening for General Information - Multiple Choice Questions - Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)

ICS Lab:

Instruction: Features of Good Conversation – Strategies for Effective Communication

Practice: Role Play Activity - Situational Dialogues –Expressions used in Various Situations –Making Requests and Seeking Permissions – Taking Leave - Telephone Etiquette

Exercise - III**CALL Lab:**

Instruction: Errors in Pronunciation – Tips for Neutralizing Mother Tongue Influence (MTI)

Practice: Differences between British and American Pronunciation –Listening Comprehension Exercises

ICS Lab:

Instruction: Describing Objects, Situations, Places, People and Events

Practice: Picture Description Activity – Looking at a Picture and Describing Objects, Situations, Places, People and Events (A wide range of Materials / Handouts are to be made available in the lab.)

Exercise – IV**CALL Lab:**

Instruction: Techniques for Effective Listening

Practice: Listening for Specific Details - Listening - Gap Fill Exercises - Listening Comprehension Exercises

(It is essential to identify a suitable passage with exercises for practice.)

ICS Lab:

Instruction: How to Tell a Good Story - Story Star- Sequencing-Creativity

Practice: Activity on Telling and Retelling Stories - Collage

Exercise – V**CALL Lab:**

Instruction: Identifying the literal and implied meaning

Practice: Listening for Evaluation - Write the Summary – Listening Comprehension Exercises

(It is essential to identify a suitable passage with exercises for practice.)

ICS Lab:

Instruction: Understanding Non-Verbal Communication

Practice: Silent Speech - Dumb Charades Activity

- ❖ Post-Assessment Test on ‘Express Your View’

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:

- i) Computers with Suitable Configuration

- ii) High Fidelity Headphones

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio & video system and camcorder etc.

- ❖ **Note: English Language Teachers are requested to prepare Materials / Handouts for each Activity for the Use of those Materials in CALL & ICS Labs.**

Suggested Software:

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10th Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).

References:

- Shobha, KN & Rayen, J. Lourdes. (2019). Communicative English – A workbook. Cambridge University Press
- Board of Editors. (2016). ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities. Orient BlackSwan Pvt. Ltd.
- Mishra, Veerendra et al. (2020). English Language Skills: A Practical Approach. Cambridge University Press
- (2022). English Language Communication Skills – Lab Manual cum Workbook. Cengage Learning India Pvt. Ltd.
- Ur, Penny and Wright, Andrew. 2022. Five Minute Activities – A Resource Book for Language Teachers. Cambridge University Press.

Electronic Resources:

- https://owl.purdue.edu/owl/general_writing/grammar/index.html?utm_source=chatgpt.com
- https://www.ego4u.com/?utm_source=chatgpt.com
- https://www.eslfast.com/?utm_source=chatgpt.com
- https://learnenglish.britishcouncil.org/skills/reading?utm_source=chatgpt.com

Material Online:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
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I - II



COURSE CONTENT

ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS								
II Semester: CE/CSD/CSE/CSM/ECE/EEE/ME								
Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2520002	Basic sciences	3	0	0	3	40	60	100
ContactClasses:45	Tutorial Classes: Nil	Practical Classes: Nil			TotalClasses:45			
Prerequisites: Mathematics courses of 10+2 year of study.								

Course Overview:

This course is a foundation for all engineering branches. This course serves as a foundation course on differential equations and vector calculus. It includes techniques for solving ordinary differential equations, Laplace Transform, vector differentiation and vector integration. It is designed to extract the mathematical developments, skills, from basic concepts to advance level of engineering problems to meet the technological challenges.

Course Objectives:

1. Methods of solving the differential equations of first order and first degree.
2. Concept of higher order linear differential equations.
3. Concept, properties of Laplace transforms, solving ordinary differential equations by using Laplace transforms techniques.
4. The physical quantities involved in engineering field related to vector valued functions.
5. The basic properties of vector valued functions and their applications to line, surface and volume integrals.

Course Outcomes: After Completion of the Course, Students should be able to

1. Utilize the methods of differential equations for solving Newton's law of cooling and Law of Natural growth and decay.
2. Understand the solutions of linear differential equations with constant coefficients.
3. Explain the concept of the Laplace transforms and its significance in solving differential equations and evaluating integrals.
4. Interpret the vector differential operators and their relationships for solving engineering problems.
5. Apply the integral transformations to line, surface and volume of different geometrical models.

UNIT-I: First Order ODE

Exact differential equations, equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

UNIT-II: Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax} , $\sin ax$, $\cos ax$, polynomials in x , $e^{ax} V(x)$ and $x V(x)$, method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Cauchy-Euler equation, Legendre's equation.

UNIT-III: Laplace transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function (All without proof), Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration

Line, Surface and Volume Integrals, Theorems of Green's, Gauss and Stokes's (without proof) and their applications.

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

REFERENCEBOOKS:

1. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

ELECTRONIC RESOURCES:

1. <https://www.youtube.com/watch?v=wtUk7CqbAt4>
2. <https://www.youtube.com/watch?v=OZ0JM9RAa00>
3. <https://www.youtube.com/watch?v=vTUPQq2mdbY>
4. https://www.youtube.com/watch?v=oVLhKP_JfnE&t=2s
5. <https://www.youtube.com/watch?v=fOdM9HKRtbs&t=122s>

MATERIALS ONLINE:

1. Course template
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COURSE CONTENT

ENGINEERING CHEMISTRY								
I Semester: CSE								
II Semester: CE/ CSD / CSM / ECE / EEE / ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
25X0009	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: Intermediate Chemistry								

Course Overview:

This course provides on practical relevance, covering water chemistry for industrial use, fuel properties, polymer types, and corrosion control, linking core chemistry to engineering disciplines.

Course Objectives:

1. To develop adaptability to new advances in Engineering Chemistry and acquire the essential skills to become a competent engineering professional.
2. To understand the industrial significance of water treatment, fundamental principles of battery chemistry, and the impact of corrosion, along with its control methods for structural protection.
3. To impart foundational knowledge of various energy sources and their practical applications in engineering.
4. To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

Course Outcomes: After Completion of the Course, Students should be able to

CO1: Understand the fundamental properties of water and its applications in both domestic and industrial purposes.

CO2: Acquire the knowledge of electro chemical processes and their relevance to corrosion and its control methods.

CO3: Determine the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs.

CO4: Understand the basic concepts and properties of polymers and other engineering materials.

CO5: Apply the medicinal values in daily life

UNIT-I: Water and its treatment: [8]

Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break- point chlorination.

Boiler troubles: Scales, Sludges and Caustic embrittlement. Internal treatment of boiler feed

water - Calgon conditioning, Phosphate conditioning, Colloidal conditioning. External treatment methods - Softening of water by ion-exchange processes. Desalination of brackish water – Reverse osmosis.

UNIT-II: Electrochemistry and Corrosion: [8]

Introduction- Electrode potential, standard electrode potential, Nernst equation (no derivation), electrochemical cell - Galvanic cell, cell representation, EMF of cell - Numerical problems. Types of electrodes, reference electrodes - Primary reference electrode - Standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode. Construction, working and determination of pH of unknown solution using SHE and the Calomel electrode. Corrosion: Introduction- Definition, causes and effects of corrosion – Theories of corrosion, chemical and electrochemical theories of corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion - Nature of the metal, Nature of the corroding environment. Corrosion control methods - Cathodic protection Methods - Sacrificial anode and impressed current methods.

UNIT-III: Energy sources: [8]

Batteries: Introduction – Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Zn-air and Lithium-ion battery. Fuel Cells – Differences between a battery and a fuel cell, Construction and applications of Direct Methanol Fuel Cell (DMFC).

Fuels: Introduction and characteristics of a good fuel, Calorific value – Units - HCV, LCV- Dulong's formula - Numerical problems.

Fossil fuels: Introduction, Classification, Petroleum - Refining of Crude oil, Cracking - Types of cracking

- Moving bed catalytic cracking. LPG and CNG composition and uses.

Synthetic Fuels: Fischer-Tropsch process, Introduction and applications of Hythane and Green Hydrogen.

UNIT - IV: Polymers: [8]

Definition - Classification of polymers: Based on origin and tacticity with examples – Types of polymerization - Addition (free radical addition mechanism) and condensation polymerization.

Plastics, Elastomers and Fibers: Definition and applications (PVC, Buna-S, Nylon-6,6).

Differences between thermoplastics and thermo setting plastics, Fiber reinforced plastics (FRP).

Conducting polymers: Definition and Classification with examples - Mechanism of conduction in trans- poly-acetylene and applications of conducting polymers.

Biodegradable polymers: Polylactic acid and its applications.

UNIT-V- Advanced Functional Materials: [8]

Smart materials: Introduction, Classification with examples - Shape Memory Alloys – Nitinol, Piezoelectric materials – quartz and their engineering applications.

Biosensor - Definition, Amperometry Glucose monitor sensor.

Cement: Portland cement, its composition, setting and hardening.

Lubricants: Definition and characteristics of a good lubricant — thin film mechanism of lubrication, properties of lubricants - viscosity, cloud and pour point, flash and fire point.

TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2. Engineering Chemistry by Rama Devi, Dr. P. Aparna and Rath, Cengage learning, 2025.

REFERENCE BOOKS:

1. Engineering Chemistry: by Thirumala Chary Laxminarayana & Shashikala, Pearson Publications (2020)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi 2011.
3. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi 2015.
4. Engineering Analysis of Smart Material Systems by Donald J. Leo, Wiley, 2007.
5. Challenges and Opportunities in Green Hydrogen by Editors: Paramvir Singh, Avinash Kumar Agarwal, Anupma Thakur, R.K Sinha.
6. Raman Spectroscopy in Human Health and Biomedicine, <https://www.worldscientific.com/doi/epdf/10.1142/13094>

ELECTRONIC RESOURCES:

1. <https://libguides.wits.ac.za/chemical>
2. <https://eng.libretexts.org>
3. <https://nptel.ac.in/courses/104105039>
4. https://ftp.idu.ac.id/wp-content/uploads/ebook/tdg/ADVANCED%20MATERIAL%20DESIGN/epdf.pub_advanced-functional-materials.pdf
5. [https://eng.libretexts.org/Bookshelves/Environmental_Engineering_\(Sustainability_and_Conservation\)/Energy_Conservation_for_Environmental_Protection_\(Pisupati\)/01%3A_Energy_and_Society/1.04%3A_New_Page](https://eng.libretexts.org/Bookshelves/Environmental_Engineering_(Sustainability_and_Conservation)/Energy_Conservation_for_Environmental_Protection_(Pisupati)/01%3A_Energy_and_Society/1.04%3A_New_Page)

MATERIALS ONLINE:

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COURSE CONTENT

PYTHON PROGRAMMING								
II Semester: CE / ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2520503	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: C Programming and Data structures								

Course overview:

This course provides a strong foundation in Python programming, starting with an introduction to Python features, syntax, data types, operators, input/output functions, and core control structures such as conditional statements and loops. Students then explore Python's built-in data structures—including strings, lists, tuples, sets, and dictionaries—and learn efficient data manipulation using comprehensions and iteration techniques. The course emphasizes modular and reusable code through functions, lambda expressions, recursion, and the use of standard and user-defined modules and packages.

Course Objectives:

1. Develop structured, modular, and efficient Python programs to solve computational problems.
2. Explain the use of Python's built-in data structures such as lists, tuples, dictionaries, and sets for effective data handling.
3. Utilize Python libraries and modules to construct solutions for scientific and business applications.
4. Illustrate file handling, exception handling, and object-oriented programming features in software development tasks.
5. Implement Python-based solutions for real-world applications including automation, data processing, and problem-solving.

Course Outcomes: After completion of course, student should be able to

1. Write Python programs using variables, operators, expressions, and control structures.
2. Implement Python programs using built-in data structures like lists, tuples, sets, and dictionaries.
3. Apply modular and object-oriented programming principles in Python.
4. Handle files, exceptions, and apply Python libraries for problem-solving.
5. Develop small-scale applications in Python for automation and data manipulation.

UNIT-1 – Introduction to Python and Basics of Programming

Introduction to Python: Features, Applications, Installation, IDEs, Python Syntax, Indentation, Comments, Variables, Data Types, Type Casting, Operators: Arithmetic, Relational, Logical, Assignment, Membership, Identity, Bitwise, Input/Output functions (input(), print()), Control Structures: if, if-else, if-elif-else, Nested Conditions, Looping: for, while, Nested Loops, break, continue, pass.

UNIT-2 – Data Structures in Python

Strings: Creation, Indexing, Slicing, Methods, String Formatting, Lists: Creation, Indexing, Slicing, List Comprehension, Methods, Tuples: Properties, Indexing, Methods, Sets: Creation, Operations, Methods, Dictionaries: Creation, Access, Methods, Dictionary Comprehension, Iterating over data structures.

UNIT-3 – Functions and Modules

Functions: Defining, Calling, Parameters, Return Values, Types of Arguments: Positional, Keyword, Default, Variable Length, Scope of Variables: Local and Global, Lambda Functions, Map, Filter, Reduce, Recursion in Python, Modules: Importing, Creating User-defined Modules, Standard Modules (math, random, datetime), Packages in Python.

UNIT-4 – File Handling and Exception Handling

File Handling: Opening, Reading, Writing, Appending, File Modes, File Methods, Working with CSV and JSON Files, Exception Handling: try, except, else, finally, Built-in Exceptions, Raising Exceptions, Introduction to Regular Expressions (re module).

