CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)
B. Tech - Mechanical Engineering
CBCS & OUTCOME BASED COURSE STRUCTURE & SYLLABUS
(Effective for the students admitted into I year from the Academic Year 2025-26)

SEMESTER - I							
S. No	**Course Code**	**Course Title**	**Course Category**	**Hours per Week**			**Credits**
				L	**T**	**P**	**C**
1	A500001	Matrices and Calculus	BSC	3	1	0	4
2	A500010	Applied Chemistry	BSC	3	0	0	3
3	A503201	Engineering Graphics	ESC	2	0	2	3
4	A503202	Engineering Mechanics	ESC	3	0	0	3
5	A505203	C Programming and Data Structures	ESC	3	0	0	3
6	A500508	Chemistry Laboratory for Engineers	BSC	0	0	2	1
7	A500506	Introduction to Social Innovation	HSMC	0	0	2	1
8	A503501	Engineering Workshop	ESC	0	0	2	1
9	A505503	C Programming and Data Structures Laboratory	ESC	0	0	2	1
		Induction Program					
	Total:			**14**	**1**	**10**	**20**
	Total hours per Week:			**25**			

SEMESTER - II							
S. No	**Course Code**	**Course Title**	**Course Category**	**Hours per Week**			**Credits**
				L	**T**	**P**	**C**
1	A500002	Ordinary Differential Equations and Vector Calculus	BSC	3	0	0	3
2	A500008	Advanced Engineering Physics	BSC	3	0	0	3
3	A500101	English for Skill Enhancement	HSMC	3	0	0	3
4	A502203	Basic Electrical and Electronics Engineering	ESC	3	0	0	3
5	A505206	Python Programming	ESC	3	0	0	3
6	A500502	Advanced Engineering Physics Laboratory	BSC	0	0	2	1
7	A500504	English Language and Communication Skills Laboratory	HSMC	0	0	2	1
8	A502502	Basic Electrical and Electronics Engineering Laboratory	ESC	0	0	2	1
9	A503502	Engineering Exploration and Practice	ESC	0	0	2	1
10	A505507	Python Programming Laboratory	ESC	0	0	2	1
	Total:			**15**	**0**	**10**	**20**
	Total hours per Week:			**25**			
	Total Credits in I Year: 40						

SEMESTER – III							
S. No	**Course Code**	**Course Title**	**Course Category**	**Hours per Week**			**Credits**
				L	**T**	**P**	**C**
1	A501201	Fluid Mechanics and Hydraulic Machines	ESC	3	0	0	3
2	A503301	Thermodynamics	PCC	3	0	0	3
3	A503303	Mechanics of Solids	PCC	3	0	0	3
4	A503304	Machine Drawing	PCC	1	0	2	2
5	A503307	Material Science and Metallurgy	PCC	3	0	0	3
6	A500507	Social Innovation and Entrepreneurship	HSMC	0	1	2	2
7	A501519	Fluid Mechanics and Hydraulic Machines Laboratory	ESC	0	0	2	1
8	A503506	Material Science and Mechanics of Solids Laboratory	PCC	0	0	2	1
9	A503701	Skill Development Course-1 (Product Design using AUTOCAD)	SDC	0	0	2	1
10	A500901	Environmental Science	VAC	1	0	0	1
		Total:		**14**	**1**	**10**	**20**
		Total hours per Week:		**25**			

SEMESTER – IV							
S. No	**Course Code**	**Course Title**	**Course Category**	**Hours per Week**			**Credits**
				L	**T**	**P**	**C**
1	A500004	Probability, Statistics and Complex Variables	BSC	3	0	0	3
2	A503302	Production Technology	PCC	3	0	0	3
3	A503305	Instrumentation and Control Systems	PCC	2	0	0	2
4	A503306	Thermal Engineering - I	PCC	3	0	0	3
5	A503308	Design of Machine Elements	PCC	3	0	0	3
6	A503309	Kinematics of Machinery	PCC	3	0	0	3
7	A500501	Computational Mathematics Laboratory	BSC	0	0	2	1
8	A503505	Instrumentation and Control Systems Laboratory	PCC	0	0	2	1
9	A503504	Production Technology Laboratory	PCC	0	0	2	1
10	A503507	Thermal Engineering-I Laboratory	PCC	0	0	2	1
11	A503702	Skill Development Course-2 (Data Analytics Using Python for Engineers)	SDC	0	0	2	1
		Total:		**17**	**0**	**10**	**22**
		Total hours per Week:		**27**			
	Total Credits in II Year: 42						

SEMESTER – V							
S. No	**Course Code**	**Course Title**	**Course Category**	**Hours per Week**			**Credits**
				L	**T**	**P**	**C**
1		Professional Core Course	PCC	3	0	0	3
2		Professional Core Course	PCC	3	0	0	3
3		Professional Core Course	PCC	3	0	0	3
4		Professional Elective Course-I	PEC	3	0	0	3
5		Open Elective Course-I	OEC	2	0	0	2
6		Professional Core Course Laboratory	PCC	0	0	2	1
7		Professional Core Course Laboratory	PCC	0	0	2	1
8		Professional Core Course Laboratory	PCC	0	0	2	1
9		Skill Development Course - 3	SDC	0	0	2	1
10	A503801	Field Based Project	PROJ	0	0	4	2
	A503802	Internship					
11	A500903	Gender Sensitization	VAC	1	0	0	1
	A500904	Human Values and Professional Ethics					
		Total:		**15**	**0**	**12**	**21**
		Total hours per Week:		**27**			

SEMESTER – VI							
S. No	**Course Code**	**Course Title**	**Course Category**	**Hours per Week**			**Credits**
				L	**T**	**P**	**C**
1	A500102	Business Economics and Financial Analysis	HSMC	3	0	0	3
2		Professional Core Course	PCC	3	0	0	3
3		Professional Core Course	PCC	3	0	0	3
4		Professional Elective Course-II	PEC	3	0	0	3
5		Open Elective Course – II	OEC	2	0	0	2
6	A500505	English for Employability Skills Laboratory	HSMC	0	0	2	1
7		Professional Core Course Laboratory	PCC	0	0	2	1
8		Professional Core Course Laboratory	PCC	0	0	2	1
9		Professional Core Course Laboratory	PCC	0	0	2	1
10		Skill Development Course – 4	SDC	0	0	2	1
11	A500902	Indian Knowledge System	VAC	1	0	0	1
		Total:		**15**	**0**	**10**	**20**
		Total hours per Week:		**25**			
	Total Credits in III Year: 41						

SEMESTER – VII							
S. No	**Course Code**	**Course Title**	**Course Category**	**Hours per Week**			**Credits**
				L	**T**	**P**	**C**
1		Professional Core Course	PCC	3	0	0	3
2		Professional Core Course	PCC	3	0	0	3
3		Professional Core Course	PCC	3	0	0	3
4		Professional Elective Course - III	PEC	3	0	0	3
5		Professional Elective Course – IV	PEC	3	0	0	3
6		Open Elective Course – III	OEC	2	0	0	2
7		Professional Core Course Laboratory	PCC	0	0	2	1
8		Professional Core Course Laboratory	PCC	0	0	2	1
9	A503803	Industry Oriented Mini Project	PROJ	0	0	4	2
	A503804	Summer Internship					
	Total:			**17**	**0**	**8**	**21**
	Total hours per Week:			**25**			

SEMESTER – VIII							
S. No	**Course Code**	**Course Title**	**Course Category**	**Hours per Week**			**Credits**
				L	**T**	**P**	**C**
1		Professional Elective Course – V	PEC	3	0	0	3
2		Professional Elective Course – VI	PEC	3	0	0	3
3	A503805	Project Work	PROJ	0	0	28	14
	Total:			**6**	**0**	**28**	**20**
	Total hours per Week:			**34**			
	Total Credits in IV Year: 41						
	Total Credits in B. Tech Mechanical Engineering: 164						

(A500001) MATRICES AND CALCULUS

(Common to All Branches)

B. Tech. (ME): I Year I Semester

L	T	P	C
3	1	0	4

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. Gauss Seidel Iteration Method

UNIT - II: Eigen values and Eigen vectors

Linear Transformation and Orthogonal Transformation: Eigen values – Eigen vectors and their properties – 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 form by Orthogonal Transformation

UNIT - III: Single Variable Calculus

Limits and Continuous functions and its properties. 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 (All the theorems without proof).

Definition of Improper Integral: Beta and Gamma functions and their applications.

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

Definitions of Limit and continuity – 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) – Change of variables for double integrals (Cartesian to polar), Evaluation of Triple Integrals – Change of variables for triple integrals (Cartesian to Spherical and Cylindrical polar coordinates), Applications: Areas by double integrals and volumes by triple integrals

TEXT BOOKS

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

REFERENCES

1. Advanced Engineering Mathematics (9th Edition), Erwin Kreyszig, John Wiley & Sons, 2006.
2. Calculus and Analytic geometry (9th Edition), G.B. Thomas and R.L. Finney, Pearson, Reprint, 2002.

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Formulate the matrix representation of a system of linear equations and analyze the corresponding solution set.
2. Determine the eigen values and eigenvectors of a matrix, and reduce a quadratic form to its canonical form using orthogonal transformations.
3. Apply the mean value theorems to solve relevant problems in mathematical analysis. Find solution of improper integrals by using Beta and Gamma function
4. Find the extreme values of functions of two variables, both with and without constraints.
5. Evaluate multiple integrals and apply the concept to calculate areas and volumes.

CO-PO MAPPING

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

****End****

(A500010) APPLIED CHEMISTRY

(Common to CE and ME)

B. Tech. (ME): I Year I Semester	L	T	P	C
	3	0	0	3

UNIT - I: Water and its treatment

Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by EDTA 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. Defluoridation - Nalgonda technique.

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, Electrodialysis

UNIT - II: Electrochemistry and Corrosion

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 p^H of unknown solution using SHE and Calomel electrode.

Corrosion: Introduction- Definition, causes and effects of corrosion - Theories of corrosion, chemical and electrochemical theories of corrosion, Types of corrosion: galvanic, waterline 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

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 GreenHydrogen.

Biofuels: Biodiesel.