UNIT-5 – Object-Oriented Programming and Applications

OOP Basics: Classes, Objects, Attributes, Methods, Constructor (`__init__`), self keyword, Inheritance: Single, Multiple, Multilevel, Hierarchical, Method Overriding, Method Overloading (conceptual), Encapsulation and Polymorphism, Application Development: Data Processing Script, Basic Calculator, File Organizer, Simple Data Analysis with pandas.

TEXT BOOKS:

1. Python Programming: Using Problem Solving Approach by Reema Thareja.
2. Python Crash Course by Eric Matthes, Learning Python by Mark Lutz.

REFERENCE BOOKS:

1. Introduction to Python Programming by Gowrishankar S., Veena A.
2. Python Cookbook by David Beazley and Brian K. Jones.
3. Fluent Python by Luciano Ramalho, Automate the Boring Stuff with Python by Al Sweigart.

ELECTRONIC RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc26_cs84/preview
2. <https://www.geeksforgeeks.org/python/python-programming-language-tutorial/>

MATERIALS ONLINE:

1. Course template
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COURSE CONTENT

ELEMENTS OF ELECTRICAL AND ELECTROINCS ENGINEERING								
II Semester: CE/Mech								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2520202	Foundation	3	0	0	3	40	60	100
		Contact Classes:45		Tutorial Classes: Nil		Practical Classes: Nil		Total Classes:45
Prerequisites: Mathematics.								

Course Overview:

This course introduces elements of electrical and electronics engineering concepts, including DC/AC circuits, electrical machines, installations, semiconductor devices, and digital logic. It builds fundamental analytical and practical skills required for electrical and electronics applications.

Course Objectives:

1. To understand the basics of electrical circuits and perform AC/DC waveform analysis.
2. To study the principles and performance of electrical machines.
3. To gain knowledge of electrical installations and LT switchgear components.
4. To learn the operation and characteristics of semiconductor devices and rectifier circuits.
5. To understand and compare different transistor types and configurations for electronic circuit applications.

Course Outcomes: After Completion of the Course, Students should be able to

1. Apply basic laws and network theorems for DC and AC circuits.
2. Analyze the working principles, performance characteristics of transformers, DC and induction machines.
3. Identify electrical installation components, compute energy consumption and power factor improvement.
4. Explain the features, functions of diodes, rectifiers and filter circuits.
5. Understand working principles and biasing techniques of BJTs, FETs.

UNIT - I: ELECTRICAL CIRCUITS

DC Circuits: Basic Circuit elements, Classification, Ohm's Law, KVL & KCL, Series, Parallel, Star-Delta Connections, Mesh and Nodal Analysis (Simple Problems).

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT - II: ELECTRICAL MACHINES

Transformers: Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency.

DC Machines: Construction and working principle of DC generators, EMF equation, Working Principle of DC motor, Torque Equation, Speed Control methods of DC Motors.

UNIT - III: ELECTRICAL INSTALLATIONS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing.

Batteries: Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

UNIT - IV: DIODES & TRANSISTORS

Diodes: Classification of solids based on energy band theory- Intrinsic Semi Conductors- Extrinsic Semiconductors- P-type and N-type- PN junction- Zener effect- Zener diode characteristics- Half wave and full wave rectifiers.

Bipolar Junction Transistor (BJT): CB, CE, CC configuration and characteristics- Biasing circuits – Class A, B and C amplifiers.

UNIT - V: DIGITAL LOGIC DESIGN

Binary number system, Boolean algebra, Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive OR and NOR gates, Flip flops, half and full adders, Registers, Counters, A/D and D/A conversion.

TEXT BOOKS:

1. “Basic Electrical and electronics Engineering”, M S Sukija and TK Nagasarkar, Oxford University, 1st Edition, 2012
2. “Basic Electrical and electronics Engineering”, D P Kothari and I J Nagarath, McGraw Hill Education, 2nd Edition, 2020

REFERENCE BOOKS:

1. “Electronic Devices and Circuits”, R. L. Boylestad and Louis Nashelsky, PEI and PHI, 9th Edition, 2006.
2. “Millman’s Electronic Devices and Circuits”, J. Millman, C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.
3. “Engineering Circuit Analysis”, William Hayt and Jack E. Kemmerly, McGraw Hill, 6th Edition, 1971.
3. “Linear circuit analysis”, Raymond A. De Carlo and Pen, Min, Lin, Oxford University Press, 2nd edition, 2004.
4. “Network Theory”, N. C. Jagan and C. Lakshminarayana, McGraw Hill, 2nd Edition, 2005.
5. “Network Theory”, Sudhakar and Shyam Mohan Palli, Tata McGraw Hill, 2nd Edition, 2011.
6. “Fundamentals of Electrical Engineering”, L. S. Bobrow, Oxford University Press, 12th edition, 2003.
7. “Electrical and Electronic Technology”, E. Hughes, Pearson Education, 10th Edition, 2010.
8. “Electrical Engineering Fundamentals”, V. D. Toro, Prentice Hall India, 2nd Edition, 1989.

ELECTRONIC RESOURCES:

1. <https://www.allaboutcircuits.com/textbook/>
2. <https://www.electricaltechnology.org/>
3. <https://www.electronics-tutorials.ws/>
4. <https://www.geeksforgeeks.org/digital-logic/>

MATERIALS ON LINE:

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COURSE CONTENT

ENGINEERING MECHANICS								
I Semester: ME								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2520302	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: There are no prerequisites to take this course.								

Course Overview:

This course introduces the fundamentals of engineering mechanics, beginning with basic concepts, force systems, moments, couples, and equilibrium of coplanar and spatial force systems. It covers the laws and applications of friction, including dry friction and practical cases such as ladders, wedges, and screw jacks. The course explains centroid and center of gravity concepts for lines, areas, and composite bodies, along with the Theorem of Pappus. Students learn area moment of inertia, polar moment, product of inertia, and mass moment of inertia using transfer theorems and integration. The kinetics of rigid bodies is studied, including types of motion, D'Alembert's principle, and connected body systems. The work-energy principle is applied to analyze plane motion and rigid body rotation problems in engineering applications.

Course Objectives:

1. To solve the resultant of any force system.
2. To analyze the types of friction for moving bodies and problems related to friction.
3. To determine the centroid of an area and center of gravity of body.
4. To understand the concept of area moment and mass moment about any axes.
5. Understand the work-energy principle

Course Outcomes: After Completion of the Course, Students should be able to

1. Determine the resultant of coplanar concurrent and special force systems and analyse the bodies for equilibrium to find the unknown forces.(L1)
2. Analyze the bodies on rough horizontal and inclined planes and connected Bodies (L4)
3. Determine the centroid of composite areas, centre of gravity of composite bodies (L3)
4. Determine the moment of inertia of simple areas and mass moment of inertia of simple bodies.(L3).
5. Apply work-energy principle to solve the rigid body problems.(L3).

UNIT – 1

Introduction to Mechanics: Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space -Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

LEARNING OUTCOME:

- Determine the resultant of coplanar concurrent and special force systems and analyse the bodies for equilibrium to find the unknown forces.(L1)

UNIT – 2

Friction: Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions – Types of friction – Dry friction – Ladder friction – Wedge friction – Screw friction – Simple Screw Jack

LEARNING OUTCOME:

- Analyze the bodies on rough horizontal and inclined planes and connected Bodies (L4)

UNIT – 3

Centroid and Center of Gravity: Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity - Center of gravity of composite bodies.

LEARNING OUTCOME:

- Determine the centroid of composite areas, centre of gravity of composite bodies L3

UNIT – 4

Area moments of Inertia: Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration - Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures- Product of Inertia.

Mass Moment of Inertia: Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration - Mass moment of inertia of composite bodies.

LEARNING OUTCOME :

- Determine the moment of inertia of simple areas and mass moment of inertia of simple bodies.(L3)

UNIT – 5

Kinetics of Rigid Bodies: Types of motion, D'Alemberts principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies kinetic of rigid body rotation.

LEARNING OUTCOME :

- Understanding basic laws and principles of kinetics of particle and rigid body.(L2)
- Apply work-energy principle to solve the rigid body problems.(L3)

TEXTBOOKS:

1. Singer's Engineering Mechanics Statics and Dynamics/ K. Vijaya Kumar Reddy and J.Suresh Kumar BSP
2. Engineering Mechanics/ Irving Shames, G.Krishna Mohan Rao / Prentice Hall.

REFERENCE BOOKS:

1. Engineering Mechanics/ Bhattaharyya/ Oxford.
2. Tayal A.K.(2010), Engineering Mechanics. Umesh Publications.
3. Engg. Mechanics by S.S. Bhavikati & K.G. Rajasekharappa

ELECTRONIC RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_me99/preview
2. <https://www.youtube.com/watch?v=gp3wFTFGstM>
3. https://www.youtube.com/watch?v=hOkV4Uo_w2Y
4. <https://archive.nptel.ac.in/courses/112/107/112107219/>
5. <http://www.digimat.in/nptel/courses/video/112107145/L01.html>
6. <https://archive.nptel.ac.in/courses/112/107/112107145/>
7. <https://www.youtube.com/watch?v=6ISddRRHAhA>



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COURSE CONTENT

PROGRAMMING FOR PROBLEM SOLVING								
II Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2520316	Foundation	3	0	0	3	40	60	100
		Practical Classes: Nil			Total Classes: 45			
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

Prerequisites: Basic Engineering Physics and Basic Engineering Chemistry

Course Overview:

The course on *Metallurgy and Material Science* provides a fundamental understanding of the structure, properties, and behaviour of engineering materials. It covers crystal structures, imperfections, and strengthening mechanisms, along with the necessity of alloying and solid solution formation. Phase diagrams, solid-state transformations, and Fe–Fe₃C equilibrium with TTT diagrams are emphasized. Heat treatment processes and surface hardening methods are explained alongside advanced techniques such as age hardening and cryogenic treatment. The course also explores cast irons, steels, non-ferrous alloys, and ceramics. Finally, students learn material testing methods including tensile, hardness, impact, creep, and fatigue, linking theory with engineering applications.

Course Objectives:

1. Understand crystal structures, imperfections, and strengthening mechanisms.
2. Learn phase diagrams, transformations, and Fe–Fe₃C equilibrium.
3. Study heat treatment and surface hardening processes.
4. Know the classification and properties of ferrous, non-ferrous, and ceramic materials.
5. Gain knowledge of testing and characterization of materials

Course Outcomes: After Completion of the Course, Students should be able to

1. Explain structures, defects, and strengthening in metals and alloys.
2. Interpret phase diagrams and TTT diagrams.
3. Apply heat treatment to improve material properties.
4. Identify properties of ferrous, non-ferrous alloys, and ceramics.
5. Conduct material tests and analyze mechanical behaviour.

UNIT - I: Crystal Structure: Unit cells, Metallic crystal structures, **Imperfections in solids:** point, line, surface and volume defects. **Strengthening mechanisms:** Grain Boundary Strengthening, Solid Solution Strengthening, Strain Hardening, Precipitation (Particle) Strengthening, Dispersion Strengthening. **Hume Rotherys rules:** Necessity of alloying, types of solid solutions.

UNIT - II: Equilibrium diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule. Eutectic, Peritectic, eutectoid, peritectoid reactions, phase rule. Transformations in the solid-state allotropy, Study of Fe-Fe₃C equilibrium phase diagram, TTT diagram.

UNIT - III: Heat treatment: Annealing, normalizing, Hardening, tempering, Spheroidising, Harden ability. **Surface hardening methods:** Case hardening, Carburizing, Nitriding, Cyaniding, Carbo Nitriding, Age hardening treatment, Cryogenic treatment of alloys

UNIT - IV: Cast irons and steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron. Classification of steels, structure and properties of plain carbon steels, tool steels. **Non-ferrous metals and alloys:** Structure and properties of copper and its alloys, Aluminium and its alloys. Titanium and its alloy. **Ceramic materials:** Definition, properties of ceramic materials.

UNIT - V: Material testing and characterization, Material testing: Tensile testing, Hardness– Brinell, Rockwell test and micro hardness. Impact test - Charpy and Izod, Creep – creep test, creep curve, Mechanism of creep. Fatigue – fatigue test, S-N curve. **Material Characterization:** Working principle and applications of Optical microscopy (OM), Scanning electron microscopy (SEM).

TEXT BOOKS:

1. Introduction to Physical Metallurgy: Avner, 2nd ed., Tata McGraw-Hill Education, 2010.
2. William D. Callister, Jr, Materials Science and Engineering – An introduction, sixth edition, John Wiley & Sons, Inc. 2004.
3. Materials Science and Metallurgy: Kodgire V. D. 25th ed., Everest Publishing House, 2009

REFERENCE BOOKS:

1. Physical Metallurgy: Raghavan V., 2nd ed., PHI, 2006
2. Materials Science and Metallurgy: Khanna O.P. 5th ed., Dhanpat Rai and Sons, 2009
3. Lawrence H. Van Vlack, Elements of Materials Science and Engineering, sixth edition, Addison Wesley Longman, Inc. New York, 1998.