UNIT - IV: Polymers

Definition - Classification of polymers: Based on origin and tacticity with examples - Types ofpolymerization - 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 thermosetting plastics, Fiber reinforced plastics (FRP).

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

Biodegradable polymers: Polylactic acid and its applications.

UNIT - V: Applications for Engineering Materials

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

Phase rule: Definition - Phase, component, degrees of freedom. Phase rule equation. Phase diagrams - One component system - water. Two component system - Lead silver system

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.

Interpretative spectroscopic applications of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Pollution Under Control- CO sensor (Passive Infrared detection)

TEXTBOOKS:

1. Engineering Chemistry (1st edition), J. Saroja, D. Divya, Skytech Publishing Company, 2025.
2. Engineering Chemistry (2nd edition), P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
3. Engineering Chemistry (1st edition), Rama Devi, P. Aparna and Rath, Cengage learning, 2025.

REFERENCE BOOKS:

1. Engineering Chemistry (1st edition), Thirumala Chary Laxminarayana & Shashikala, PearsonPublications (2020)
2. Engineering Chemistry (2nd edition), Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi 2011.

3. Engineering Chemistry (1st edition), Shikha Agarwal, Cambridge University Press, Delhi 2015.
4. Engineering Analysis of Smart Material Systems (1st edition), Donald J. Leo, Wiley, 2007.
5. Challenges and Opportunities in Green Hydrogen (1st edition), Paramvir Singh, Avinash KumarAgarwal, Anupma Thakur, R.K Sinha.
6. Raman Spectroscopy in Human Health and Biomedicine,https://www.worldscientific.com/doi/epdf/10.1142/13094
7. E-Content:https://doi.org/10.1142/13094 | October 2023
8. E-books:https://archive.org/details/EngineeringChemistryByShashiChawla/page/n11/mode/2u

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Apply the principles of water chemistry to determine hardness using EDTA, and analyze various water treatment methods including disinfection, defluoridation, softening, and desalination techniques.
2. Explain electrochemical concepts, determine electrode potentials, and evaluate corrosion phenomena; propose suitable corrosion control methods for engineering applications.
3. Understand the working and applications of batteries and fuel cells; evaluate the characteristics, calorific value, and environmental impact of fossil fuels, synthetic fuels, and biofuels.
4. Classify polymers, describe polymerization mechanisms, examine the properties and applications of plastics, elastomers, conducting polymers, and biodegradable polymers for engineering use.
5. Analyze the composition, setting, and hardening of cement, interpret phase diagrams using phase rule principles, and understand lubricants' characteristics and mechanisms relevant to engineering applications.

CO-PO MAPPING

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

****End****

(A503201) ENGINEERING GRAPHICS

(Common to CE and ME)

B. Tech. (ME): I Year I Semester

L	T	P	C
2	0	2	3

UNIT-I

Introduction to Engineering Graphics:

Principles of Engineering Graphics and their Significance, Geometrical Constructions, Conic Sections: Ellipse, Parabola and Hyperbola – General Method (eccentricity) only. Cycloid, Epicycloids and Hypocycloid, Scales – Plain & Diagonal

UNIT-II

Orthographic Projections:

Introduction to Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures

UNIT-III

Projections of Regular Solids:

Introduction to Regular Solids – Prism, Cylinder, Pyramid, Cone

UNIT-IV

Sections or Sectional views of Right Regular Solids:

Prism, Cylinder, Pyramid, Cone – sectional views

Development of Surfaces:

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone

UNIT-V

Isometric Projections:

Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines, Isometric Projection of Spherical Parts.

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 Publishers, 54th Edition, 2023.
2. Engineering Drawing, Basant Agrawal and C M Agrawal, McGraw Hill, 3rd Edition, 2019

REFERENCE BOOKS:

1. Engineering Drawing, M. B. Shah, B.C. Rane, Pearson, 3rd Edition, 2015
2. Engineering Graphics and Design, WILEY, John Wiley and sons Inc, 3rd Edition, 2020
3. Engineering Drawing, N. S. Parthasarathy and Vela Murali, Oxford, 1st Edition, 2015
4. Engineering Drawing and graphics Using AutoCAD, T. Jeyapoovan, Vikas, S. Chand and Company Ltd, 3rd Edition, 2010

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Understand and Apply concepts to construct engineering curves and scales
2. Understand and Apply the principle of Orthographic projection for Points, Lines and Planes
3. Construct and interpret Orthographic projections of Solids
4. Create the Sectional views of Solids and Development of surfaces
5. Conversion of 2D to 3D objects and Create the Orthographic to Isometric view & vice versa

CO-PO MAPPING:

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

****End****

(A503202) ENGINEERING MECHANICS

(Common to CE and ME)

B. Tech. (ME): I Year I Semester

L	T	P	C
3	0	0	3

UNIT-I

Introduction to Engineering Mechanics:

Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D, Rigid Body equilibrium, System of Forces: Coplanar Concurrent Forces, Components in Space – Resultant - Moment of Forces and its Application; Couples and Resultant of Force System.

Equilibrium of System of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial systems.

UNIT-II

Friction and Centre of Gravity:

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction, Motion of Bodies, Wedge friction, Screw jack and Differential Screw jack

Centroid and Centre of Gravity: Centroid of Lines, Areas and Volumes from first principle, Centroid of composite sections, Centre of Gravity and its implications, Theorem of Pappus

UNIT-III

Moment of Inertia:

Definition, Area Moment of Inertia, Moment of inertia of Plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections. Product of Inertia, Parallel Axis theorem, Perpendicular Axis Theorem

Mass Moment of Inertia: Moment of Inertia of Masses, Radius of Gyration, Transfer Formula for Mass Moments of Inertia, Mass moment of inertia of composite bodies.

UNIT-IV

Dynamics of a Particle:

Rectilinear motion, Plane curvilinear motion: Rectangular and Polar coordinates. Relative and constrained motion, Newton's law of motion for a particle (rectangular, path, and polar coordinates)

Work -kinetic energy, power, potential energy. Impulse and momentum: Linear, Angular, Elastic Impact (Direct and oblique).

UNIT-V

Kinetics of Rigid Bodies:

Introduction, Types of motion, Instantaneous centre of rotation in plane motion and simple problems,

D' Alembert's principle and its applications in plane motion and connected bodies

Work-Energy Method: Work-Energy principle and its application in plane motion of connected bodies or Systems, Work energy Applied to particle motion, Kinetics of rigid body rotation.

TEXTBOOKS:

1. Engineering Mechanics – Statics & Dynamics, Reddy Vijay Kumar K. and J. Suresh Kumar, Singer's, 3rd Edition, Rpt, 2024
2. Engineering Mechanics, Shames and Rao, Pearson Education, 4th edition, 2016

REFERENCE BOOKS:

1. Engineering Mechanics, Dumir P.C, Sengupta, Srinivas, Universities Press, 1st edition, 2020
2. Engineering Mechanics, Hibbeler R.C, Pearson, 14th Edition, 2017
3. Engineering Mechanics, Arshad Noor, Zahid & Goel, Cambridge University Press, 1st edition, 2018
4. Engineering Mechanics, Bhavikatti S.S, New age international publishers, 7th Edition, 2019

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Determine resultant of forces acting on a body and analyze equilibrium of a body subjected to a system of forces.
2. Determine the problem of bodies subjected to friction.
3. Find the location of Centroid and Centre of gravity of a given section.
4. Calculate moment of inertia and mass moment of inertia of a given section.
5. Solve problems using work energy equations for translation, fixed axis rotation and plane motion.

CO-PO MAPPING:

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

****End****

(A505203) C PROGRAMMING & DATA STRUCTURES

(Common to CE and ME)

B. Tech. (ME): I Year I Semester

L	T	P	C
3	0	0	3

UNIT - I:

Basics of Algorithm, Flowchart and Overview of C: Algorithm, flowchart, program development steps, structure of C program, a simple C program, identifiers, basic data types and sizes, constants, variables.

Operators & Expressions: Arithmetic operators, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, Special Operators, , Evaluation of Expressions, Formatting Input / Output statements. Type conversions, precedence and order of evaluation, example C programs

Decision Statements: Introduction, Decision making with if statement, simple if statement, if-else-statement, Nesting if-else-statements, else-if ladder, Switch statement C program examples.

UNIT - II:

Looping Control Statements: While, do-while, for loop statements, Jumping Statements – Goto, Break and Continue Statements, programming examples.

Functions: Designing structured programs, functions, basics, parameter passing, storage classes-extern, auto, register, static, scope rules, block structure, user-defined functions, standard library functions, recursive functions, example C programs**.**

UNIT - III:

Arrays-concepts, declaration, definition, accessing elements, storing elements, One-dimensional array, Two-dimensional arrays and functions, applications of arrays

Pointers: Pointers and the Indirection Operator, Declaration & Initialization of a pointer, Multiple Calls to a Function with Input / Output Parameters, Formal Output Parameters as Actual Arguments, Pointer – Arithmetic, Pointer to Pointer, Dynamic Memory Allocation, C program examples.

UNIT - IV:

Strings: String Basics, defining a String, Initialization of Strings, Reading and Writing a String, String-handling functions.

Structure and Union: Derived type structures-declaration, definition and initialization of structures. Accessing structures nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, type def, Enumerated data type, C program examples.

UNIT - V:

Introduction to Data Structures: Abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks- Operations, array representations, Queues- operations, array representations.

Searching and Sorting: Linear and Binary search methods, Bubble sort & Selection sort.

TEXTBOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. Jeri R. Hanly and Elliot B. Koffman, Problem solving and Program Design in C 7th Edition, Pearson
3. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
4. Yashavant Kanetkar, Let Us C, 18th Edition, BPB
5. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
6. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
7. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition
8. Ashok N. Kamthane, C and Data Structures, Pearson Education, 2009.

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Apply the basic concepts of algorithms, flowcharts, and C program structure to develop simple programs.
2. Implement programs using control statements and functions to solve real-world problems efficiently.
3. Utilize arrays, pointers, and dynamic memory allocation in C for effective data storage and manipulation.
4. Demonstrate the use of strings, structures, and unions to manage complex and structured data.
5. Apply linear data structures such as linked lists, stacks, and queues, and implement searching and sorting techniques for data processing.