ELECTRONIC RESOURCES:

1. <https://archive.nptel.ac.in/courses/113/102/113102080/>
2. <https://archive.nptel.ac.in/courses/113/105/113105024/>
3. <https://archive.nptel.ac.in/courses/113/104/113104096/>
4. <https://archive.nptel.ac.in/courses/113/106/113106101/>
5. <https://archive.nptel.ac.in/courses/113/106/113106032/>

MATERIALS ONLINE:

1. Course template
2. Tech talk and Concept Video topics
3. Assignments
4. Model question paper – I
5. Model question paper – II
6. Lecture notes
7. E-Learning Readiness Videos (ELRV)



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COURSE CONTENT

ENGINEERING CHEMISTRY LAB								
I Semester: CSE								
II Semester: CE / CSD / CSM / ECE / EEE / ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
25X0072	Foundation	0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 30			Total Classes: 30			
Prerequisites: Intermediate Chemistry								

Course Overview:

The course includes experiments based on fundamental principles of chemistry essential for engineering students, aiming to develop practical skills and reinforce theoretical concepts.

Course Objectives:

1. Students will understand and perform experiments based on core chemical principles relevant to engineering applications.
2. Students will learn to estimate the hardness of water to assess its suitability for drinking purposes.
3. Students will acquire the ability to perform acid-base titrations using instrumental methods such as conductometry, potentiometry, and pH metric.
4. Students will gain hands-on experience in synthesizing polymers like Bakelite and Nylon – 6, 6 in the laboratory.
5. Students will learn to determine the unknown concentration of potassium permanganate (KMnO₄) using a calibration curve.

Course Outcomes: After Completion of the Course, Students should be able to

CO1: Develop the practical skills through hands-on chemistry experiments relevant to engineering.

CO2: Determine the important parameters such as water hardness and the corrosion rate of mild steel under various conditions.

CO3: Apply the techniques like conductometry, potentiometry, and pH metric to determine concentrations or equivalence points in acid base reactions.

CO4: synthesize the polymers such as Bakelite and Nylon-6,6.

CO5: Determine the unknown concentration of strong acid with strong base by Potentiometry using quinhydrone

List of Experiments:

- I. Volumetric Analysis: Estimation of Hardness of water by EDTA Complexometric method.
- II. Conductometry:
 1. Estimation of the concentration of strong acid by Conductometry.
 2. Estimation of the concentration of strong and weak acid in an acid mixture by Conductometry.
- III. Potentiometry:
 1. Estimation of concentration of Fe⁺² ion by Potentiometry using KMnO₄.
 2. Estimation of concentration of strong acid with strong base by Potentiometry using quinhydrone
- IV. pH Metry: Determination of an acid concentration using pH meter.
- V. Preparations:

1. Preparation of Bakelite.
 2. Preparation Nylon – 6, 6.
- VI. Corrosion: Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.

VII Lubricants:

1. Estimation of acid value of given lubricant oil.
2. Estimation of viscosity of lubricant oil using Ostwald's Viscometer.

VII Virtual lab experiments:

1. Construction of Fuel cell and it's working.
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.

OPEN ENDED EXPERIMENTS:

1. Aspirin
2. Paracetamol

REFERENCE BOOKS:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
2. Vogel's text book of practical organic chemistry 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).

ELECTRONIC RESOURCES:

1. <https://virtual-labs.github.io/exp-microbial-fuel-cell-au>
2. <https://www.doitpoms.ac.uk/>
3. https://phet.colorado.edu/sims/html/circuit-construction-kit-dc-virtuallab/latest/circuit-construction-kit-dc-virtual-lab_en.html



COURSE CONTENT

PYTHON PROGRAMMING LAB								
II Semester: CE / ME								
III Semester: CSD / CSE / CSM								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
25X0575	Core	L	T	P	C	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 30			Total Classes: 30			
Prerequisites: Programming for Problem Solving Lab								

Course Overview:

This Python Programming Laboratory introduces students to fundamental and advanced Python concepts through hands-on experiments. The course covers core programming constructs, data structures, functions, file handling, modules, exception handling, object-oriented programming, and GUI development. It also provides exposure to scientific libraries, digital logic simulation, and real-world problem-solving using Python.

Course Objectives:

1. To install and run the Python interpreter
2. To learn control structures.
3. To Understand Lists, Dictionaries in python
4. To Handle Strings and Files in Python

Course Outcomes: After Completion of the Course, Students should be able to

1. Apply Python language fundamentals, interpreter features, control structures, functions, recursion, and modules for solving computational problems.
2. Develop Python programs using lists, tuples, arrays, dictionaries, and strings for data manipulation and validation tasks.
3. Implement file handling, exception handling, and text processing techniques for data analysis and information retrieval.
4. Design object-oriented Python programs using classes, attributes, and methods including graphical object representation and GUI components.
5. Utilize Python libraries and packages such as NumPy, SciPy, Plotting tools, and logic gate simulations for scientific computing and visualization.

List of Experiments

1.
 - I. Use a web browser to go to the Python website <http://python.org>. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.
 - II. Start the Python interpreter and type `help()` to start the online help utility.
2. Start a Python interpreter and use it as a Calculator.
3. Write a program to calculate compound interest when principal, rate and number of periods are given.
4. Read the name, address, email and phone number of a person through the keyboard and print the details.
5. Print the below triangle using for

loop. 5

4 4

3 3 3

2 2 2 2

1 1 1 1 1

6. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character (use 'if-else-if' ladder)
7. Python program to print all prime numbers in a given interval (use break)
8. Write a program to convert a list and tuple into arrays.
9. Write a program to find common values between two arrays.
10. Write a function called `palindrome` that takes a string argument and returns True if it is a palindrome and False otherwise. Remember that you can use the built-in function `len` to check the length of a string.
11. Write a function called `is_sorted` that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.
12. Write a function called `has_duplicates` that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.
13. Write a function called `remove_duplicates` that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.
14. The wordlist I provided, `words.txt`, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
15. Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.
16. Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
17. Remove the given word in all the places in a string?
18. Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?
19. Writes a recursive function that generates all binary strings of n-bit length
20. Write a python program that defines a matrix and prints
21. Write a python program to perform multiplication of two square matrices
22. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
23. Use the structure of exception handling all general-purpose exceptions.
24. Write a function called `draw_rectangle` that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.
25. Add an attribute named `color` to your Rectangle objects and modify `draw_rectangle` so that it uses the `color` attribute as the fill color.
26. Write a function called `draw_point` that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.
27. Define a new class called `Circle` with appropriate attributes and instantiate a few Circle objects. Write a function called `draw_circle` that draws circles on the canvas.
28. Write a python code to read a phone number and email-id from the user and validate it for correctness.
29. Write a Python code to merge two given file contents into a third file.
30. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.
31. Write a Python code to Read text from a text file, find the word with most number of

occurrences

32. Write a function that reads a file file1 and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.
33. Import numpy, Plotpy and Scipy and explore their functionalities.
34. Install NumPy package with pip and explore it.
35. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
36. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

TEXT BOOKS:

1. Supercharged Python: Take your code to the next level, Overland
2. Learning Python, Mark Lutz, O'reilly

REFERENCE BOOKS:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Sheetal Taneja, Naveen Kumar, Pearson
3. Introduction to Python Programming, Gowrishakar S, Veena A, CRC Press
4. Programming with Python, A User's Book, Michael Dawson, Cengage Learning, India Edition
5. Python for Data Science, Dr. Mohd Abdul Hameed, Wiley publications
6. Core Python Programming, Dr. R. Nageswara Rao, Dreamtech press
7. Introduction to Python, Gowrishankar S, Veena A., CRC Press

ELECTRONIC RESOURCES:

1. <https://python-iitk.vlabs.ac.in/exp/built-in-functions/simulation.html>
2. <https://python-iitk.vlabs.ac.in/exp/loops/simulation.html>
3. <https://python-iitk.vlabs.ac.in/exp/built-in-modules/simulation.html>
4. <https://python-iitk.vlabs.ac.in/exp/file-operators/simulation.html>
5. <https://python-iitk.vlabs.ac.in/exp/strings/simulation.html>

MATERIALS ONLINE:

1. Lab Manual
2. Open-ended experiments



COURSE CONTENT

ELEMENTS OF ELECTRICAL AND ELECTROINCS ENGINEERING LAB								
II Semester: CE/MECH								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2520272	Core	0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes:30			Total Classes:30			
Prerequisites: Elements of electrical and electronic engineering.								

Course Overview: This lab introduces basic electrical circuit analysis and electronic devices, covering circuit laws, RLC circuits, measuring instruments, diodes, transistors, rectifiers, and logic gates through simulation and practical experiments.

Course Objectives: Students will learn

1. To acquire fundamental knowledge of electrical and electronic circuit components and their measurement techniques.
2. To understand the operating principles and performance characteristics of electrical machines and transformers.
3. To analyze the behavior of semiconductor devices and their applications in basic electronic circuits.
4. To explore the working of rectifiers, voltage regulators, and test instruments used in electronic measurements.
5. To develop practical skills in conducting experiments, interpreting results, and correlating theoretical concepts with real-time applications.

Course Outcomes: After Completion of the Course, Students should be able to

1. Demonstrate the verification of basic electrical laws and characteristics of DC and AC circuits.
2. Determine the performance parameters of electrical machines and transformers through experimental analysis.
3. Examine the characteristics of semiconductor devices and their operation in various configurations.
4. Evaluate the performance of rectifiers and voltage regulators using appropriate test equipment.
5. Construct and test electrical and electronic circuits to interpret practical results and validate theoretical concepts.

List of Experiments:

PART A: ELECTRICAL

1. Verification of KVL by using digital simulation.
2. Verification of KCL by using digital simulation.
3. Verification of Ohm's law by using digital simulation.
4. Verification of voltage division in circuits by using digital simulation.
5. Verification of mesh analysis in circuits by using digital simulation.
6. Verification of impedance in series RLC circuits by using digital simulation.

PART B: ELECTRONICS

1. Study and operation of (i) Multi-meters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.
2. PN Junction diode characteristics.
3. Zener diode characteristics and Zener as voltage Regulator.
4. Input & Output characteristics of Transistor in CB / CE configuration.
5. Full Wave Rectifier with & without filters.
Realization of Boolean expressions using Logic Gates.

Proposed open ended experiments:

1. Verification of current division in circuits by using digital simulation.
2. Verification of Impedance in Series RL Circuits by using digital simulation.

TEXT BOOKS:

1. Basic Electrical and electronics Engineering, M.S. Sukija and T.K. Nagasarkar, Oxford University press, 1st Edition, 2012.
2. Basic Electrical and electronics Engineering, D.P. Kothari and I.J. Nagarath, McGraw Hill Education, 2nd Edition, 2020.

REFERENCE BOOKS:

1. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, PEI and PHI, 9th Edition, 2006.
2. Millman's Electronic Devices and Circuits, J. Millman, C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.
3. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, McGraw Hill, 6th Edition, 1971.
4. Linear circuit analysis, Raymond A. De Carlo and Pen, Min, Lin, Oxford University Press 2nd Edition, 2004.
5. Network Theory, N. C. Jagan and C. Lakshminarayana, Mc Graw Hill, 2nd Edition, 2005.
6. Network Theory, Sudhakar and Shyam Mohan Palli, Tata McGraw Hill, 2nd Edition, 2011.
7. Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 12th Edition 2003.
8. Electrical and Electronic Technology, E. Hughes, Pearson Education, 10th Edition, 2010.
9. Electrical Engineering Fundamentals, V. D. Toro, Prentice Hall India, 2nd Edition, 1989.

ELECTRONIC RESOURCES:

1. <https://www.allaboutcircuits.com/textbook/>
2. <https://www.electrical4u.com/basic-electrical-engineering/>
3. <https://www.electronics-tutorials.ws/>
4. <https://www.electricaltechnology.org/>
5. <https://archive.nptel.ac.in/courses/108/105/108105066/>

MATERIALS ONLINE:

1. Lab Manual
2. Open-ended experiments



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I - III



COURSE CONTENT

PROBABILITY DISTRIBUTIONS AND COMPLEX VARIABLES								
IV Semester: MECH								
Course Code	Category	Hours/ Week			Credits	Maximum Marks		
2530007	Basic Science	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 48			
Prerequisites: Mathematics courses of first year of study.								

Course Overview:

The course covers advanced topics of probability and complex variables with applications. Probability theory is the branch of mathematics that deals with modelling uncertainty, and random variate distributions play an exceptional role in designing data-driven technology, known as data-centric engineering. They also have various applications in telecommunications and other engineering disciplines. The course includes random variables, probability distributions, hypothesis testing, confidence intervals, and linear regression. There is an emphasis placed on real-world applications to engineering problems. The course focuses on Advanced Engineering Mathematics, which provides the relevant mathematical tools required to analyse engineering problems and scientific professions. The course includes complex functions and differentiation, complex integration, power series expansion of complex functions. The mathematical skills derived from this course form a necessary base for analytical and design concepts encountered in the program.

Course Objectives:

1. The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
2. The basic ideas of statistics including measures of central tendency, correlation and regression.
3. The statistical methods of studying data samples.
4. Differentiation and integration of complex valued functions.
5. Evaluation of integrals by using Cauchy's integral formula and Cauchy's residue theorem.
6. Expansion of complex functions by using Taylor's and Laurent's series.

Course Outcomes: After Completion of the Course, Students should be able to

1. Apply the binomial distribution and its Poisson approximation to model real-world discrete data scenarios.
2. Apply the Normal distribution and Sampling to model real-world data
 - scenarios.
3. Explain the concept of hypothesis testing and the procedure for performing large sample tests for proportions and means.
4. Illustrate the Milne-Thomson method for constructing analytic functions.
5. Identify the Taylor and Laurent series expansions for analytic functions.

UNIT-I: Random Variables and Probability distributions

Concept of a Random variables: Discrete and continuous random variables and their properties, Expectation of Random Variables, Variance of random variables.

Discrete probability distributions: Binomial and Poisson distributions.