CO-PO MAPPING:

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

****End****

(A500508) CHEMISTRY LABORATORY FOR ENGINEERS

(Common to CE and ME)

B. Tech. (ME): I Year I Semester

L	T	P	C
0	0	2	1

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 $KMnO_4$.
2. Estimation of concentration of strong acid with strong base by Potentiometry using quinhydrone

IV. **p^H Metry:** Determination of an acid concentration using p^H meter.

V. **Preparations:**
1. Preparation of Bakelite.
2. Preparation of bioplastic from Starch.

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.

VIII. **Virtual lab experiments:**
1. Construction of Fuel cell and it's working.
2. Smart materials for Biomedical applications.
3. Batteries for electric vehicles.
4. Functioning of solar cells and its applications

TEXT BOOKS:

1. Engineering Chemistry Lab manual (1st edition),J. Saroja, andD. Divya, Skytech Publishing Company (2025)
2. Lab manual for Engineering chemistry (1st edition), B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)

REFERENCE BOOKS:

1. Vogel's textbook of practical organic chemistry (5th edition)
2. Inorganic Quantitative Analysis (3rd edition), A.I. Vogel, ELBS Publications.
3. College Practical Chemistry (1st edition), V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).

VIRTUAL LABS LINKS:

1. https://www.vlab.co.in/broad-area-chemical-sciences
2. https://chemcollective.org/
3. https://phet.colorado.edu/en/simulations/filter?subjects=chemistry&type=html
4. https://www.labster.com/discipline/chemistry

COURSE OUTCOMES:

On completion of the course students will be able to

1. Estimate the hardness of water using the EDTA Complexometric method and determine the concentration of acids and bases using conductometric, potentiometric, and p^H metric techniques.
2. Synthesize polymers such as Bakelite and bioplastics from starch and relate their properties to real-world engineering applications in material science.
3. Determine the rate of corrosion of mild steel in the presence and absence of inhibitors and assess their effectiveness in corrosion prevention.
4. Estimate the acid value and viscosity of lubricant oils and understand their relevance to engineering applications in machinery and lubrication systems.
5. Simulate the functioning of fuel cells, smart materials, batteries, and solar cells through virtual laboratory simulations and assess their engineering applications.

CO-PO MAPPING:

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

****End****

(A500506) INTRODUCTION TO SOCIAL INNOVATION

(Common to All Branches)

B. Tech. (ME): I Year I Semester

L	T	P	C
0	0	2	1

WEEK-1

Types and features of community - Rural, Sub urban, Urban and Regional

WEEK-2

Service based learning, Aims of Community based projects, Sustainable Development Goals

WEEK-3

Community visit, Report Writing, Resource Diagram, Chapati Diagram, Transect Walk

WEEK-4

Then on-profit sector, public sector, the private sector, the inform all sector

WEEK-5

Poster presentation on four sectors

WEEK-6

Process of Design Thinking

WEEK-7

Social organization sand enterprises, social movements

WEEK-8

Social software sand open-source methods

WEEK-9

Introduction to Ethics, moral values, significance of professional ethics code of conduct for engineers

WEEK-10

Identify ethical dilemmas in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas

WEEK-11

Case studies on Engineering Ethics

WEEK-12

Steps for Patent filing and Start ups, Procedure for grants of patents, Indian Scenario of Patenting, International cooperation on Intellectual Property, Documentation, Panel Presentation

TEXT BOOKS:

1. Social Entrepreneurship for the 21st Century: Innovation Across the Non Profit, Private and Public Sectors; Georgia Levenson Keohane; Tata Mc Graw Hill
2. Solving Problems with Design Thinking – Ten Stories of What Works (Columbia Business School Publishing) Hard cover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author)

REFERENCE BOOKS:

1. Fundamentals of Intellectual Property (English) 1st Edition (Paperback, Dr. Kalyan C. Kankanala) Publisher: Asia Law House ISBN: 9789381849514, 938184951 X Edition: 1st Edition, 2012
2. Indian Patent Law (English, Paperback, Kalyan C. Kankanala) Publisher: Oxford University Press – New Delhi, ISBN: 9780198089605, 0198089600 Edition: 2012
3. Social Enterprises: An Organizational Perspective edited; Benjamin Gidron, Yeheskel Hasenfeld; Palgrave Macmillan
4. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
5. Engineering Ethics: An Industrial Perspective; Gail Baura; Elsevier
6. Intellectual Property and Financing Strategies for Technology Startups; Gerald B. Halt, Jr., John C. Donch Jr., Amber R. Stiles, Robert Fesnak; Springer

COURSE OUTCOMES:

On completion of the course students will be able to

1. Identify community issues through community Interaction
2. Illustrate the factors affecting social innovation in various sectors
3. Apply design thinking concept to analyze the community problems
4. Adopt the ethical values in implementing the Social innovation
5. Describe the process of property rights and patent filing.

CO-POMAPPING:

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

****End****

(A503501) ENGINEERING WORKSHOP

(Common to CE and ME)

B. Tech. (ME): I Year I Semester

L	T	P	C
0	0	2	1

Pre-requisites: Practical skill

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

I. Carpentry: T Lap joint, Cross Lap joint, Dovetail joint, Mortise and Tenon joint
II. Fitting: V fit, Dovetail fit and Semi-circular fit
III. Tin-Smithy: Square tin, Rectangular try and Conical funnel
IV. Foundry: Preparation of Green Sand mould using Single piece and Split pattern
V. Welding Practice: Arc welding and Gas welding
VI. House-wiring: Parallel and Series, Two-way Switch and Tube light
VII. Black Smithy: Round to Square, Fan hook and S-hook

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Lathe, Power tools and Wood working

TEXT BOOKS:

1. Workshop Practice, B. L. Juneja, Cengage Learning India, 1st Edition, 2016
2. Workshop Practice Manual, Venkat Reddy, BS Publications, 6th Edition, Rpt 2025

REFERENCE BOOKS:

1. Work shop Manual, P. Kannaiah & K.L. Narayana, Scitech Publishers, 2nd Edition, 2008
2. Workshop Manual, K. Venugopal, Anuradha Publications, 12th Edition, 2012

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Study and practice on trade tools and their operations
2. Practice and prepare components using workshop trades including carpentry, fitting, Tin smithy.
3. Practice and prepare components using workshop trades including Foundry, welding.
4. Practice and prepare components using workshop trades including House wiring, black smithy and Plumbing.
5. Acquire knowledge by exposure to modern Tools.

CO-PO MAPPING:

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

****End****

(A505503) C PROGRAMMING AND DATA STRUCTURES LABORATORY

(Common to CE and ME)

B. Tech. (ME): I Year I Semester

L	T	P	C
0	0	2	1

[Note:The programs may be executed using any available Open Source/ Freely available IDE
Some of the Tools available are:
CodeLite: https://codelite.org/
Code::Blocks: http://www.codeblocks.org/
DevCpp :http://www.bloodshed.net/devcpp.html
Eclipse: http://www.eclipse.org
This list is not exhaustive and is NOT in any order of preference]

Course Outcomes:
After completing this course, the student will be able to:
CO1: Write simple programs using C language to perform basic input/output operations and evaluate expressions using operators and selection statements.
CO2: Apply iterative constructs and functions to solve real-time computational problems.
CO3: Implement programs using arrays and pointers for storing and manipulating data efficiently.
CO4: Develop applications using strings and structures for text processing and record management.
CO5: Apply data structures such as linked lists, stacks, and queues and implement searching and sorting algorithms for effective data processing.

Operators and Expressions:
Practice Programs:

- Write a simple program that prints the results of all the operators available in C, Read required operand valuesfrom standard input.
- Write a program that reads the radius of a circle (as a float value) and computes and prints the diameter, the circumference and the area, consider π value as a symbolic constant.
- Write a C program for the simple and compound interest.

Additional Programs:

- Write a C program to compute $s = ut + ½ at^2$ [Read u, t & a values from keyboard].
- Write a program that asks the user to enter the total time elapsed, in seconds, since an event and converts the time to hours, minutes and seconds. The time should be displayed as hours: minutes: seconds. [Hint: Use the remainder operator]

Decision statements:
Practice Programs:

- Write a C program for finding the max and min from the given three numbers.
- Write a C program to find the roots of a Quadratic equation.
- 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).

Additional Programs:

- Write a C program to calculate the electricity bill. Read starting and ending meter readings. The charges are as follows:

No. of Units Consumed	**Unit Cost (per unit)**
>=500	5.00 Rs/unit
>=200 to <500	3.50 Rs/unit
>=100 &<200	2.50 Rs/unit
Less than 100	1.50 Rs/unit

- Write a C program to convert years into 1. MINUTES 2. HOURS 3. DAYS 4. MONTHS 5. SECONDS using switch-case statement.

Loop Control Statements:
Practice Programs:

- Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:
  5 x 1 = 5
  5 x 2 = 10
  5 x 3 = 15

- Write a C program to print all the prime numbers between the given limits.
- Write a C program to find the sum of individual digits of a positive integer.
- Write a C program to construct a pyramid of numbers as follows:

1	a
1 2	b b
1 2 3	c c c
1 2 3 4	d d d d

Additional Programs:

- A 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.
- Write a C program to check whether the given year is leap-year or not using goto statement.
- Write a C program to summate the Sin Series of n terms [Hint: input x and n terms]

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots$$

Functions & Recursion:

Practice Programs:

- Write a C program to find the sum of any two integers, using function.
- Write C programs that uses recursive functions:
  a. To find the factorial of a given integer.
  b. To find the GCD (greatest common divisor) of two given integers.

Additional Programs:

- Write a C program to check whether the given number is Armstrong or not? using function
- Write a C program to convert the given decimal number into equivalent binary form.

Arrays:

Practice Programs:

- Write a C program to find the minimum, maximum and average in an array of integers.
- Write a C program that uses functions to perform the Addition of Two Matrices

Additional Programs:

- Write a C program that uses functions to perform the Multiplication of Two Matrices
- Write a C program to find second largest number from given array.

Strings:

Practice Programs:

- Write C programs using String-Handling functions:
  a**. T**o find the length of a given string
  b. To append one string at end of another string
- Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, etc.) using string handling functions
- Write a C program that displays the position of a character ch in the string S or – 1 if S doesn't contain ch.