UNIT-II: Continuous probability distributions and Sampling

Uniform distribution - Normal distribution - Area under the Normal Curve - Applications of the Normal Distribution- Normal Approximation to the Binomial distributions. Fundamental Sampling Distributions: Random Sampling - Some important Statistics - Sampling Distributions - Sampling Distribution of Means - Central Limit Theorem.

UNIT-III: Tests of Hypotheses (Large and Small Samples)

Statistical Hypothesis, General Concepts, Testing a Statistical Hypothesis, Test of a single mean, difference of means, single proportion and difference of proportion for large samples, F-distribution.

UNIT-IV: Complex Differentiation

Differentiation of Complex functions, Analyticity, Cauchy-Riemann equations (without proof), Finding harmonic conjugate-Milne Thomson method-Elementary analytic functions (Exponential, Trigonometric, logarithm) and their properties.

UNIT-V: Complex Integration

Line integral, Cauchy's theorem, Cauchy's Integral formula, Zeros of analytic functions, Singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem (All theorems without Proof)

TEXTBOOKS:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics For Engineers & Scientists, 9th Ed. Pearson Publishers.

REFERENCEBOOKS:

1. Fundamentals of Mathematical Statistics, Khanna Publications, S.C. Gupta and V.K. Kapoor.
2. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Education.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. J. W. Brown and R.V. Churchill, Complex Variables and Applications, 7th Edition, McGraw-Hill, 2004.

ELECTRONIC RESOURCES:

1. <https://www.youtube.com/watch?v=j9WZyLZCBzs>
2. <https://www.youtube.com/watch?v=UnzbuggU2LE>
3. <https://www.youtube.com/watch?v=gI5y3RZe9fk>
4. <https://www.youtube.com/watch?v=l87zHfGW3Z4>
5. https://www.youtube.com/watch?v=ccIw3vGW0Rg&list=PLeIE3weEKo4aamYts4iA_Ymb8ULYm82WR
6. <https://www.youtube.com/watch?v=TP8PDII7gxo&list=PLeIE3weEKo4b3ixjoqqIPVgHROQykVa69>

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Definitions and terminology
4. Assignments
5. Model question paper-I
6. Model question paper-II
7. Lecture notes
8. E-Learning Readiness Videos(ELRV)



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COURSE CONTENT

THERMODYNAMICS								
III Semester: CE / CSD / CSE / CSM / ECE / EEE / ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2530303	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: There are no prerequisites to take this course.								

Course Overview:

Thermodynamics is the science that deals with the relationship between heat and work, as well as the properties of systems associated with them. It encompasses the general laws governing energy transformations in various types of systems, including mechanical, electrical, and chemical. These laws, derived from empirical evidence and experimentation, enable predictions about the physical behavior of systems through logical reasoning. The findings have been formalized as the laws of thermodynamics. Power cycles and refrigeration cycles, which are based on thermodynamic principles, are also studied. In this process, students become familiar with standard charts and tables

Course Objectives:

1. To introduce the basic concepts and laws of thermodynamics.
2. To apply the first and second laws to closed and open systems.
3. To understand the properties of pure substances and their use in thermodynamic processes.
4. To study the working principles and performance of thermodynamic cycles.
5. To prepare students for applications in engines, power plants and refrigeration

Course Outcomes: After Completion of the Course, Students should be able to

1. Understand the basic thermodynamic concepts, systems, and properties.
2. Apply the first law to both closed and open systems.
3. Analyze thermodynamic processes using property diagrams and tables.
4. Apply the second law and evaluate entropy changes and efficiency.
5. Examine the performance of power and refrigeration cycles

UNIT - I: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium State, Property, Process, Exact and Inexact Differentials, Cycle, Reversibility, Quasi – static Process, Irreversible Process, Causes of Irreversibility, Energy in State and in Transition, Types, Displacement and Other forms of Work Heat Point and Path functions, Zeroth Law of Thermodynamics, Concept of Temperature, Principles of Thermometry, Reference Points, Constant Volume gas Thermometer, Scales of Temperature, Ideal Gas Scale, PMM - I, Joule’s Experiments, First law of Thermodynamics, Corollaries, First law applied to a Process, applied to a flow system, Steady Flow Energy Equations.

UNIT - II: Limitations of the First Law, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin, Planck and Clausius Statements and their Equivalence, Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics..

UNIT - III: Pure Substances, P - V- T surfaces, T- S and h- s diagrams, Mollier Charts, Phase Transformations: Triple point at critical state properties during change of phase, Dryness Fraction, Clausius - Clapeyron Equation, Property tables and application of these concepts in various thermodynamic processes, including steam calorimetry. Perfect Gas Laws, Equation of State, Specific and Universal Gas constants, various Nonflow processes, Properties, end states, Heat and Work Transfer, changes in Internal Energy, Throttling and Free Expansion Processes, Flow processes.

UNIT - IV: Deviations from perfect Gas Model, Vander Waals Equation of State, and Compressibility charts, variable specific Heats, Gas Tables.

Mixtures of perfect Gases: Mole Fraction, Mass fraction Gravimetric and volumetric Analysis. Dalton's Law of partial pressure, Avogadro's Laws of additive volumes. Mole fraction, Volume fraction and partial pressure, Equivalent Gas constant and Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour.

UNIT - V: Atmospheric air, Psychrometric Properties, Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, Saturated Air, Vapour pressure, Degree of saturation, Adiabatic Saturation, Carrier's Equation, Psychrometric chart.

Thermodynamic Cycles: Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle, Description and representation on P–V and T- S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis, Comparison of Cycles.

Refrigeration Cycles: Bell Coleman cycle, Vapour compression cycle, Ammonia, Water Vapor Absorption Cycle.

TEXT BOOKS:

1. Engineering Thermodynamics, P.K. Nag, Mc Graw Hill, 7th Edition, 2020.
2. Thermodynamics, Yunus A Cengel, Michael A Boles, Mehmet Kanoglu, McGraw-Hill, 9th Edition, 2019

REFERENCE BOOKS:

1. Thermodynamics, Yunus A Cengel, Michael A Boles, Mehmet Kanoglu, McGraw-Hill, 9th Edition, 2019
2. Thermodynamics, J.P. Holman, McGraw Hill Education, 10th Edition, 2010
3. Engineering Thermodynamics, Chattopadhyay, Oxford, 2nd Edition, 2015.
4. Engineering Thermodynamics, Rogers, Pearson, 4th Edition, 1996.
Engineering Thermodynamics, M Achuthan, PHI, 2nd Edition, 2009

ELECTRONIC RESOURCES:

1. <https://www.thermopedia.com/>
2. <https://heattransferbooks.com/>
3. https://www.cheresources.com/mass_transfer.asp
4. <https://engineeringtutorials.net/thermodynamics/>

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
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(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956

COURSE CONTENT

MECHANICS OF SOLIDS								
III Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2530317	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: Engineering Mechanics								

Course Overview:

This course explores the fundamental concepts of stress and strain in materials, including axial, shear, and thermal stresses. It examines shear force and bending moment relationships in beams, bending stress, and deflection analysis. The syllabus covers the theory of torsion for circular shafts and helical springs, stresses in thin-walled cylinders, and principal stresses using analytical and graphical methods. Practical applications in structural analysis and material strength are emphasized throughout.

Course Objective:

1. To Understand the concepts of internal forces, moments, stress, strain, and deformation of solids with applications to bars, beams, and columns.
2. To Learn the fundamentals of applying equilibrium, compatibility, and force – deformation relationships to structural elements.
3. To Study twisting of circular bars and hollow shafts acted on by torsional moments.
4. To Define the state of stress at a point on a body and to develop stress transformations.
5. To Introduce the concept of theories of elastic failure and their significance in the design.

Course Outcomes: After successful completion of the course, students should be able to

1. Evaluate the internal forces, moments, stresses, strains, and deformations in structures made of various materials acted on by a variety of loads.
2. Draw axial force, shear force and bending moment diagrams for beams and frames.
3. Develop the Bending and Torsion formula and apply to the design of beams and shafts.
4. Use the stress transformation equations to find the state of stress at a point for various rotated positions of the stress element and display the same in graphical form as Mohr's circle.
5. Understand the different criteria for the safety of the component by applying the theories of elastic failure.

UNIT - I

[09]

Stress and Strain: Elasticity and plasticity, Types of stresses and strains, Hooke's law, Stress – strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio and volumetric strain, Elastic moduli and the relationship between them, Bars of varying sections, Composite bars, Temperature stresses. Strain energy and Resilience: Gradual, sudden, impact and shock loadings.

UNIT -II:

[10]

Shear Force and Bending Moment: Definition of beam, Types of beams, Concept of shear force and bending moment, S.F and B.M diagrams for cantilever, Simply supported and overhanging beams subjected to point loads and Uniformly Distribute Load, Uniformly varying loads and combination of these loads, Point of contra flexure, Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT -III:

[10]

Flexural Stresses: Theory of simple bending, Assumptions, Derivation of pure bending equation, Determination of bending stresses. Section modulus for rectangular and circular sections of Solid and Hollow: I, T, Angle and Channel sections, Design of simple beam sections.

Shear Stresses: Derivation of formula, Shear stress distribution across various beams sections: Rectangular, Circular, Triangular, I, T and Angle sections.

UNIT -IV:

[10]

Principal Stresses and Strains: Introduction, Stresses on inclined sections of a bar under axial loading, Compound stresses, Normal and tangential stresses on an inclined plane for biaxial stresses, two perpendicular normal stresses accompanied by a state of simple shear, Mohr's circle of stresses, Principal stresses and strains, Analytical and graphical solutions.

Torsion of Circular Shafts: Theory of pure torsion, Derivation of Torsion equations, Assumptions made in the theory of pure torsion, Torsional moment of resistance, Polar section modulus, Power transmitted by shafts, Combined bending and torsion and end thrust.

UNIT -V:

[9]

Columns and Struts: Euler's Theory, Limitations of Euler's theory, Equivalent Length, Rankine's Formula, Secant Formula.

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

TEXT BOOKS:

1. Strength of Materials, S. Ramamrutham and R. Narayanan, Dhanpat Rai Publishing, 20th Edition, 2020.
2. Elements of Strength of Materials, S.P. Timoshenko and D.H. Young, CBS Publishers, 5th Edition, Reprint 2020.

REFERENCE BOOKS:

1. Strength of Materials, S. S. Rattan, Tata McGraw Hill, 2nd Edition, 2011.
2. Engineering Mechanics of Solids, Egor P. Popov and Toader A. Balan, PHI Learning, 2nd Edition, 2010.
3. Strength of Materials, Bansal, Lakshmi Publications, 6th Edition, 2012.

ELECTRONIC RESOURCES:

1. http://www.efunda.com/sm_home/sm.cfm
2. <https://nptel.ac.in/courses/112105171/1>
3. <https://nptel.ac.in/courses/112107146>
4. https://onlinecourses.nptel.ac.in/noc23_me140/preview

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Definitions and terminology
4. Assignments
5. Model question paper – I
6. Model question paper – II
7. Lecture notes
8. E-Learning Readiness Videos (ELRV)



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COURSE CONTENT

PRODUCTION TECHNOLOGY								
III Semester: ME								
Course Code	Category	Hours / Week			Credit	Maximum Marks		
2530318	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: There are no prerequisites for this course.								

Course Overview:

This course provides fundamental knowledge of manufacturing processes including casting, welding, forming, and related modern techniques. Students will learn the principles, equipment, and operations of traditional and advanced manufacturing methods. The course emphasizes process characteristics, advantages, limitations, and defect analysis. By the end of the course, students will develop the ability to select appropriate manufacturing processes for specific engineering applications.

Course Objectives:

1. To understand the principles, processes, and design considerations involved in casting.
2. To study the types, applications, and techniques of welding processes.
3. To analyze gas welding, advanced welding processes, and inspection methods.
4. To comprehend hot and cold working processes and their industrial applications.
5. To gain knowledge of extrusion, forging, and high-energy rate forming processes.

Course Outcomes: After Completion of the Course, Students should be able to

1. To understand the principles, processes, and design considerations involved in casting.
2. To study the types, applications, and techniques of welding processes.
3. To analyze gas welding, advanced welding processes, and inspection methods.
4. To comprehend hot and cold working processes and their industrial applications.
5. To gain knowledge of extrusion, forging, and high-energy rate forming processes.

UNIT - I: CASTING

Casting: Steps involved in making a casting, Advantage of casting and its applications, Patterns, Pattern making, Types, Materials used for patterns, Pattern allowances, Properties of moulding methods. Methods of Melting, Crucible melting and cupola operation, Defects in castings, Principles of Gating, Requirements, Types of gates, Design of gating systems, Riser, Function, Types of Riser and Riser design. Casting processes, Types, Sand moulding, Centrifugal casting, Die, Casting, Investment casting, Shell moulding.

UNIT - II: ARC WELDING

Arc Welding: Classification, Types of welds and welded joints and their characteristics, Welding Positions, Arc welding, shielded metal arc welding, Submerged arc welding, Resistance welding, Thermit welding.

UNIT - III: GAS WELDING

Gas Welding: Gas welding, Types, Oxyfuel gas cutting, Standard time and cost calculations. Inert Gas Welding, TIG Welding, MIG welding, Friction welding, Friction Stir Welding, Induction welding, Explosive welding, Laser Welding. Soldering, Brazing, Heat affected zone in welding. Welding defects, Causes and remedies, Destructive and non, Destructive testing of welds.