Additional Programs:

- Write a C program to count the lines, words and characters in a given text.
- Write a C program that uses functions to perform the following operations:
  i. To insert a sub-string into a given main string from a given position.
  ii. To delete n Characters from a given position in a given string

Pointers:

Practice Programs:

- Write a C program to perform different arithmetic operations using pointers.
- Write a C program to swap two numbers using call-by-value and call-by-reference concept.

Additional Programs:

- Write a C program to read and display array elements using pointers only, and compute the minimum, maximum, and average using pointer operations.
- Write a program for display values in reverse order from an array using a pointer.
- Write a C program to find the length of a given string including and excluding spaces using pointers.
- Write a C program to read string from keyboard and display it using character pointer.

Structures:

Practice Programs:

- Write a C program to read and display a student structure with the following data items: student_name, student_rno, student_percentage.
- Write a C program to copy the structure elements from one structure variable to another.
- Write a C program to declare pointer to structure and display the contents of the structure.

Additional Programs:

- Write a C program to find the sum of any two complex numbers using function.
- Write a C program to read and display roll number, full name and date of birth of a student using nested structures.
- Write a C program to create enumerated data type for 12 months. Display their values in integer constants.

Files:

Practice Programs:

- Write a C program to write data to text file and read it.
- Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents and read the result file.

Additional Programs:

- Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)using CLA.
- Write a C program to read and display the contents of an existing file by skipping the first n-characters from the beginning of the file. [Hint: Use fseek() funcion]

DataStructures

Practice Programs:

- Writeaprogramthatusesfunctionstoperformthefollowingoperationsonsinglylinkedlist
  - Creation,ii)Insertion,iii)Deletionandiv) Traversal
- Writeaprogramthatimplementstack(itsoperations)using Arrays
- WriteaprogramthatimplementQueue(itsoperations)using Arrays

Additional Programs:

- Write a C Program to display the elements in the Single Linked List in reverse Order.
- Write a C Program to store and display a Polynomial Equation of order n ($4X^8+2X^5-3X^3+X^2-10$, here 'n' is 8)

Sorting and Searching:

Practice Programs:

- Write a C program that uses function to search for a Key value in a given list of integers using linear search method.
- Write a C program that uses recursive and non-recursive functions to search for a Key value in a given sorted list of integers using binary search method.
- Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.

Additional Programs:

- Write a C program that sorts the given array of integers using selection sort in descending order
- Write a C program that sorts the given array of integers using insertion sort in ascending order
- Write a C program that sorts a given array of names.

TEXT BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. Jeri R. Hanly and Elliot B. Koffman, Problem solving and Program Design in C 7th Edition, Pearson

REFERENCE BOOKS:

- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
- E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
- Yashavant Kanetkar, Let Us C, 18th Edition, BPB
- R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
- Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
- Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition
- B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

CO-PO MAPPING:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1
CO 1	3	2	1	-	1	-	-	-	-	-	-
CO 2	3	3	2	-	2	-	-	-	-	-	-
CO 3	3	3	2	-	2	-	-	-	-	-	-
CO 4	3	3	3	-	2	-	-	-	1	1	-
CO 5	3	3	3	2	3	-	-	-	-	-	-

****End****

(A500002) ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

(Common to All Branches)

B. Tech. (ME): I Year II Semester

L	T	P	C
3	0	0	3

UNIT-I: First Order Ordinary Differential Equations

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

Higher 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.

UNIT-III: Laplace Transforms

Laplace Transforms: Laplace Transform of standard functions – First shifting theorem – Laplace transforms of functions multiplied by 't' and divided by 't' – Laplace transforms of derivatives and integrals of function – 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, Gauss and Stokes (without proofs) and their applications

TEXT BOOKS

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

REFERENCES

1. Advanced Engineering Mathematics (9th Edition), Erwin Kreyszig, John Wiley & Sons, 2006.
2. Calculus and Analytic geometry (9th Edition), G.B. Thomas and R.L. Finney, Pearson, Reprint, 2002.

COURSE OUTCOMES:

On completion of the course students will be able to

1. Determine whether a given first-order differential equation is exact, linear or Bernoulli's and apply the concepts to model and analyze real-world problems.
2. Solve higher-order differential equations and apply Method of variation of parameters.
3. Utilize Laplace transform techniques for solving ordinary differential equations.
4. Find Gradient, Divergence, Curl and Directional derivatives of vector point functions and scalar point functions
5. Evaluate line, surface, and volume integrals in various coordinate systems. Transform one type of integral into another using the appropriate vector integral theorems.

CO-PO MAPPING

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

****End****

(A500008) ADVANCED ENGINEERING PHYSICS

(Common to All Branches)

B. Tech. (ME): I Year II Semester

L	T	P	C
3	0	0	3

UNIT - I: CRYSTALLOGRAPHY

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.

CONCEPT OF NANOMATERIALS & MATERIALS CHARACTERIZATION:

Surface to volume ratio, X -ray diffraction: Bragg's law, powder method, crystallite size - Debye Scherrer's formula, scanning electron microscopy (SEM): block diagram, working principle.

UNIT - II: QUANTUM MECHANICS

Introduction, de-Broglie hypothesis, physical significance of wave function, postulates of quantum mechanics, operators in quantum mechanics, Eigen values and Eigen functions, expectation value; Schrödinger's time independent wave equation, particle in a 1D box, Kronig-Penny Model (qualitative), classification of solids, concept of discrete energy levels and quantum confinement in nanomaterial.

SEMICONDUCTORS AND DEVICES:

Intrinsic and Extrinsic semiconductors (qualitative), Hall effect, Construction, principle of operation and characteristics of P-N Junction diode, Direct and indirect band gap semiconductors – LED and Solar cells, their structure, materials, working principle and characteristics.

UNIT - III: QUANTUM COMPUTING

Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere (qualitative), concept of quantum computer, classical bits. Qubits, multiple Qubit system

Quantum computing system for information processing, evolution of quantum systems, quantum measurements, Entanglement(qualitative), Single qubit gates, multi qubit gate, challenges and advantages of quantum computing over classical computation(qualitative). Quantum algorithms: Deutsch-Jozsa, Shor, Grover.

UNIT - IV: MAGNETIC MATERIALS

Introduction to magnetic materials, origin of magnetic moment-classification of magnetic materials, hysteresis, Weiss domain theory of ferromagnetism, soft and hard magnetic materials, synthesis of ferromagnetic materials using sol-gel method, applications: magnets for electric vehicles (EV).

DIELECTRIC MATERIALS:

Introduction to dielectric materials, types of polarization (qualitative): electronic, ionic & orientation; ferroelectric, piezoelectric, pyroelectric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM), production of Ultrasonics by piezoelectric method.

UNIT - V: LASER

Introduction to laser, characteristics of laser, Einstein coefficients and their relations, metastable state, population inversion, pumping mechanism, lasing action, Ruby laser, He-Ne laser, CO_2 laser, semiconductor diode laser, applications: Bar code scanner, LIDAR for autonomous vehicle.

FIBER OPTICS

Introduction to Fiber optics, total internal reflection, construction of optical fiber, acceptance angle, numerical aperture, classification of optical fibers, losses in optical fiber (qualitative), applications: optical fibers for communication system.

TEXTBOOKS:

1. Crystallography: An Introduction (3rd Edition), Walter Borchardt-Ott, Springer, 2011.
2. Introduction to Solid State Physics (9th Edition) Charles Kittel, John Wiley & Sons, Inc, 2018
3. Introduction to Classical and Quantum Computing, (1st Edition) Thomas G. Wong, Rooted Grove, 2022.
4. Physics of Semiconductor devices (4th edition), Simon.MSze and Kwok K . Ng, Wiley Student Edition, 2006.

REFERENCE BOOKS:

1. Quantum Computing (1st Edition), Jozef Gruska, McGraw Hill, 1999.
2. Quantum Computation and Quantum Information (10th Edition), Cambridge University Press, 2010
3. Optical Fiber Communications Principles and Practice (3rd Edition), Pearson Education Limited,2009
4. Essentials of Nano science& Nanotechnology(1stedition), Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 2021
5. Engineering Physics (3rd edition), PK Palanisam, SciTech Publications, 2015.

COURSE OUTCOMES:

On completion of the course students will be able to

1. Analyze crystal structures, identify defects, and apply XRD and SEM techniques for material characterization.
2. Apply quantum mechanical principles to explain particle behavior and energy band formation in solids and classify semiconductor devices.
3. Understand quantum computing concepts, use quantum gates, and explain basic quantum information process.
4. Classify magnetic and dielectric materials and explain their properties, synthesis, and applications.
5. Appreciate the principles of lasers and fiber optics and their applications in communication.

CO-PO MAPPING

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

****End****

(A500101) ENGLISH FOR SKILL ENHANCEMENT

(Common to All Branches)

B. Tech. (ME): I Year II Semester

L	T	P	C
3	0	0	3

Unit –I

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 Black Swan 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

Theme: Digital Transformation

Lesson on '*Emerging Technologies*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan 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

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 Black Swan 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

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 Black Swan 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

Theme: Integrity and Professionalism

Lesson on '*Professional Ethics*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan 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.***

TEXT BOOKS:

1. English for the Young in the Digital World, Orient Black Swan Pvt. Ltd, Board of Editors, 2025

REFERENCE BOOKS:

1. Practical English Usage, Swan,Michael, Oxford University Press. New Edition..(2016).
2. English Grammar Just for You. Karal, Rajeevan, Oxford University Press. New Delhi (2023).
3. Communication Skills –A Workbook.Sanjay Kumar & Pushp Lata. Oxford University Press New Delhi (2022).
4. English for Technical Communication for Engineering Students, Vishwamohan, AyshaMc Graw-Hill Education India Pvt. Ltd.(2013)

COURSE OUTCOMES:

On completion of the course students will be able to

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

CO-PO MAPPING:

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

****End****

(A502203) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to CE and ME)

B. Tech. (ME): I Year II Semester

L	T	P	C
3	0	0	3

Course Objectives:

1. To introduce the concepts of electrical circuits and its components
2. To understand magnetic circuits, DC circuits and AC single phase and three phase circuits
3. To study and understand the different types of DC, AC machines and Transformers.
4. To import the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.
6. To introduce the concepts of diodes and transistors, and
7. To impart the knowledge of various configurations, characteristics and applications

UNIT - I: D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation. A.C. 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, Threephase balanced circuits, voltage and current relations in star and delta connections.