UNIT - IV: HOT WORKING AND COLD WORKING

Strain hardening, Recovery, Recrystallization and grain growth. Sheet metal Operations: Stamping, Blanking and piercing, Coining, Strip layout, Hot and cold spinning, Bending and deep drawing. Rolling fundamentals, Theory of rolling, Types of Rolling mills and products. Drawing and its types, Wire drawing and Tube drawing, Types of presses and press tools.

UNIT - V: METAL FORMING AND HIGH-ENERGY PROCESSES

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion, Forward extrusion and backward extrusion, Impact extrusion, Extruding equipment, Tube extrusion, Hydrostatic extrusion. Forces in extrusion.

Forging Processes: Forging operations and principles, Tools, Forging methods, Smith forging, Drop Forging, Roll forging. Forging hammers: Rotary forging, Forging defects, Cold forging, Swaging, Forces in forging operations.

High Energy Rate Forming Processes: Principles of Explosive Forming, Electrohydraulic Forming, Electro, Magnetic forming and rubber pad forming.

TEXTBOOKS:

1. A Textbook of Production Technology (Manufacturing Processes), Dr. P.C. Sharma, S. Chand Publishing, 11th Revised Edition, 2022.
2. Manufacturing Technology: Foundry, Forming and Welding, P.N. Rao, McGraw Hill Education, Vol. 1, 5th Edition, 2018.

REFERENCE BOOKS:

1. Manufacturing Engineering and Technology, Serope Kalpakjian and Steven R. Schmidt, Pearson, 7th Edition, 2014.
2. Elements of Workshop Technology Vol.1, S.K. Hajra Choudhury, A.K. Hajra Choudhury and Nirjhar Roy, Media Publishers and Promoters Pvt. Ltd., 1st Edition, 2008.

ELECTRONIC RESOURCES:

1. <https://nptel.ac.in/courses/112106200>
2. <https://nptel.ac.in/courses/112104204>
3. <https://nptel.ac.in/courses/112107083>
4. <https://nptel.ac.in/courses/112105127>
5. <https://nptel.ac.in/courses/112104205>

MATERIALS ONLINE:

1. Course template
2. Tech talk and Concept Video topics
3. Open-ended experiments
4. Definitions and terminology
5. Assignments
6. Model question paper – I
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COURSE CONTENT

FLUID MECHANICS AND HYDRAULIC MACHINES								
III Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2530319	Foundation	3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: Engineering Mechanics, Thermodynamics								

Course Overview:

Fluid Mechanics and Hydraulic Machines introduce the fundamentals of fluid properties, flow behavior, and measurement techniques. It also covers the principles and performance of hydraulic turbines and pumps for practical engineering applications.

Course Objectives:

1. To understand the basic principles of fluid mechanics.
2. To identify various types of flows.
3. To understand boundary layer concepts and flow through pipes.
4. To evaluate the performance of hydraulic turbines.
5. To understand the functioning and characteristic curves of pumps.

Course Outcomes: After Completion of the Course, Students should be able to

1. Explain the effect of fluid properties on a flow system.
2. Identify type of fluid flow patterns and describe continuity equation.
3. Analyze fluid flow, measuring devices, and boundary layer concepts by applying Fluid Mechanics principles in design.
4. Select and analyze an appropriate turbine with reference to given situation in power plants.
5. Estimate performance parameters of a given Centrifugal and Reciprocating pump.

UNIT - I: Fluid statics: Dimensions and units: Physical properties of fluids, Specific gravity, Viscosity and surface tension, Vapour pressure and their influence on fluid motion, Atmospheric, Gauge and vacuum pressures, Measurement of pressure, Piezometer, U-tube and differential manometers.

UNIT - II: Fluid kinematics: Stream line, Path line and streak lines and stream tube. Classification of flows: Steady and unsteady, Uniform and non, Uniform, Laminar and turbulent, Rotational and irrotational flows, Equation of continuity for one dimensional flow and three-dimensional flows.

Fluid dynamics: Surface and body forces, Euler's and Bernoulli's equations for flow along a stream line.

Measurement of flow: Pitot tube, venture meter, and orifice meter, Flow nozzle Momentum equation and its application on force on pipe bend.

UNIT - III: Closed conduit flow: Reynold's experiment, Darcy Weisbach equation, Minor losses in pipes, pipes in series and pipes in parallel, total energy line & hydraulic gradient line.

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

UNIT - IV: Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT - V: Centrifugal pumps: Classification, working, work done – barometric head-losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

TEXT BOOKS:

1. Hydraulics, Fluid mechanics and Hydraulic Machinery, Modi and Seth, standard Book House, 22nd Edition, 2019.
2. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publications, 10th Edition, 2020.

REFERENCE BOOKS:

1. Fluid Mechanics and Hydraulic Machines, Er. R. K. Rajput, S. Chand, 2019.
2. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria and Sons, 22nd Edition, 2018.
3. Fluid Mechanics and Machinery, D. Rama Durgaiyah, New Age International publishers, 1st Edition, 2002.

ELECTRONIC RESOURCES:

1. <https://elearn.nptel.ac.in/shop/nptel/introduction-to-fluid-mechanics/>
2. <https://www.nptelprep.in/courses/112105183/videos?>
3. <https://archive.nptel.ac.in/courses/105/105/105105203/?>

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)



COURSE CONTENT

Computational Mathematics Lab (Using Python software)								
II year/ I Semester: CE/CSD/CSM/EEE/ME								
II year/ II Semester: CSE/ECE/EEE								
CourseCode	Category	Hours/ Week			Credits	MaximumMarks		
		L	T	P	C	CIA	SEE	Total
2530075	Basic sciences	0	0	2	1	40	60	100
ContactClasses:Nil	TutorialClasses:Nil	PracticalClasses:32			TotalClasses:32			
Prerequisites: Matrices, Iterative methods and ordinary differential equations								

Course Overview:

This course introduces the mathematical foundations of numerical methods for solving systems of equations, root-finding problems, eigenvalue analysis, and differential equations. It emphasizes the development and implementation of standard numerical algorithms such as LU decomposition, Bisection, and Newton-Raphson methods using Python. Learners will model and analyze real-world scientific and engineering phenomena through exponential and differential equations.

Course Objectives:

1. Understand the mathematical foundations of numerical methods used for solving systems of equations, root-finding, and differential equations. Also, apply computational tools (Python and relevant libraries) to model, analyze, and solve scientific and engineering problems.
2. Develop programs that implement standard numerical algorithms such as LU decomposition, Bisection, and Newton–Raphson methods.
3. Analyze and interpret eigenvalues and eigenvector computations for system stability and physical modeling.
4. Model real-world phenomena (e.g., population growth, drug decay, cooling, and radioactive decay) using exponential and differential equations.
5. Formulate, verify, and solve both exact and non-exact differential equations symbolically and numerically using Python. Methods of solving the differential equations of first order and first degree.

Course Outcomes: After Completion the experiments, Students should be able to

1. Solve non-homogeneous linear systems using LU decomposition and interpret the computational results.
2. Compute real and complex eigenvalues and eigenvectors of matrices using Python.
3. Apply Bisection and Newton–Raphson methods to determine roots of nonlinear equations with specified accuracy.
4. Identify, verify, and solve exact and non-exact differential equations symbolically and numerically. Also, implement homogeneous and non-homogeneous linear ordinary differential equations using analytical and numerical techniques.
5. Model and simulate natural processes such as population growth, drug decay, and radioactive half-life using exponential functions and estimate parameters like the cooling constant in Newton’s law of cooling and predict system behavior over time.

List of Experiments:

1. Solve a non-homogeneous linear system using LU decomposition in Python.
Input: matrix A and right-hand side vector b.

- Output: solution vector x , and the L and U factors (with pivoting if needed).
2. Write a general Python program that accepts a square matrix from the user and returns its eigenvalues (including complex values when they occur).
Input: square matrix.
Output: list of eigenvalues (real and complex).
 3. Implement computational tools in Python to compute eigenvectors for a given square matrix.
Input: square matrix (and optionally selected eigenvalues).
Output: corresponding eigenvectors (normalized or not, as specified).
 4. Implement the Bisection method in Python to find a root of any continuous function on a given interval.
Input: function f , interval $[a, b]$ with $f(a)f(b) < 0$, tolerance, and max iterations.
Output: approximate root and iteration info.
 5. Implement the Newton–Raphson method in Python to find a root of any differentiable function.
Input: function f , its derivative f' , initial guess x_0 , tolerance, and max iterations.
Output: approximate root and iteration info.
 6. Detect and solve exact differential equations in Python.
Input: first-order differential equation $M(x,y) + N(x,y) y' = 0$.
Output: determine if the equation is exact; if so, provide the general solution (implicit or explicit).
 7. Solve non-exact first-order differential equations in Python by finding and applying an integrating factor when possible.
Input: $M(x,y) + N(x,y) y' = 0$.
Output: integrating factor (if found) and the general solution.
 8. Write a Python program that models exponential processes, such as population growth, drug decay in blood, or radioactive decay.
Input: model parameters (initial value, rate or half-life, time span).
Output: time series (table or plot) and parameter estimates where applicable.
 9. Compute the cooling constant k from two temperature measurements and predict future temperature using Newton’s law of cooling in Python.
Input: ambient temperature, two measurements
Output: estimated k and predicted temperature for requested times.
 10. Derive and solve homogeneous linear ordinary differential equations in Python.
Input: linear ODE with constant coefficients (specify order).
Output: general solution (analytic where possible) and particular initial/boundary value solutions.
 11. Solve non-homogeneous linear ordinary differential equations with constant coefficients in Python.
Input: Linear ODE with constant coefficients and a non-homogeneous term, including initial or boundary conditions if provided.
Output: general solution and particular solution; numeric solution if analytic form is not available.
 12. Solve non-homogeneous linear ordinary differential equations with variable coefficients in Python.
Input: Linear ODE with variable coefficients and a non-homogeneous term, including initial or boundary conditions if provided.
Output: general solution and particular solution; numeric solution if analytic form is not available.

Open Ended Experiments:

1. Solve a System of Linear Equations using the Gauss–Jordan Elimination Method in Python
Input: Coefficient matrix A and right-hand side vector b .
Output: Solution vector x ; reduced row echelon form of the augmented matrix; verification of results using built-in functions (if desired).
2. Solve a System of Linear Equations using the Gauss–Seidel Iterative Method in Python

Input: Coefficient matrix A , right-hand side vector b , initial guess x_0 , tolerance, and maximum number of iterations.

Output: Approximate solution vector x and number of iterations required for convergence.

TEXTBOOKS:

1. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
2. Think Python First Edition, by Allen B. Downey, Orielly publishing.
3. IntroductiontoPythonProgramming, William Mitchell, Povel Solin, Martin Novak et al., NC Lab Public Computing, 2012.
4. IntroductiontoPythonProgramming, ©Jacob Fredslund, 2007.

REFERENCEBOOKS:

1. An Introduction to Python, John C. Luth, The University of Alabama, 2011.
IntroductiontoPython, ©Dave Kuhlman, 2008.

ELECTRONIC RESOURCES:

1. <https://www.youtube.com/watch?v=wtUk7CqbAt4>
2. <https://www.youtube.com/watch?v=OZ0JM9RAa00>
3. <https://www.youtube.com/watch?v=vTUPQq2mdbY>
4. https://www.youtube.com/watch?v=oVLhKP_JfnE&t=2s
5. <https://www.youtube.com/watch?v=fOdM9HKRtbs&t=122s>

MATERIALS ONLINE:

1. Course template
2. Lab Manual
3. Open-ended experiments
4. e-Learning Readiness Videos (ELRV)



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COURSE CONTENT

PRODUCTION TECHNOLOGY LAB								
III Semester: ME								
Course Code	Category	Hours / Week			Credit	Maximum Marks		
2530375	Foundation	L	T	P	C	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45			Total Classes: 45			
Prerequisites: Engineering Workshop								

Course Overview:

The Production Technology Lab provides practical exposure to basic manufacturing processes such as casting, welding, forming, machining, and plastic processing. It helps students understand the working principles of production tools, machines, and equipment through hands-on experiments. The lab bridges the gap between theory and practice while emphasizing safety, process understanding, and product quality.

Course Objectives:

1. To provide hands-on experience with casting, welding, forming, and machining operations.
2. To help students understand the working principles of manufacturing processes.
3. To expose students to tools, machines, and equipment used in production workshops.
4. To develop safety awareness and quality control in manufacturing practices.
5. To bridge theoretical knowledge with practical application of manufacturing methods.

Course Outcomes: After Completion of the Course, Students should be able to

1. Demonstrate casting practices such as pattern making and sand molding.
2. Perform welding operations like arc welding, gas welding, and spot welding.
3. Operate basic machining tools such as lathe, drilling, and milling machines.
4. Understand sheet metal fabrication, bending, and joining processes.

List of Experiments:

- I. Metal Casting:
 1. Pattern Design and making - 1 Exercise (one casting drawing).
 2. Sand properties testing - 1 Exercise (strengths, and permeability)
 3. Moulding Melting and Casting -1 Exercise
- II. Welding:
 1. ARC Welding Lap and Butt Joint - 2 Exercises
 2. Spot Welding - 1 Exercise
 3. TIG Welding - 1 Exercise
 4. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

III. Mechanical Press Working:

1. Blanking and Piercing operation and study of simple, compound and progressive press tool.

2. Hydraulic Press: Deep drawing and extrusion operation.

3. Bending and other operations

IV. Processing of Plastics:

1. Injection Moulding

2. Blow Moulding

TEXTBOOKS:

1. Dictionary of Mechanical Engineering, G.H.F. Naylor, Jaico Publishing House, 1st Edition, 1999.

REFERENCE BOOKS:

1. Manufacturing Engineering and Technology, Serope Kalpakjian and Steven R. Schmidt, Pearson, 7th Edition, 2014.
2. Elements of Workshop Technology Vol.1, S.K. Hajra Choudhury, A.K. Hajra Choudhury and Nirjhar Roy, Media Publishers and Promoters Pvt. Ltd., 1st Edition, 2008.