UNIT - II: Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries, Elementary calculations for energy consumption, power factor improvement and battery backup

UNIT - III: Electrical Machines: Working principle of Single-phase transformer, equivalent circuit, losses in transformers, efficiency, Three-phase transformer connections. Construction and working principle of DC generators, EMF equation, working principle of DC motors, Torque equations and Speed control of DC motors, Construction and working principle of Three-phase Induction motor, Torques equations and Speed control of Three-phase induction motor. Construction and working principle of synchronous generators

UNIT - IV: P-N Junction and Zener Diode: Principle of Operation Diode equation, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Zener diode characteristics and applications. Rectifiers and Filters: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

UNIT - V: Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations. Field Effect Transistor (FET): Construction, Principle of Operation, Comparison of BJT and FET, Biasing FET.

TEXT BOOKS:

1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education

REFERENCE BOOKS:

1. Electronic Devices and Circuits – R. L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, SatyabrataJit, TMH, 2/e, 1998.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2 nd edition by Raymond A. De Carlo and Pen-Min-Lin, Oxford University Press-2004.
5. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
7. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
8. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
9. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

COURSE OUTCOMES:

On completion of the course students will be able to

1. Analyze and solve electrical circuits using network laws and theorems.
2. Understand and analyze basic Electric and Magnetic circuits
3. Study the working principles of Electrical Machines
4. Introduce components of Low Voltage Electrical Installations

5. Identify and characterize diodes and various types of transistors.

CO-PO MAPPING:

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

****End****

(A505206) PYTHON PROGRAMMING

(Common to All Branches)

B. Tech (ME): I Year II Semester

L	T	P	C
3	0	0	3

UNIT – I

Introduction to Python Programming: History and features of Python, Installation and setup of Python environment, Python interpreter and help utility, Variables, data types, and operators, Input/output operations, Using Python as a calculator, Writing basic Python programs, Control structures: if, if-else, if-elif-else, Looping constructs: for, while, break, continue, String operations and formatting

UNIT – II

Functions, Recursion and Data Structures: Defining and calling functions, Function parameters and return values, Recursion and recursive functions, Lists, tuples, dictionaries: creation and manipulation, List and dictionary operations, Searching and sorting in lists, Detecting and removing duplicates, working with arrays using NumPy, Set operations and common value detection

UNIT – III

Object-Oriented Programming and Modules: Classes and objects, Attributes and methods, Constructors and destructors, Inheritance and polymorphism, Creating and using modules, Exception handling: try, except, finally, GUI programming using Tkinter, Drawing shapes on canvas: rectangles, points, circles, Adding attributes like color and position

UNIT – IV

File Handling and Text Processing: Reading and writing text files, File operations: open, read, write, append, Merging file contents, Searching for words in files, Word frequency analysis, Counting vowels, spaces, and case letters, Validating email and phone numbers, Removing and replacing words in strings

UNIT – V

Scientific Libraries and Logic Design: Introduction to NumPy, SciPy, and Matplotlib, Installing and exploring NumPy functionalities, Array operations and plotting basics, Implementing digital logic gates: AND, OR, NOT, XOR, Creating GUI windows with labels, text fields, buttons, Event handling in GUI applications, Recursive generation of binary strings

TEXTBOOKS:

1. Python Programming: A Complete Beginners Guide To Python, Nicholas I. Murphy, ISBN-13: 979-8343258240, Publisher: Independently published
2. Python Programming: Using Problem Solving Approach by Reema Thareja, Oxford University Press

REFERENCE BOOKS:

1. Think Python: How to Think Like a Computer Scientist by Allen B. Downey

COURSE OUTCOMES:

On completion of the course students will be able to

1. Understand the foundational concepts of Python programming including syntax, data types, operators, control structures, and string manipulation.
2. Apply functions, recursion, and data structures such as lists, tuples, dictionaries, and arrays to solve computational problems efficiently.
3. Implement object-oriented programming principles using Python classes and modules, and develop GUI applications using Tkinter.
4. Perform file handling operations and text processing tasks including reading, writing, searching, and analyzing textual data.
5. Explore scientific libraries such as NumPy, SciPy, and Matplotlib, and design logic-based applications including digital gates and GUI-based tools.

CO-PO MAPPING:

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

****End****

(A500502) ADVANCED ENGINEERING PHYSICS LABORATORY

(Common to All Branches)

B. Tech (ME): I Year II Semester

L	T	P	C
0	0	2	1

(Any 8 experiments are to be performed)

1. Determination of Planck's constant using Photo Electric Effect.
2. Determination of energy gap of a semiconductor.
3. Determination of Hall coefficient and carrier concentration of a given semiconductor.
4. Study of V-I characteristics of a LED
5. Study of V-I characteristics of a Solar Cell and find its Fill factor.
6. Determination of magnetic moment of a bar magnet and horizontal earth magnetic field.
7. Study of B-H curve of a ferromagnetic material.
8. Determination of dielectric constant of a given material.
9. Study of V-I & L-I characteristics of a given laser diode
10. a. Determination of wavelength of a laser using diffraction grating.
    b. Determination of LASER beam divergence
11. a. Determination of numerical aperture of a given optical fiber.
    b. Determination of bending losses of a given optical fiber.

COURSE OUTCOMES:

On completion of the course students will be able to

1. Determine the energy gap using semiconductors using experimental methods.
2. Appreciate **and apply** the principles of **quantum physics** in the field of **optoelectronics**
3. Analyze the variation of Magnetic fields and their properties
4. Examine and interpret the variation of dielectric properties of a material.
5. Demonstrate working knowledge of laser systems and optical fiber parameters through experimental study.

CO-PO MAPPING:

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

****End****

(A500504) ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY
(Common to All Branches)

B. Tech (ME): I Year II Semester

L	T	P	C
0	0	2	1

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:
5. **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

SUGGESTED SOFTWARE:
1. Punctuation Made Easy by Darling Kindersley.
2. **Free Mobile App**: The official OALD 10th Edition app provides **100 free sample entries.**
3. **Free Access**: Limited to downloadable samples (table of contents, sample pages, copyright information) available on the Cambridge website.

REFERENCES BOOKS:

- Communicative English – A workbook, Shobha, KN &Rayen, J. Lourdes. Cambridge University Press, (2019).

- English Language Communication Skills – Lab Manual cum Workbook, Cengage Learning India Pvt. Ltd (2022).
- Five Minute Activities – A Resource Book for Language Teachers Ur, Penny and Wright, Andrew Cambridge University Press (2022).

COURSE OUTCOMES:

On completion of the course students will be able to

1. Listen actively and identify important information in spoken texts
2. Interpret the speech and infer the intention of the speaker
3. Improve their accent for intelligibility
4. Speak fluently with clarity and confidence
5. Use the language in real life situations

CO-PO MAPPING:

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

****End****

(A502502) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY
(Common to CE and ME)

B. Tech (ME): I Year II Semester

L	T	P	C
0	0	2	1

Pre-requisites: Basic Electrical and Electronics Engineering

COURSE OBJECTIVES:

1. To introduce the concepts of electrical circuits and its components
2. To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
3. To study and understand the different types of DC/AC machines and Transformers.
4. To import the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.
6. To introduce the concepts of diodes & transistors, and
7. To impart the knowledge of various configurations, characteristics and applications.

LIST OF EXPERIMENTS/ DEMONSTRATIONS:

PART A: ELECTRICAL

1. Verification of KVL and KCL
2. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
3. Measurement of Active and Reactive Power in a balanced Three-phase circuit
4. Performance Characteristics of a DC Shunt Motor
5. Performance Characteristics of a Three-phase Induction Motor
6. No-Load Characteristics of a Three-phase Alternator

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
6. Half Wave Rectifier with & without filters

TEXT BOOKS:

1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education

REFERENCE BOOKS:

1. Electronic Devices and Circuits – R. L. Boylestead and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, SatyabrataJit, TMH, 2/e, 1998.

COURSE OUTCOMES:

On completion of the course students will be able to

1. To verify basic laws of electrical circuits and Network theorems.
2. To study the working principles of Electrical Machines.
3. To verify the transformer principle with suitable practical arrangement.
4. To identify and plot characteristics of diodes and various types of transistors.
5. To understand the operation of half wave and full wave rectifiers.

CO-PO MAPPING

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

****End****

(A503502) ENGINEERING EXPLORATION AND PRACTICE
(Common to All Branches)

B. Tech (ME): I Year II Semester

L	T	P	C
0	0	2	1

Week-1: Difference between Science and Engineering, Scientist and Engineer needs and wants various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer. Significance of team work, Importance of communication in engineering profession

Week-2: Engineering Design Process, Need statement to Problem conversion, Pair wise comparison chart, decision matrix, Concepts of reverse engineering

Week-3: Project management tools: Check list, Time line, Gantt chart, Requirement Analysis

Week-4: Basic Components of a Mechanism, Degrees of Freedom or Mobility of a Mechanism, 4 bar Chain, Crank Rocker Mechanism, Slider Crank Mechanism

Week-5: 3-D Modelling of a Box with two holes and curvature

Week-6: 3-D Modelling of Electronic Enclosure and Assembly of two parts

Week-7: Introduction to various platform – based development, Introduction to basic components, transducers, actuators and sensors, Introduction to Tinker cad

Week-8: Introduction to Arduino, basics of programming

Week-9: Interfacing Arduino with actuators and transducers

Week-10: Interfacing Arduino with Sensors, Liquid Crystal Display (LCD)

Week-11: Assembly and Crafting the Prototype

Week-12: Test and Validate the Prototype, Documentation, Panel Presentation

TEXT BOOKS:

1. Concepts in Engineering Design, Sumesh Krishnan and Dr. Mukul Shukla, Notion Press, 2016
2. Workshop Practice, B. L. Juneja, Cengage, 2016

REFERENCE BOOKS:

1. Theory of Mechanism and Machine, A. Ghosh and A K Malik, East West Press (Pvt) Ltd., New Delhi.
2. Arduino Cook book, O'Reilly Media, 2nd Edition
3. Introduction to auto cad - 2D and 3D design, Bernd S. Palmand, Alf Yarwood and Routledge, Taylor & Francis group, 2017
4. Engineering Fundamentals: An Introduction to Engineering (Mind Tap Course List), Saeed Moaveni, 5th Edition
5. Software Project Management (SIE) , Bob Hughes, Mike Cotterell, Rajib Mall, 5th Edition, Tata McGraw – Hill Education Pvt. Ltd, 2011, ISBN10:0071072748ISBN13:9780071072748

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Explain the importance of engineering profession in the world.
2. Identify multi-disciplinary approach required in solving an engineering problem
3. Build a mechanism for a given application
4. Create basic 3D models and animations
5. Design a mechatronic system using Mechanical and Electronic components

CO-PO MAPPING:

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

****End****

(A505507) PYTHON PROGRAMMING LABORATORY

(Common to All Branches)

B. Tech (ME): I Year II Semester

L	T	P	C
0	0	2	1

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.
1. Start a Python interpreter and use it as a Calculator.
2. Write a program to calculate compound interest when principal, rate and number of periods are given.
3. Read the name, address, email and phone number of a person through the keyboard and print the details.
4. Print the below triangle using for loop.

   5
   4 4
   3 3 3
   2 2 2 2
   1 1 1 1 1
5. 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)
6. Python program to print all prime numbers in a given interval (use break)
7. Write a program to convert a list and tuple into arrays.
8. Write a program to find common values between two arrays.
9. 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.
10. 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.
11. Write a function called has duplicates that take a list and returns true if there is any element that appears more than once. It should not modify the original list.
12. 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.
13. The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
14. 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.
15. Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
16. Remove the given word in all the places in a string?
17. 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?
18. Writes a recursive function that generates all binary strings of n-bit length
19. Write a python program that defines a matrix and prints
20. Write a python program to perform multiplication of two square matrices
21. 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.
22. Use the structure of exception handling all general-purpose exceptions.
23. 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.
24. Add an attribute named color to your Rectangle objects and modify draw rectangle so that it uses the color attribute as the fill color.
25. 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.
26. 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.
27. Write a python code to read a phone number and email-id from the user and validate it for correctness.
28. Write a Python code to merge two given file contents into a third file.
29. 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.
30. Write a Python code to Read text from a text file, find the word with most number of occurrences

31. 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.
32. Import numpy, Plotpy and Scipy and explore their functionalities.
33. Install NumPy package with pip and explore it.
34. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
35. 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

COURSE OUTCOMES:

On completion of the course students will be able to:

3. Understand and apply basic Python syntax, data types, control structures, and string operations.
4. Develop Python programs using functions, recursion, and data structures like lists, tuples, dictionaries, and arrays.
5. Implement object-oriented programming concepts and GUI applications using Python modules and Tkinter.
6. Perform file handling and text processing operations including reading, writing, searching, and analyzing textual data.
7. Utilize scientific libraries (NumPy, SciPy, Matplotlib) and design logic-based applications including digital gates and GUI tools.

CO-PO MAPPING:

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

****End****

(A501201) FLUID MECHANICS AND HYDRAULIC MACHINES

B. Tech (ME): II Year I Semester

L	T	P	C
3	0	0	3

Prerequisites: Engineering Mechanics, Thermodynamics

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 no
n, 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, Momentum equation and its application on force on pipe bend.

UNIT – III: 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. **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, Measurement of flow: Pitot tube, Venturi meter and Orifice meter, Flow nozzle.

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. Hydraulic Machines: Fluid Machinery, Jagdish Lal, Metropolitan Book Co., 6th Edition, 2016.
3. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria and Sons, 22nd Edition, 2018.
4. Fluid Mechanics and Machinery, D. Rama Durgaiah, New Age International publishers, 1st Edition, 2002.
5. Hydraulic Machines, T.R. Banga and S.C. Sharma, Khanna Publishers, 7th Edition, Rpt. 2019.

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Able to explain the effect of fluid properties on a flow system.
2. Able to identify type of fluid flow patterns and describe continuity equation.
3. To analyze a variety of practical fluid flow and measuring devices and utilize Fluid Mechanics principles in design.
4. To select and analyze an appropriate turbine with reference to given situation in power plants.
5. To estimate performance parameters of a given Centrifugal and Reciprocating pump.

CO-PO MAPPING:

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

****End****

(A503301) THERMODYNAMICS

B. Tech (ME): II Year I Semester

L	T	P	C
3	0	0	3

Note: 1. Steam Tables are permitted for examinations.
2. Refrigeration and psychrometry tables are permitted for examinations.

UNIT-I:
Basic Concepts and First Law of Thermodynamics:
System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & 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 Equation.

UNIT-II:
Second Law of Thermodynamics and Availability:
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 Substance and Perfect Gas:
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. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.
Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes

UNIT-IV
Real Gas Models and Perfect Gas mixtures:
Deviations from perfect Gas Model – Vader Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables
Mixtures of perfect Gases – Mole Fraction, Mass friction 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 const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour,

UNIT-V
Psychrometry and Thermodynamic Cycles:
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.
Power Cycles: Otto, Diesel, Dual Combustion 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, Brayton and Rankine cycles – Performance Evaluation.
Refrigeration Cycles: Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

TEXT BOOKS:
1. Engineering Thermodynamics, PK Nag, Mc Graw Hill, 7th Edition, 2020
2. Fundamentals of Thermodynamics, Richard E Sonntag and Claus Borgnakke, Wiley, 8th Edition, 2014

REFERENCE BOOKS:

1. Thermodynamics, Yunus A. Cengel, Michael A. Boles, Mehmet Kanoglu, McGraw-Hill, 9th Edition, 2019
2. Thermodynamics by M. Achutan, PHI, 3nd Edition, 2013.
3. Fundamentals of Classical Thermodynamics by G. Van Wylan & R.E. Sonntag, John Wiley Pub
4. Engineering Thermodynamics by Jones & Dugan, PHI, 2007.

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Describe the basic concepts of thermodynamics.
2. Apply first law of thermodynamics to different systems.
3. Apply second law of thermodynamics to different systems.
4. Analyze properties of pure substances.
5. Analyze air standard cycles and refrigeration cycles.

CO-PO MAPPING:

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

****End****

(A503303) MECHANICS OF SOLIDS

B. Tech (ME): II Year I Semester

L	T	P	C
3	0	0	3

Pre-Requisites: Engineering Mechanics

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

UNIT – II:
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, 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:
Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (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 like rectangular, circular, triangular, I, T angle sections.

UNIT – IV:
Principal Stresses and Strains: Introduction – Stresses on an inclined section 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.
Theories of Failure: Introduction – Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

UNIT – V:
Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: $T/J = q/r = N\theta/L$
– 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 – Design of shafts according to theories of failure.
Columns and Struts: Euler's Theory, Limitations of Euler's theory, Equivalent Length, Rankine's Formula, Secant Formula.

TEXT BOOKS:
1. Strength of Materials, S. Ramamrutham and R. Narayanan, Dhanpat Rai Publisher, 20th Edition, 2020
2. Strength of Materials, R. K. Bansal, Laxmi Publications (P) Limited, 4th Edition, 2009

REFERENCE BOOKS:
1. Strength of Materials, S. S. Rattan, Tata McGraw Hill Education Pvt. Ltd, 2nd Edition, 2011
2. Strength of Materials, U. C. Jindal, Pearson Education India,2012
3. Mechanics of Materials, Goodno and James M. Gere, Cengage Learning, 9th Edition, 2018.
4. Strength of Materials, W. A. Nash and M. C. Potter, McGraw Hill, 5th Edition,2011

COURSE OUTCOMES:
On completion of the course students will 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 equation and shear stresses and apply to the design of beams and shafts.
4. Determine principal stresses and understand the different criteria for the safety of the component by applying the theories of elastic failure.
5. Develop the torsion equation, apply it to design of shafts and to determine crippling load in struts and columns

CO-PO MAPPING:

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

****End****

(A503304) MECHINE DRAWING

B. Tech (ME): II Year I Semester

L	T	P	C
1	0	2	2

Pre-Requisites: Engineering Graphics

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, bolts, nuts, stud bolts, tap 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.

Drawing of Machine Elements: Using manual drawing approach

Assembly Drawings:
Drawing of assembled views for the part drawings 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 manual drawing approach

NOTE: 1. First angle projection to be adopted.
2. All the drawing components, Assembly to be drawn using manual drawing approach

TEXT BOOKS:

1. Machine Drawing, N.D. Bhatt, Charotar Publication, 51st Edition, 2022
2. Machine Drawing, Ajeet Singh, Mc Graw Hill, 2nd Edition, 2012

REFERENCE BOOKS:

1. Machine Drawing with Auto CAD, Goutham Pohit and Goutam Ghosh, Pearson, 2016
2. Machine Drawing, Bhattacharyya, Oxford, 2011

COURSE OUTCOMES:
On completion of the course students will be able to:

1. Draw conventional representation of materials and machine elements.
2. Draw different types of fasteners.
3. Draw different types of riveted joints.
4. Draw different types of couplings and bearings.
5. Draw assembly drawings of engine parts, machine parts and valves

CO-PO MAPPING:

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

****End****

(A503307) MATERIAL SCIENCE AND METALLURGY

B. Tech (ME): II Year I Semester

L	T	P	C
3	0	0	3

UNIT – I

Crystal Structure: Unit cells, Metallic and Ceramic crystal structures. **Imperfection in solids:** Point, line, surface and volume defects; dislocations, strengthening mechanisms, slip systems, critical resolved shear stress.

UNIT – II

Hume – Rothery Rules: Alloys, substitutional and interstitial solid solutions, **Phase diagrams:** Interpretation of binary phase diagrams and microstructure development, Eutectic, Peritectic, Eutectiod, Peritectoid and monotectic reactions, Iron, Iron carbide phase diagram and micro structural aspects of ledeburite, Austenite, Pearlite, Ferrite and Cementite.