ELECTRONIC RESOURCES:

1. <https://www.vlab.co.in>
2. <http://www.vlab.amrita.edu>
3. <https://mp-dei.vlabs.ac.in/>
4. <https://3dp-dei.vlabs.ac.in/List%20of%20experiments.html>
5. <http://gssl.iitk.ac.in/pssl/>
6. <http://sm-nitk.vlabs.ac.in/>
7. <http://msvs-dei.vlabs.ac.in/>

MATERIALS ONLINE:

1. Lab Manual



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COURSE CONTENT

PROGRAMMING FOR PROBLEM SOLVING								
III Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2530376	Foundation	0	0	2	1	40	60	100
		Practical Classes: Nil			Total Classes: 45			
Contact Classes: 26	Tutorial Classes: Nil							
Prerequisites: Basic knowledge in Physics								

Course Overview:

The course is to learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. Detailed study of properties of materials and also of interest. Fundamentals of applying equilibrium, compatibility, and force- deformation relationships to structural elements are emphasized. The students are introduced to advanced concepts of flexibility and stiffness methods of structural analysis. The course builds on the fundamental concepts of engineering mechanic's course.

Course Objectives:

1. Learn crystal structures and microstructures of metals and alloys.
2. Understand microstructures of steels and cast irons.
3. Gain skills in mechanical testing of materials.
4. Perform hardness, impact, bending, and torsion tests.
5. Interpret test results for engineering applications.

Course Outcomes: After Completion of the Course, Students should be able to

1. Identify crystal models and microstructures.
2. Explain microstructure–property relationships.
3. Perform mechanical tests (tension, torsion, bending, hardness, impact).
4. Analyze results of hardenability and strength tests.
5. Interpret and conclude experimental data for material selection.

LIST OF EXPERIMENTS:

1. Preparation and study of crystal models for simple cubic, body centered cubic, face centered cubic and close packed structures.
2. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
3. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
4. Study of the Microstructures of Cast Irons.
5. Hardenability of steels by Jominy End Quench Test.
6. Direct Tension Test
7. Bending test on Simple supported beam.
8. Bending test on Cantilever beam
9. Torsion test
10. Brinell hardness test / Rockwell hardness test
11. Test on springs

12. Izod Impact test / Charpy Impact test.

TEXT BOOKS:

1. Introduction to Physical Metallurgy: Avner, 2nd ed., Tata McGraw-Hill Education, 2010.
2. William D. Callister, Jr, Materials Science and Engineering –An introduction, sixth edition, John Wiley & Sons, Inc. 2004.
3. Materials Science and Metallurgy: Kodgire V. D. 25th ed., Everest Publishing House, 2009

REFERENCE BOOKS:

1. Physical Metallurgy: Raghavan V., 2nd ed., PHI, 2006
2. Materials Science and Metallurgy: Khanna O.P. 5th ed., Dhanpat Rai and Sons, 2009
3. Lawrence H. Van Vlack, Elements of Materials Science and Engineering, sixth edition, Addison Wesley Longman, Inc. New York, 1998.

ELECTRONIC RESOURCES:

1. <https://sm-nitk.vlabs.ac.in/List%20of%20experiments.html>
2. <http://vlabs.iitkgp.ac.in/scm/>

MATERIALS ONLINE:

1. Course template
2. Definitions and terminology



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COURSE CONTENT

FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY								
III Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2530377	Foundation	L	T	P	C	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: 30	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 30			
Prerequisites: Basic knowledge in Physics								

Course Overview:

This laboratory course provides hands-on experience in fluid mechanics and hydraulic machinery. Students will perform experiments on flow measuring devices such as Venturi and Orifice meters, and study energy losses in pipelines due to friction and sudden contractions. Verification of fundamental principles like Bernoulli's theorem strengthens their understanding of fluid behavior. The course also emphasizes performance evaluation of hydraulic turbines (Pelton, Francis, Kaplan) and pumps (centrifugal and reciprocating) under various operating conditions. Through these experiments, students develop practical skills in calibration, testing, data interpretation, and analysis, enabling them to apply theoretical knowledge to real-world hydraulic systems.

Course Objectives:

1. Understand fluid flow measurement using Venturi and Orifice meters.
2. Analyze energy losses and friction in pipelines.
3. Verify fluid mechanics principles like Bernoulli's theorem.
4. Evaluate performance of turbines and pumps.
5. Develop experimental and data analysis skills in hydraulics.

Course Outcomes: After Completion of the Course, Students should be able to

1. Calibrate and use flow measuring devices accurately.
2. Determine friction factors and head losses in pipelines.
3. Verify Bernoulli's theorem experimentally.
4. Assess performance of turbines and pumps.
5. Apply experimental results for practical hydraulic system analysis.

LIST OF EXPERIMENTS:

1. Calibration of Venturi meter.
2. Calibration of Orifice meter.
3. Determination of friction factor for a given pipe line.
4. Determination of loss of head due to sudden contraction in a pipeline.
5. Verification of Bernoulli's Theorems.
6. Impact of jets on Vanes.
7. Performance Test on Pelton Wheel.
8. Performance Test on Francis Turbine.

9. Performance Test on Kaplan Turbine.
10. Performance Test on Single Stage Centrifugal Pump.
11. Performance Test on Multi Stage Centrifugal Pump.
12. Performance Test on Reciprocating Pump.

TEXT BOOKS:

1. Hydraulics, Fluid mechanics and Hydraulic Machinery, Modi and Seth, standard Book House, 22nd Edition, 2019.
2. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publications, 10th Edition, 2020.

LAB MANUALS:

1. Fluid Mechanics and Machinery Laboratory Manual, Sadhu Singh, Khanna Publishers, 2022.
2. Fluid Mechanics and Hydraulic Machines, K. Subramanya, McGraw Hill Education, 2022.

ELECTRONIC RESOURCES:

1. <https://fm-iitk.vlabs.ac.in/>

MATERIALS ONLINE:

1. Lab Manual



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I-IV



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COURSE CONTENT

KINEMATICS OF MACHINERY								
IV Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2540320	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: Basic principles of Mechanics								

Course Overview:

The Kinematics of Machinery course provides an in-depth study of mechanisms, motion analysis, and machine components essential for mechanical engineering applications. It begins with fundamental concepts, including kinematic pairs, degrees of freedom, and various mechanisms such as four-bar chains, steering mechanisms, and straight-line motion mechanisms. The course progresses to kinematic analysis using graphical and analytical methods, including velocity, acceleration, and mechanical advantage. It also covers cams, gears, gear trains, and their motion characteristics. This subject equips students with analytical and problem-solving skills for designing and optimizing mechanical systems.

Course Objective:

1. To introduce the concept of machines, mechanisms and related terminologies and the relative motion, velocity, and accelerations of the various elements in a mechanism.
2. To make the students become familiar with the most commonly used mechanisms such as fourbar, slider crank, double slider crank mechanisms and their inversions.
3. To provide an overview of straightline motion mechanisms, steering mechanisms and Hooke's joint.
4. To familiarize higher pairs like cams and principles of cams design.
5. To understand the kinematic analysis of gears and gear trains.

Course Outcomes: After successful completion of the course, students should be able to

1. Understand the various elements in mechanism and the inversions of commonly used mechanisms such as four bar, slider crank and double slider crank mechanisms.
2. Draw the velocity and acceleration polygons for a given configuration of a mechanism
3. Understand the conditions for straight line motion mechanisms, steering mechanism and the usage of Hooke's joint.
4. Draw the displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers.
5. Calculate the number of teeth and velocity ratio required for a given combination of gears.

UNIT - I

[09]

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs closed and open pairs – constrained motion – completely, partially or successfully and incompletely constrained.

Mechanism and Machines: Mobility of Mechanisms: Grubler's criterion, classification of mechanism – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage.

UNIT -II:

[10]

Kinematic Analysis: Displacement, velocity and acceleration analysis of simple mechanisms graphical method (slider crank, four bar and toggle mechanism), Relative Velocity, Rubbing Velocity, Mechanical Advantage, instantaneous centre method (slider crank, four bar and toggle mechanism)- Aronhold Kennedy Theorem, Kliens construction - Coriolis component of acceleration.

UNIT -III:

[10]

Straight line motion mechanisms, steering gears, hooke's joint

Straight-line motion mechanisms: Exact and approximate copied and generated types – Peaucellier – Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism – Pantographs

Steering gears: Conditions for correct steering – Davis Steering gear, Ackerman's Steering gear.

Hooke's Joint: Single and double Hooke's joint –velocity ratio – application.

UNIT -IV:

[10]

Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of motion of followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

UNIT –V:

[9]

Higher pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding. Forms of teeth, cycloidal and involute profiles – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical – Bevel and worm gearing

Gear Trains: Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box – Differential gear for an automobile

TEXT BOOKS:

1. Kinematic analysis and synthesis of mechanisms: by Mallik, A. K., Ghosh, A., & Dittrich/ G CRC Press/ 10th Edition, 2008.
2. Theory of Machines by Rattan.S.S. McGraw-Hill Education (India) Pvt Ltd./ 6th Edition/ 2013.

REFERENCE BOOKS:

1. The theory of machines: A Text-Book for Engineering Students: by Bevan T/ Pearson Education/ 4th Edition/ 2013.
2. Fundamentals of kinematics and dynamics of machines and mechanisms: by Vinogradov, O. G./ CRC Press/ 2nd Edition/ 2014.
3. Theory of Machines: Kinematics and Dynamics by Sadhu Singh/Pearson Education/3th Edition/2018.

ELECTRONIC RESOURCES:

1. <https://nptel.ac.in/courses/112104121>
2. <https://nptel.ac.in/courses/112105268>
3. <https://www.youtube.com/watch?v=yDEJxYGAoso>
4. <http://www.digimat.in/nptel/courses/video/112104121/L01.html>

MATERIALS ONLINE:

1. Course template
2. Assignments
3. Model question paper – I
4. Model question paper – II
5. Lecture notes
6. E-Learning Readiness Videos (ELRV)



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COURSE CONTENT

THERMAL ENGINEERING - I								
IV Semester: /ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2540321	Foundation	3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: There are no prerequisites to take this course.								

Course Overview:

Thermal Engineering-1 introduces the fundamentals of power cycles and internal combustion engines, covering their classification, working principles, and performance evaluation. It explores combustion processes in SI and CI engines, emphasizing fuel properties and abnormal combustion. Testing methods, performance analysis, and preparation of heat balance are discussed. The course also covers compressors, including reciprocating, rotary, centrifugal, and axial flow types, with focus on operation, efficiency, and performance

Course Objectives:

1. Explain the Components of IC Engines and systems.
2. Analyze the stages of combustion to improve the performance of IC engines with respect to fuel economy and control of emissions in global, environmental and social context.
3. Understand and evaluate the performance analysis of the major components and systems of IC engines and their applications.
4. Explore to the components and working principles of rotary, reciprocating, dynamic and axial compressors.
5. Understand the significance of gas turbines in real context in power generation.

Course Outcomes: After Completion of the Course, Students should be able to

1. Elaborate the working principles of IC Engine systems and its classification.
2. Explore the combustion stages of SI and CI engines, and factors influence for better combustion.
3. Evaluate the testing and performance parameters of IC engines.
4. Explain the function and working principles of rotary, reciprocating, dynamic axial compressors.
5. Understand the working principle of gas turbine and its classification with thermodynamic analysis.

UNIT - I: Otto, Atkinson, Diesel and Dual Cycles, Description and representation on P-V and T-S Diagrams, Performance Parameters: Mean Effective Pressure and Thermal efficiency evaluation on Air standard basis, Comparison of Cycles, Actual Cycles and Comparison with ideal cycles Classification of IC Engines, Working principles of two and four stroke engines, SI and CI engines, Valve and Port Timing Diagrams.

UNIT - II: Types of SI engines, Engine systems, Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry. Normal Combustion and abnormal combustion in SI engines, Importance of flame speed and effect of engine variables, Abnormal combustion, Pre-ignition and knocking in SI Engines, Fuel requirements and fuel rating, Anti-knock additives, Combustion chamber requirements.

UNIT - III: Types of CI Engines, Four stages of combustion in CI engines, Delay period and its importance, Effect of engine variables, Diesel Knock, Need for air movement, Suction, Compression and combustion induced turbulence in Diesel engines, Open and divided combustion chambers and fuel injection, Diesel fuel requirements and fuel rating.

UNIT - IV: Parameters of performance, Measurement of cylinder pressure, Fuel consumption, Air intake, Exhaust gas composition, Brake power, Determination of frictional losses and indicated power, Performance test, Heat balance sheet and chart.

UNIT - V: Classification of compressors, Fans, Blowers and Compressors, Positive displacement and dynamic types, Reciprocating and rotary types.

Reciprocating Compressors: Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and effect of clearance volume, Staged compression, under cooling, saving of work, Minimum work condition for staged compression.

Rotary Compressors: Rotary Compressors (Positive displacement type): Roots Blower, Vane sealed compressor, Mechanical details and principle of working, Efficiency considerations.

Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation, Velocity and pressure variation. Energy transfer, Impeller blade shape, Losses, Slip factor, Power input factor, Pressure coefficient and adiabatic coefficient, Velocity diagrams and power.

Axial Flow Compressors: Mechanical details and principle of operation, Velocity triangles and energy transfer per stage degree of reaction, Work done factor, Isentropic Efficiency, Pressure rise calculations, Polytropic efficiency.

TEXT BOOKS:

1. I.C. Engines, V. Ganesan, Mc Graw Hill, 4th Edition, 2010.
2. Thermal Engineering, Mahesh M Rathore, Tata Mc Graw Hill, 2010

REFERENCE BOOKS:

1. Applied Thermodynamics for Engineering Technologists, Eastop and McConkey, Pearson, 5th Edition, 1993.
2. Fundamentals of Classical Thermodynamics, Vanwylen G.J and Sonntag R.E., Wiley Eastern, 2nd Edition, 1978.
3. Internal Combustion Engines Fundamentals, John B. Heywood, McGraw Hill, 2nd Edition, 2018.

ELECTRONIC RESOURCES:

1. <https://www.mechanicalbooster.com/2017/10/air-standard-otto-diesel-dual-cycle.html>
2. <https://www.mechanicalbooster.com/2018/01/spark-ignition-engine.html>
3. <https://www.mechanicalbooster.com/2018/01/compression-ignition-engine.html>
4. <https://www.mechanicalbooster.com/2017/10/performance-of-ic-engine.html>
5. <https://www.mechanicalbooster.com/2018/04/classification-of-compressors.html>

ATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
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COURSE CONTENT

Design of Machine Elements								
IV Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2540322	Foundation	3	0	0	3	40	60	100
		Practical Classes: Nil			Total Classes: 45			
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: Engineering mechanics and Theory of machines.								

Course Overview:

The course on Machine Design provides a comprehensive understanding of fundamental concepts and design processes essential in engineering applications. It begins with the design process, emphasizing material selection, loading conditions, and failure theories. Students explore the design of temporary and permanent joints like riveted, welded, cotter, and knuckle joints, with a focus on modelling components. The course covers energy-storing elements, such as springs and flywheels, analyzing their design parameters. Lastly, students learn to design shafts and couplings under various loads, ensuring strength and rigidity. Through this course, students develop practical skills to apply design theories in engineering software.

Course Objectives:

1. Designing machine members subjected to static and variable loads.
2. Designing shafts and couplings for various applications.
3. Analyzing bolted and welded joints for various kinds of loads.
4. Designing helical and leaf springs for various applications.
5. Analyzing Riveted and cotter joints for various kinds of loads.

Course Outcomes: After Completion of the Course, Students should be able to

1. Understand and apply the design process, material selection, and failure theories in mechanical components.
2. Design and evaluate riveted, welded joints, and power screws under various loading conditions.
3. Analyze the stresses in keys, cotter, and knuckle joints, applying design principles effectively.
4. Design springs and flywheels, addressing energy fluctuations and stress analysis in practical mechanical systems.
5. Design solid and hollow shafts, couplings, and axles, ensuring strength, rigidity

UNIT - I: Simple and Variable stresses: Simple stress in machine parts: Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers- Direct, Bending and torsional loading - Factor of

safety – Combined loads – Principal stresses – Eccentric loading – theories of failure – Variable stress in Machine parts: Design based on strength and stiffness – stress concentration – Fluctuating stresses – Endurance limit- Gerber’s curve– Goodman’s line– Soderberg’s line. – Design for finite and infinite life under variable loading.

UNIT - II: Temporary joints -I:

Riveted Joints: Riveted joints- methods of failure of riveted joints-strength equations-efficiency of riveted joints-eccentrically loaded riveted joints.

Welded joints-Design of fillet welds-axial loads-circular fillet welds under bending, torsion. Welded joints under eccentric loading.

UNIT-III: Temporary joints -II

Keys, Cotters and Knuckle Joints: Design of keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter, Gib and cotter joints-Knuckle joints.

UNIT - IV: Energy Storage Elements: Springs: Types of springs, design of helical and concentric springs–surge in springs, Design of laminated springs.

Flywheel: coefficient of fluctuation of speed – Fluctuation of Energy – Maximum Fluctuation energy - coefficient of Fluctuation energy – energy stored in a flywheel - Flywheels considering stresses in rims and arms.

UNIT - V: Shafts and Couplings: Shafts: Shafts and Axles - Design of solid and hollow shafts based on strength, rigidity and critical speed.

Coupling: Rigid coupling- Muff, Clamp and Flange couplings and flexible couplings -Bushed Pin.

TEXT BOOKS:

1. P. Kanniah, “Machine Design”, 2nd Edition, Scitech Publications India Pvt. Ltd, New Delhi, 2012 .
2. V.B. Bandari, “A Text Book of Design of Machine Elements”, 3rd edition, Tata McGraw Hill, 2011

REFERENCE BOOKS:

1. R.S. Khurmi and J.K. Gupta, “A Textbook of Machine Design”, Eurasia Publishing House, New Delhi, 2005.
2. Joseph Edward Shigley, Charles R. Mischke, and Richard G. Budynas, “Mechanical Engineering Design”, 8th Edition, McGraw-Hill, New York, 2008.
3. M.F. Spotts, T.E. Shoup, and L.E. Hornberger, “Design of Machine Elements”, 8th Edition, Pearson Education, New Delhi, 2004.
4. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine Component Design”, 5th Edition, Wiley, New Delhi, 2012.

ELECTRONIC RESOURCES:

1. <https://en.pdfdrive.to/dl/design-of-machine-elements-10>
2. <https://repositori.mypolycc.edu.my/handle/123456789/5350>
3. https://www.researchgate.net/publication/328926726_Design_of_Machine_Elements?utm_source=chatgpt.com

MATERIALS ONLINE:

1. Course template
2. Tech talk and Concept Video topics
3. Open-ended experiments
4. Definitions and terminology
5. Assignments
6. Model question paper – I
7. Model question paper – II
8. Lecture notes
9. E-Learning Readiness Videos (ELRV)

COURSE CONTENT

INSTRUMENTATION AND CONTROL SYSTEMS								
IV Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2540323	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: There are no prerequisites to take this course.								

Course Objectives:

- Understanding the basic characteristics of a typical instrument. Identifying errors and their Types that would occur instrument.
- Identifying properties used for evaluating the thermal systems.
- The concept of transducer and Various types and their characters of Engineering metrology and its practice which is having increasing importance in industry

Course Outcomes: After completion of the course the student is able to

- To identify and analyse various errors that would occur in instruments (L3).
- Identify the different displacement measurement techniques and temperature measurement techniques, used in industries (L4).
- To know the working principles of various instruments to measure level (L2).
- Students will be able differentiate between mechanical electrical tachometers.(L3)
- Student will be able select appropriate device for the measurement of parameters like humidity, strain, force and torque(L4)
- Suggest control systems for speed, position and control in practical applications(L4)

UNIT – 1

[9]

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional description of measuring instruments – examples. Static and Dynamic performance characteristics – sources of errors, Classification and elimination of errors.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance.

UNIT – 2

[10]

Measurement of Temperature: Various Principles of measurement- Classification: Expansion Type: Bimetallic Strip- Liquid in glass Thermometer; Electrical Resistance Type: Thermistor, Thermocouple, RTD; Radiation Pyrometry: Optical Pyrometer; Measurement of Pressure: Different principles used- Classification: Manometers, Dead weight pressure gauge. Tester (Piston gauge), Bourdon pressure gauges, Bulkmodulus pressure gauges; Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges, ionization pressure gauges, Mcleod pressure gauge.

UNIT – 3

[9]

Measurement of Level: Direct methods – Indirect methods – Capacitive, Radioactive, Ultrasonic, Magnetic, Cryogenic Fuel level indicators – Bubbler level indicators.

Flow measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer. Measurement of Speed: Mechanical Tachometers, Electrical tachometers, Non- contact type-Stroboscope Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle- Piezo electric accelerometer.

UNIT – 4

[10]

Stress-Strain measurements: Various types of stress and strain measurements - electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – Use of strain gauges for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, Sling Psychomotor, Absorption Psychomotor, Dew point meter.

Measurement of Force, Torque and Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – 5

[10]

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems- Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems

TEXT BOOK:

- Instrumentation mechanical measurements and control by A.k.tayal, Galotia publications/2nd Edition
- Mechanical measurements & control by Dr D.S.Kumar, metropolitan book co pvt ltd/1st Edition

REFERENCE BOOK:

- Control systems by A.nagoorkani, RBA Publications/1st Edition
- Instrumentation Measurements and Analysis by B.C. Nakra, Tata mc grawhill Publishers/3rd Edition
- Electric Measurements & Instrumentation by K. Lalkishore,Pearson publications/1st Edition

Electronic Resources:

1. <https://instrumentationtools.com/free-pdf-downloads/>
2. <https://www.cedengineering.com/userfiles/Introduction%20to%20Control%20and%20Instrumentation-R1.pdf>
3. <https://www.scribd.com/document/884030601/Control-and-Instrumentation-Systems-Notes>

Materials Online:

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COURSE CONTENT

INNOVATION AND ENTREPRENEURSHIP								
III Semester: CSE / ECE / EEE IV Semester: CSD / CSM /ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
25XEXL3	CORE	L	T	P	C	CIA	SEE	Total
		2	0	0	2	40	60	100
Contact Classes: 30	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 30			
Prerequisites: NIL								

Course Overview:

This course is designed to equip students with fundamental knowledge and practical skills required to understand, develop, and apply innovation and entrepreneurial thinking. Through experiential learning, industry exposure, simulations, and venture-based activities, student progress from understanding innovation fundamentals to building viable startup concepts while on campus.

Course Objectives:

1. To familiarize on the basic concepts of innovation, entrepreneurship and its importance.
2. To Identify and analyze the process of problem-opportunity identification, market segmentation, and idea generation techniques.
3. To initiate prototype development and understand minimum viable product.
4. To develop initial Business and financial planning and Go-to-Market strategies
5. To impart knowledge on establishing startups, venture pitching and IPR

Course Outcomes: After Completion of the Course, Students Should be able to:

1. Understand innovation concepts, types of innovations, entrepreneurial mindset, leadership attributes, and the role of entrepreneurship in economic development.
2. Analyze real-world problems, customer needs, market segmentation, competition, industry trends, and opportunity identification using structured frameworks.
3. Apply opportunity assessment techniques, market sizing methods, and prototype or MVP development practices for solution validation.
4. Develop business models, lean canvas representations, financial plans, unit economics analysis, and go-to-market strategies for startup ventures.
5. Examine startup formation processes, funding mechanisms, pitching readiness, legal frameworks, and intellectual property rights within national and international contexts.

Unit I: Fundamentals of Innovation and Entrepreneurship

Innovation: Introduction, need for innovation, Features, Types of innovations, innovations in manufacturing and service sectors, fostering a culture of innovation, planning for innovation.

Entrepreneurship: Introduction, types of entrepreneurship attributes, mindset of entrepreneurial and intrapreneurial leadership, Role of entrepreneurs in economic development. Woman Entrepreneurship, Importance of on-campus startups. Understanding to build entrepreneurial mindset, attributes and networks individuals while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity.

Unit II: Problem and Customer Identification

Identification of gap, problem, analyzing the problem from a industry perspective, real-world problems, market and customer segmentation, validation of customer problem fit, Iterating problem-customer fit, Competition and Industry trends mapping and assessing initial opportunity, Porter's Five Force Model. Idea generation, Ideation techniques: Brainstorming, Brain writing, Round robin, and SCAMPER, Design thinking principles, Mapping of solution to problem.

Core Teaching Tool: Several types of activities including: Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

Unit III: Opportunity assessment and Prototype development

Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Assessing scope and potential scale for the opportunity.

Understanding prototyping and Minimum Viable Product (MVP). Developing a prototype: Testing, and validation.

Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

Unit IV: Business & Financial Models

Introduction to Business Model and types, Lean Canvas Approach: 9-block lean canvas model, building lean canvas for your startup. Business planning: components of Business plan- Sales plan, People plan and financial plan, Financial Planning: Types of costs, preparing a financial plan for profitability using a financial template, understanding the basics of Unit economics, Economies of Scale

and analyzing financial performance. Go-To-Market (GTM) approach – Selecting the Right Channel, creating digital presence, and building customer acquisition strategy.

Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

Unit V: Startups and IPR

Startup requirements, building founding team members and mentors, pitch preparation, start-up registration process, funding opportunities and schemes, institutional support to entrepreneurs, startup lifecycle, documentation, legal aspects in startup, venture pitching readiness, National Innovation Startup Policy (NISP) and its features.

Patents, Designs, Patentability, Procedure for grants of patents. Indian Scenario of Patenting, International Scenario: International cooperation on Intellectual Property. Patent Rights: Scope of Patent Rights. Copyright, trademark, and GI. Licensing and transfer of technology.

Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

Suggested Readings:

1. John R Bessant, Joe Tidd, Innovation and Entrepreneurship, 4E, Wiley, Latest Edition.
2. Ajay Batra, The Startup Launch Book- A Practical Guide for Launching Customer Centric Ventures, Wiley, 2020. (For Core Teaching Tool).
3. Entrepreneurship Development and Small Business Enterprises, Poornima M Charantimath, 3E, Pearson, 2018.
4. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.

5. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.
6. NISP -Brochure inside pages - startup_policy 2019.pdf

ELECTRONIC RESOURCES:

1. <https://my.msme.gov.in>
2. <https://www.startupindia.gov.in/>
3. <https://www.sidbi.in/en/digital-initiatives>
4. <https://iic.mic.gov.in/assets/html/ElearningResources.html>
5. <https://ediindia.org/>

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
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COURSE CONTENT

CONVENTIONAL AND COMPUTER AIDED MACHINE DRAWING LABORATORY								
IV Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2540378	Foundation	0	0	2	1	40	60	100
		Contact Classes: Nil					Tutorial Classes: Nil	
Prerequisites: Engineering Drawing and Computer Aided Drafting						Total Classes: 45		

Course Overview: Introduces computer-aided machine drawing principles, standards, and CAD tools to create accurate part and assembly drawings, dimensions, fits, tolerances, and manufacturing-ready documentation for engineering applications using AutoCAD and industry practices.

Course objectives: The students will try to learn:

- The principles and standards of engineering and machine drawing.
- The skills in visualizing and creating orthographic views of machine components. train the student to conduct performance and heat balance test on IC Engines.
- The part modeling and assembly drawing using CAD tools.
- The symbols, tolerances, and fits used in machine drawing.
- The detailed drawings of mechanical parts and assemblies as per industry standards.

Course Outcomes:

- Interpret and apply BIS conventions for machine drawing.
- Apply the concepts of limits, fits, and tolerances in generating orthographic, sectional, and dimensioned drawings of machine components
- Design part models and assembly drawings using AutoCAD or other drafting software.
- Develop detailed production-ready drawings for various machine elements and assemblies.
- Visualize, model, and document complete assemblies as per standard practice.

List of Experiments:

Drawing of Machine Elements and Simple parts:

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

1. Screw threads, nuts and bolts, set screws.
2. Keys, cotter joints and knuckle joint.
3. Rivetted joints.
4. Shaft coupling, spigot and socket pipe joint.
5. Journal, pivot and collar and foot step bearings.



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Drawing of Machine Elements: Using Computer aided drafting in addition to conventional drawing

Assembly Drawings:

Drawing of assembled views for the part drawing of the following using conventions and easy drawing proportions.

1. Steam engine parts, Stuffing box, Cross head, Eccentric.
2. Machine tool parts: Tail stock, Tool Post, Machine Vices.
3. Other machine parts: Screw jack, Connecting rod, Plumber block, Fuel Injector.
4. Valves: Steam stop valve, spring loaded safety valve, feed check valve and air cock.

Assembly Drawings: Using Computer aided drafting in addition to conventional drawing

Note:

1. First angle projection to be adopted.
2. All the drawing components, Assembly to be drawn using any Computer aided drafting packages.

Text books:

1. Machine Drawing, N.D.Bhatt, Charotar Publication, 51st Edition, 2022.
2. Machine Drawing with Auto CAD, Goutham Pohit and Goutam Ghosh, Pearson, 2016.

Reference books:

1. Machine Drawing, Bhattacharyya, Oxford, 2011.
2. Machine Drawing, Ajeet Singh, Mc Graw Hill, 2nd Edition, 2012.

Note: External examination is conducted in conventional mode and internal evaluation to be done by both conventional as well as using computer aided drafting.

Electronic Resources:

1. https://eedocs.files.wordpress.com/2014/02/machinedrawing.pdf?utm_source=chatgpt.com
2. https://bharatskills.gov.in/pdf/E_Books/CITS/ED/English/Engineering%20Drawing%20%28Mechanical%29.pdf?utm_source=chatgpt.com

Materials Online:

1. Lab Manual

COURSE CONTENT

INSTRUMENTATION AND CONTROL SYSTEMS LAB								
IV Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2540379	Foundation	L	T	P	C	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45			Total Classes: 45			
Prerequisites: There are no prerequisites to take this course.								

Course Overview:

Provides hands-on experience with sensors, transducers, signal conditioning, data acquisition, and control systems, enabling measurement, analysis, calibration, and implementation of practical instrumentation and control techniques in engineering applications

Course Objectives:

- Impart an adequate knowledge and expertise to calibrate instruments available in an Industry.
- Impart knowledge on various working principles and design of Instruments.
- Understand calibration of measuring instruments for temperature.
- Understand the functioning of strain gauges for measuring pressure, load and vibrations.
- Apply calibration of measuring instruments of flow and speed measurement.

COURSE OUTCOMES: After completion of the course the student is able to

- Analyse errors, integrate and interpret different types of measurements (L3)
- Understand how physical quantities are measured and how they are converted to electrical or other forms. (L2)
- Evaluate the measurement of speed in engineering applications and importance of speed measurement in instrumentation (L4).
- Visualize the areas affected with pressure in equipment and calibrate the pressure measuring devices (L3).
- Comprehend the level of liquid in any container and the various applications of measurement of flow (L4)
- Able to analyse Instrumentation and Control systems and their applications of various industries(L4)

LIST OF EXPERIMENTS (A minimum of 10 experiments to be conducted)

1. Calibration of pressure gauges
2. Calibration of transducer for temperature measurements
3. Study and calibration of LVDT transducer for displacement measurements
4. Calibration of strain gauge
5. Calibration of thermocouple for temperature measurements
6. Calibration of capacitive transducer for angular displacement
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.

8. Calibration of resistance temperature detector for temperature measurements
9. Study and calibration of Rota meter for flow measurement
10. Study and use of a Seismic pick up for the measurement of vibration
11. Study and calibration of McLeod gauge for low pressure
12. Measurement And Control Of Temperature Loop of A Process Using Resistance Temperature Detector With SCADA

Electronic Resources:

1. <https://vlabs.iitkgp.ac.in/ctrl/index.html> — Virtual Control & Instrumentation Lab (IIT Kharagpur)

Materials Online:

1. Lab Manuals



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COURSE CONTENT

THERMAL ENGINEERING-I LAB								
I Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2540380	Foundation	L	T	P	C	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: 32	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 36			
Prerequisites: There are no prerequisites to take this course.								

Course Overview:

The Thermal Engineering Laboratory is designed to provide practical exposure to the operation, testing, and performance evaluation of internal combustion engines. The course enables students to understand real-time engine behavior, analyze performance parameters, and correlate experimental results with theoretical concepts studied in Thermal Engineering and IC Engines

Course Objectives:

1. To provide the knowledge to the student about working of IC Engines.
2. To train the student to conduct performance and heat balance test on IC Engines.
3. To practice the student to calculate the frictional losses in an IC Engine.
4. To impart practical exposure on performance of Reciprocating air compressor.
5. To make the student to understand the working principle of various types of boilers.

Course Outcomes: After Completion of the Course, Students should be able to

1. Identify the various parts of an IC Engine.
2. Sketch the Valve and Port Timing diagrams for IC Engines.
3. Determine the performance and friction power various types of IC Engines.
4. Prepare the heat balance sheet for various types of IC Engines.
5. Analyze the performance of reciprocating air compressor.

LIST OF EXPERIMENTS:

I.C. Engines:

1. Draw the valve and port timing diagrams for four and two stroke engines.
2. Evaluate the performance of 4 -stroke Diesel engines.
3. Evaluate the performance of 2-stroke Petrol engine.
4. Evaluate the performance of 4 -stroke Petrol engines.
5. Evaluation of frictional power by conducting Morse test on 4-stroke multi cylinder petrol engine.
6. Draw the heat balance sheet for 4-stroke Single cylinder Diesel / Petrol engines.
7. Draw the heat balance sheet for 4- stroke multi cylinder petrol engine.
8. Calculate the performance of variable compression ratio engines.
9. Effect of Air Fuel Ratio in a SI engine.

Other Experiments:

10. Study of Steam boilers
11. Disassembly / assembly of engines.
12. Volumetric efficiency of Air Compressor Unit.



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COURSE CONTENT

INDIAN KNOWLEDGE SYSTEM								
II Semester: CSD/ CSM								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2520028	Foundation	1	0	0	1	40	60	100
		Contact Classes: 15		Tutorial Classes: Nil		Practical Classes: Nil		Total Classes: 15
Prerequisites: There are no prerequisites for this course.								

Course Overview:

Bharat is considered one of the oldest civilizations of the world. Some of the archaeological evidences proved the existence of Indus Valley Civilization in 7000 B.C. Bhartiya traditions, culture, cultural activities, rituals, sacraments, painting, art of dancing, art of singing etc. is being practised till the modern times without knowing scientific approaches behind that. Eternity of Indian knowledge system proved itself that not only many rituals but also many traditions, many streams of knowledge like astrology, mathematics, physics, chemistry, biology, language studies, yoga and meditation had been following from the starting till now with some changes, in the form of traditions.

This course is for undergraduate students to inculcate Indian values. It will promote advance study and inter disciplinary research on all aspects of the Indian knowledge system.

Course Objectives: This course aims:

1. To provide a tribute of the rich culture and traditions of Indian knowledge system to students of various disciplines.
2. To introduce historical account on the education and scientific literature available in ancient Indian traditions and its connections with ancient Indian Philosophy
3. To give insights about the applications of Bharatiya Jnana Parampara
4. To introduce Indian approach towards health and wellbeing
5. To elaborate vast contribution of ancient Indian researchers, engineers, scientists and architects to the modern world

Course Outcomes: Students will be able to:

1. Understand nature, scope and related fields of Indian knowledge system.
2. Demonstrate the scientific literature available in ancient Indian traditions
3. Understanding the application of Bharatiya Jnana Parampara
4. Understand Indian approach towards Wellbeing
5. Appreciate vast contribution of ancient Indian researchers, engineers, scientists and architects to the modern world

Unit 1: Introduction to Indian Knowledge Systems

Meaning, Nature, Scope and Salient Aspects of Bharatiya Jnana Parampara - Introduction to Vedas, Upanishads, Vidya, Kala, Jnana, Shastra - Practices and Continuity of Tradition

Unit 2: Overview of History of Indian Education and Scientific Literature

Gurukul System - Role of Sanskrit in Natural Language Processing - Scientific Literature - Vedic Literature - Available Scientific Treatises - Interlinkings

Unit 3: Introduction to Scientific Theories from Pure Sciences from Ancient Indian Knowledge Systems

Overview of theories from available ancient Indian Literature about Physics, Chemistry and Mathematics - Interlinkings and applications

Unit 4: Introduction to Ancient Indian Wellness Systems

Concept of Wellness – Yoga System - Ayurveda System - Ancient Indian Aesthetics

Unit 5: Development of Engineering, Science, Technology & Fine Arts in India

Various Industries - Silk, Cotton and Ship Building - Evolution of Indian Fine Arts – Cave and Temple Architecture, Vastu - Vidya, Sculpture, Forts and Stepwells, Observatories and Paintings - Music and Natyakala - Cultural Traditions & Folk Arts

❖ Pedagogy for Teachers: Apart from Class Room Instruction, the following Methods are Suggested.

1. Project based activities and learning.
2. Presentation and case studies.
3. Film screening and book reviews.
4. Visit to historical places, archives centre, research centre or library nearby.

Note: Activities mentioned above are only suggestive. Teacher-educators should encourage students to be innovative.

Suggested Readings:

1. B. Mahadevan, Bhat Vinayak and Nagendra Pavan R.N., (2022) '*Introduction to Indian Knowledge Systems: Concepts and Applications*' PHI learning PVT, New Delhi ISBN [9789391818203]
2. Dharmapal (1971) '*Indian Science and Technology in the Eighteenth Century*'. Other India Press, Goa.
3. Kapil Kapoor, Singh Avdhesh Kumar, (2005) '*Indian Knowledge Systems*' D.K. Printworld (P) Ltd. ISBN 10: 8124603367 / ISBN 13: 9788124603369
4. Chakradeo, Ujwala, *Temples of Bharat*, Aayu Publications, New Delhi, 2024.
5. D.N. Bose, S.N. Sen and B. V. Subbarayappa, *A Concise History of Science in India*, Indian National Science Academy, New Delhi, 2009.
6. Datta B. and A. N. Singh, *History of Hindu Mathematics: Parts I and II*, Asia Publishing House, Bombay, 1962.
7. Kapoor, K. (2021), *Indian Knowledge System: Nature, Philosophy, Character in Indian Knowledge System*, vol. 1, Pub. Indian Institute of Advanced Studies, Shimla
8. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), *Philosophical Systems, in Introduction to Indian Knowledge System*, Pub. PHI Learning, New Delhi.
9. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), *Knowledge: Framework and Classification, in Introduction to Indian Knowledge System*, Pub. PHI Learning, New Delhi.

Video Resources:

1. Introductory lectures by Prof. Gauri Mahulikar
2. Introductory lectures by Prof. Kapil Kapoor

Websites:

- <https://iksin.dia.org/index.php>
- Official Website of IKS- Indian Knowledge System
- <https://www.youtube.com/watch?v=uKcf-hSlcUE>
- Address by Prof Kapil Kapoor | Indian Institute of Advanced Study (FDP 2021)
- https://www.youtube.com/watch?v=MDJTXNiH2_A
- Mukul Kanitkar on Bharatiya Knowledge System
- <https://www.youtube.com/watch?v=uARMhv97pjk>
- <https://www.youtube.com/watch?v=oTwgf56GbsA>
- Scientific History of India | Mukul Kanitkar Lecture in DTU
- <https://youtu.be/gNJNmPJqXJc?si=WFBbuUT65mLZzpOW>
- Ancient India's Scientific Achievements & Contribution in Mathematics, Astronomy, Science & Medicine