UNIT –III

Heat treatment: Isothermal transformation diagrams for Fe-C alloys and microstructures development. Martensite, Bainite, Annealing, Normalising, Hardening, Tempering and Spheroidising

UNIT – IV

Cooling Curves and Surface Hardenig: Continuous cooling curves and interpretation of final microstructures and properties, Thermo mechanical treatments: Austempering, Martempering, Surface hardening methods: Case hardening, Carburizing, Nitriding, Cyaniding, Carbo Nitriding, Flame and induction hardening, Vacuum and plasma hardening

UNIT – V

Alloys and Composites: Alloy steels, Properties and applications of stainless steels and tool steels, Maraging steels, Types of Cast irons: Grey, White, Malleable and Spheroidal Graphite cast irons, Copper and its alloys: Brass and bronze, Aluminium and its alloys: Al-Cu Alloys, Ceramics and Composites: Types, properties and applications

TEXT BOOKS:

1. Introduction to Physical Metallurgy, Sidney H Avner, McGraw Hill, 2nd Edition, 2017
2. Material Science and Engineering,V. Raghavan, Prentice Hall of India Private Limited, 5th Edition, 2004

REFERENCE BOOKS:

1. Engineering Materials, Kenneth G. Budinski and Michael K. Budinski, Prentice Hall of India Private Limited, 9th Edition, 2009.
2. Engineering Materials and Metallurgy, U. C. Jindal, Pearson, 1st Edition, 2011
3. Materials Science and Engineering: An Introduction, William. D. Callister and David G. Rethwisch, John Wiley & Sons, 10th Edition, 2018
4. Mechanical Metallurgy, George E Dieter, Tata McGraw Hill, 3rd Edition, 2013

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Describe the types of Crystal structures and their defects.
2. Learn the necessity of alloying and identify types of alloy phases.
3. Demonstrate importance of critical understanding of heat treatment in achieving required properties.
4. Apply the knowledge of heat treatment to enhance surface properties.
5. Analyze the properties and micro structure of ferrous and non-ferrous alloys.

CO-PO MAPPING:

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

****End****

(A500507) SOCIAL INNOVATION AND ENTREPRENEURSHIP

(Common to All Branches)

B. Tech (ME): II Year I Semester

L	T	P	C
0	1	2	2

Week-1
Identify community issues to be addressed, Requirements Analysis: Extensive User requirements analysis, generating effective System Requirement document

Week-2
Introduction to Innovation & Entrepreneurship, Innovation vs. Invention vs. Creativity, Types of Entrepreneurs (Tech, Social, Green)

Week-3
Social Innovation – Case Studies, Impact of Social Innovation on communities

Week-4
Process of Social Innovation Prompts – identifying needs, Proposals – generating ideas, Proto typing – testing the idea in practice

Week-5
Sustaining – developing a business model, Scaling and diffusion – growing social innovations, Systematic change

Week-6
Introduction to sustainability, Sustainability leadership, Life cycle assessment, Carbon foot print calculation

Week-7
Business Model & Start-Up Ecosystem Elements of a business model (Canvas model)

Week-8
Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Assessing scope and potential scale for the opportunity

Week-9
Types of Start - Ups, Market analysis and feasibility Minimum Viable Product (MVP), Market risks and Marketing strategies, legal aspects in start up, National Innovation Start up Policy (NISP) and its features

Week-10
Government schemes for startups (Startup India, Atal Innovation Mission) Incubators, accelerators

Week-11
Financial planning, budgeting, and cost estimation for the Business model

Week-12
Funding options: Bootstrapping, Angel investors, venture pitching readiness, Documentation, Panel Presentation

TEXT BOOKS:

1. "Innovation and Entrepreneurship" by Peter F.Drucker
2. "Entrepreneurship Development" by S.S.Khanka
3. "Design Thinking" by Tim Brown

REFERENCE BOOKS:

1. AICTE Innovation Cell & Startup India Toolkit
2. Social Enterprise Law: Trust, Public Benefit and Capital Markets By Dana Brakman Reiser & Steven A. Dean
3. Introduction to Sustainability by Robert Brinkmann, Wiley-Blackwell

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Understand the fundamentals of innovation, creativity, and entrepreneurs
2. Develop innovative solutions to the community issues
3. Assess market competition, estimate market size, and develop a prototype.
4. Develop a scalable business model
5. Analyze Business and financial planning models and Go-to-Market strategies

CO-PO MAPPING:

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

****End****

(A501519) FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY

B. Tech (ME): II Year I Semester	L	T	P	C
	0	0	2	1

List of Experiments:

Fluid Mechanics:

1. Venturimeter
2. Orifice meter.
3. Friction factor for a given pipe line.
4. Loss of head due to sudden contraction in a pipeline.
5. Application of Bernoulli's Theorem.

Hydraulic Machinery: Performance Test on

1. Impact of jets on Vanes.
2. Pelton Wheel.
3. Francis Turbine. 4. Kaplan Turbine.
5. Single Stage Centrifugal Pump.
6. Multi Stage Centrifugal Pump
7. Reciprocating Pump.

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.

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Able to explain the effect of fluid properties on a flow system.
2. Able to identify type of fluid flow patterns and describe continuity equation.
3. To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
4. To select and analyze an appropriate turbine with reference to given situation in power plants.
5. To estimate performance parameters of a given Centrifugal and Reciprocating pump.

CO-PO MAPPING:

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

****End****

(A503506) MATERIAL SCIENCE AND MECHANICS OF SOLIDS LABORATORY

B. Tech (ME): II Year I Semester

L	T	P	C
0	0	2	1

Pre-Requisites: Material Science and Metallurgy, and Mechanics of Solids

MATERIAL SCIENCE LABORATORY

LIST OF EXPERIMENTS:

1. Preparation and study of crystal models for simple cubic, body centred cubic, face centred cubic and hexagonal 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 Carbon steels.
4. Study of the Microstructures of Various Cast Irons.
5. Study of the Microstructures of Non-Ferrous alloys. (Al, Cu, Mg)
6. Hardenability of steels by Jominy End Quench Test.

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Characterize the microstructures of different ferrous and non ferrous metals.
2. Identify the effect of heat treatment on the properties of ferrous materials.
3. Perform metallographic methods for characterizing the micro structure of the various metals.
4. Plot the hardness variations of various heat treated and non-heat treated steels.
5. Identify the effect of heat treatment on the properties of nonferrous materials.

CO-PO MAPPING:

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

MECHANICS OF SOLIDS LAB

LIST OF EXPERIMENTS:

1. Direct tension test
2. Bending test on Simple supported beam
3. Bending test on Cantilever beam
4. Torsion test
5. Brinell hardness test/ Rockwell hardness test
6. Test on springs
7. Izod Impact test/ Charpy Impact test

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Calculate modulus of Elasticity for given material from the Tension test, bending test on simply supported and cantilever beams.
2. Calculate modulus of rigidity of given material from Torsion test on circular shafts.
3. Calculate hardness of materials from Brinell / Rockwell hardness tests.
4. Calculate modulus of rigidity of given material from spring test.
5. Calculate Impact strength and hardness of given material from Charpy / Izod impact tests

CO-PO MAPPING:

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

****End****

(A503701) PRODUCT DESIGN USING AUTOCAD
(SKILL DEVELOPMENT COURSE – 1)

B. Tech (ME): II Year I Semester

L	T	P	C
0	0	2	1

Week 1: Introduction to Auto CAD:
Introduction of AutoCAD, AutoCAD versions Interface, Control the Drawing, Function keys AutoCAD basics, Cartesian coordinate system, Absolute Coordinate System, Relative Coordinate System

Week 2: Commands in Auto CAD:
Draw commands, Line command, Poly line command, Rectangle command, Modify commands Move, Rotate, Scale, copy, Mirror, erase, trim, extend, Annotate Dimension Style Manager Linear, Aligned, Radius Angular, Arc length

Week 3: Text Commands and Dimensioning Command: Text command, Layers, blocks, Single line text, Multiline text, Layer properties, insert blocks, Parametric Geometric, Dimensional Manage

Week 4: Orthographic Projection of Point – all quadrants

Week 5: Orthographic Projection of Line – inclined to both plane Problems

Week 6: Orthographic Projection of Plane - Square, Pentagon, Hexagon and Circle – 3 stage problems

Week 7: Orthographic Projection of Solid – Prism - Square, Pentagon, Hexagon, Cylinder – 3 stage problems

Week 8: Orthographic Projection of Solid – Pyramid - Square, Pentagon, Hexagon, Cone – 3 stage problems

Week 9: Isometric views: Isometric top, left, right Isometric diagrams, Isometric drawings, Isometric diagrams exercise, 2D Fundamentals Drawing units, Sheet settings – Simple problems

Week 10: Isometric view of isometric and non isometric problems - Prism and Pyramid - Square, Pentagon, Hexagon, Cylinder and Cone

Week 11: Isometric view of frustum and composite problems - Prism and Pyramid - Square, Pentagon, Hexagon, Cylinder and Cone

Week 12: Introduction to 3D Interface, AutoCAD workspaces, Mechanical 3D Modeling

COURSE OUTCOMES:
On completion of the course students will be able to:

1. Understand the concepts of CAD and CAD tools
2. Understand the concepts of Command tools
3. Understand the concepts of Text and Dimension commands tools
4. Create 2D Modeling: Orthographic projection
5. Create 3D Modeling: Isometric projection

CO-PO MAPPING:

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

****End****

(A500901) ENVIRONMENTAL SCIENCE

L	T	P	C
1	0	0	1

B. Tech (ME): II Year I Semester

UNIT-I

Environmental Studies: Introduction, Definition, scope and importance, Ecosystems: Introduction, types, characteristic features, structure and functions of ecosystems, Bio-geo chemical cycle, Classification of Eco system.

UNIT-II

Natural Resources: Classification of Resources, Land resources, Land as resource, Common property resources, Land degradation, Soil erosion and desertification, Effects of modern agriculture, fertilizer –pesticide problems, Forest resources, Use and over-exploitation. Mining and dams – their effects on forest and tribal people, Water resources, Use and over- utilization of surface and groundwater, Floods, droughts, Water logging and salinity, Dams –benefits and costs, Conflicts over Water, Energy resources.

UNIT-III

Bio-diversity and its conservation, Value of bio-diversity-consumptive and productive use, social, ethical, aesthetic and option values, Bio-geographical classification of India – India as a mega diversity habitat, Threats to bio-diversity –Hot-spots, habitat loss, poaching of wild life, loss of species, seeds, etc. Conservation of bio-diversity– In-situ and Ex-situ conservation

UNIT-IV

Environmental Pollution–Local and Global Issues, Nature of thermal pollution and nuclear hazards, Global warming, Acid rain, Ozone depletion, Environmental case studies

UNIT-V

Environmental Problems in India, Drinking water, sanitation and public health, Effects of the activities on the quality of environment, Water scarcity and groundwater depletion, Controversies on major dams – resettlement and rehabilitation of people: problems and concerns, Rain water harvesting, cloud seeding and watershed management. Economy and Environment, The economy and environment interaction, Economics of development, preservation and conservation, Sustainability: theory and practices, Limits to growth, Equitable use of resources for sustainable life styles, Environmental Impact Assessment.

TEXT BOOKS:

1. Environmental Science (1st edition), Y. Anjaneyulu, B S Publications.
2. Environmental studies (1st edition), Deekshadave, Cengage learning India Pvt. Ltd.

REFERENCE BOOKS:

1. Environmental sciences and Engineering (1st edition), P. VenugopalRao, PHI learning Pvt. Ltd.,
2. Environmental Science and Technology (1st edition), M. Anji Reddy, B S Publications.
3. Clark, R.S., Marine Pollution, Clanderson Press, Oxford, 2002.
4. Environmental Encyclopedia (Cunningham, W.P., et al., Jaico Publishing House, Mumbai, 2003.

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Acquire the knowledge on environmental science
2. Acquire the knowledge of various natural resources
3. Understand the importance of conservation and preserve the biodiversity
4. Understand the hazardous effects of environmental pollution
5. Develop skills in understanding various environmental problems

CO-PO MAPPING:

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

****End****

(A500004) PROBABILITY, STATISTICS AND COMPLEX VARIABLES
(For Mechanical Engineering)

B. Tech (ME): II Year II Semester

L	T	P	C
3	0	0	3

UNIT-I: Random Variables and Probability Distributions
Concept of a Random Variable – Discrete Probability Distributions – Continuous Probability Distributions – Mean of a Random Variable – Variance of a Random Variable

Discrete Probability Distributions: Binomial Distribution – Poisson distribution

UNIT-II: Continuous Distributions and sampling
Uniform Distribution – Normal Distribution – Areas 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 Hypotheses: General Concepts – Testing a Statistical Hypothesis. Single sample: Tests concerning a single mean. Two samples: Tests on two mean (Unknown for equal variance). One sample: Test on a single proportion. Two samples: Tests on two proportions. Two- sample tests concerning variances: F-distribution

UNIT-IV: Applied Statistics
Curve fitting by the method of least squares – Fitting of straight lines – Second degree parabolas and more general curves. Correlation and Regression – Rank correlation

UNIT-V: Complex Differentiation
Differentiation of Complex functions – Analyticity – Cauchy-Riemann equations (without proof) – Harmonic Functions – Finding harmonic conjugate – Milne Thomson method – Elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

TEXT BOOKS
1. Probability & Statistics for Engineers & Scientists (9^{th} edition),Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye,Pearson Publishers.
2. Fundamentals of Mathematical statistics, S C Gupta and V K Kapoor, Khanna publications.

REFERENCES
1. Fundamentals of Probability and Statistics for Engineers, T.T. Soong, John Wiley & Sons, Ltd, 2004.
2. Probability and statistics for Engineers and scientists, Sheldon M Ross, academic press.

COURSE OUTCOMES:
On completion of the course students will be able to
1. Apply the concepts of random variables and probability distributions to relevant case studies.
2. Explain the principles of sampling theory.
3. Apply hypothesis testing methods to real-world data.
4. Interpret statistical and analytical results to support problem-solving in applied contexts.
5. Analyze complex functions for analyticity and perform differentiation.

CO-PO MAPPING

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

****End****

(A503302) PRODUCTION TECHNOLOGY

B. Tech (ME): II Year II Semester	L	T	P	C
	3	0	0	3

UNIT – I:

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 Risers and Riser design. Casting processes – Types – Sand moulding, Centrifugal casting, die casting, Investment casting, shell moulding

UNIT – II:

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 - Types, oxy-fuel 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 and 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, Forces in rolling and power requirements. Drawing and its types – wire drawing and Tube drawing – Types of presses and press tools, Forces and power requirement in the above operations

UNIT – V:

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, Electro-hydraulic Forming, Electro-magnetic forming and rubber pad Forming.

TEXT BOOKS:

1. A Text book of Production Technology (Manufacturing Processes), Dr. P.C. Sharma, S. Chand Publications, 11th Edition, 2022.
2. Manufacturing Technology, P.N. Rao, Vol. 1, Mc Graw Hill Education, 5th Edition, 2018.

REFERENCE BOOKS:

1. Manufacturing Engineering & Technology, Serope Kalpakjian & Steven R. Schmid, Pearson, 7th Edition,2014
2. Elements of Workshop Technology, S.K. Hajra Choudhury, A.K. Hajra Choudhury & Nirjhar Roy, Vol.1,Media Publishers & Promoters Pvt. Ltd., 1st Edition,2008.
3. Production Technology, Sreeramulu, Vol. 1, Wiley, 1st Edition, 2018
4. Manufacturing processes, H. S. Shan, Cambridge University Press, 2nd Edition, 2017.

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Elaborate the fundamentals of various molding, casting techniques and furnaces.
2. Identify the importance of permanent joining and principles behind different welding processes.
3. Describe the concepts of various welding processes
4. Describe the concepts of hot working, cold working, rolling and sheet metal operations..
5. Elaborate the uniqueness of extrusion, forging and high energy rate forming processes in metal working.

CO-PO MAPPING:

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

****End****

(A503305) INSTRUMENTATION AND CONTROL SYSTEMS

B. Tech (ME): II Year II Semester	L	T	P	C
	2	0	0	2

Pre-Requisites: Mathematics – 1, Thermodynamics, Basic of Electrical and Electronics Engineering

UNIT – I: 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 – Using Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

UNIT – II: Measurement of Temperature and Pressure:
Measurement of Temperature: Various Principles of measurement, Classification, Expansion Type: Bimetallic Strip, Liquid in glass Thermometer, Electrical Resistance Type: Thermistor, Thermocouple, RTD, Radiation Pyrometry and Optical Pyrometer, Changes in Chemical Phase, Fusible Indicators and Liquid crystals.
Measurement of Pressure: Different principles used, Classification, Manometers, Dead weight pressure gauge Tester (Piston gauge), Bourdon pressure gauges, Bulk modulus pressure gauges, Bellows, Diaphragm gauges. Low pressure measurement, Thermal conductivity gauges, ionization pressure gauges, McLeod pressure gauge.

UNIT – III: Measurement of Level, Flow and speed:
Measurement of Level: Direct methods, indirect methods, Capacitive, Radioactive, Ultrasonic, Magnetic and Cryogenic Fuel level indicators, Bubbler level indicators.
Flow measurement: Rota meter, Magnetic, Ultrasonic, Turbine flow meter, Hotwire anemometer, Laser Doppler Anemometer (LDA).
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 – IV: Stress-Strain measurements:
Various types of stress and strain measurements, Selection and installation of metallic strain gauges, Electrical strain gauge, gauge factor, Method of usage of resistance strain gauge for bending, compressive and tensile strains, Temperature compensation techniques, Use of strain gauges for measuring torque, Strain gauge Rosettes.
Measurement of Humidity: Moisture content of gases, Sling Psychrometer, Absorption Psychrometer, Dew point meter. Measurement of Force, Torque and Power, Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – V: Elements of Control Systems:
Introduction, Importance, Classification, Open and closed systems, Servomechanisms, Examples with block diagrams, Temperature, speed and position control systems, Transfer functions, First and Second order mechanical systems

TEXT BOOKS:

1. Principles of Industrial Instrumentation and Control Systems, Chennakesava R Alavala, Cengage Learning, 1st Edition, 2009.
2. Instrumentation – Operations, Measurement, Scope and Application of Instruments, N.V.S. Raju, B. S. Publications, 2016

REFERENCE BOOKS:

1. Measurement Systems: Applications & design, E. O. Doebelin, TMH, Tata Mcgraw Hill, 6th Edition, 2017.
2. Instrumentation, Measurement & Analysis, B.C. Nakra and K.K. Choudhary, TMH, 4th Edition, 2016.
3. Experimental Methods for Engineers, Jack P Holman, McGraw Hill, 8th Edition, 2011
4. Mechanical and Industrial Measurements, R. K. Jain, Khanna Publishers, 11th Edition, 1995

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Know the basic knowledge of the functional blocks of measurement systems.
2. Describe the working of various physical variable Temperature and pressure measuring instruments.
3. Explain the working of various physical variable Level, flow, Speed and Acceleration measuring instruments.
4. Describe the working of various physical and Electrical variables Stress, Humidity, Force, Torque and Power measuring instruments.
5. Describe the concept of control system and calculate transfer functions of mechanical and translational systems with different techniques.

CO-PO MAPPING:

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

****End****

(A503306) THERMAL ENGINEERING - I

B. Tech (ME): II Year II Semester	L	T	P	C
	3	0	0	3

Pre-Requisites: Thermodynamics

UNIT – I: Power Cycles and I.C. Engines Classification:
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 I.C. Engines, Working principles of Two and Four stroke engines, SI and CI engines, Valve and Port Timing Diagrams

UNIT – II: Combustion in S I Engines:
Types of S I engines, Engine systems, Carburetor and Fuel injection Systems for S I engines. Fuel injection systems for C I 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: Combustion in C I Engines:
Types of C I 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 engine, Open and divided combustion chambers and fuel injection, Diesel fuel requirements and fuel rating.

UNIT – IV: Testing and Performance:
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: Compressors:
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 Compressor: Rotary Compressor (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, polytrophic efficiency.

TEXT BOOKS:

1. I C Engines, Ganesan V, McGraw Hill, 5th Edition, 2012.
2. Thermal Engineering, Mahesh M Rathore, Tata McGraw Hill, 2010.

REFERENCE BOOKS:

1. Engineering Thermodynamics, P K Nag, Tata McGraw-Hill Education, 2013
2. Internal Combustion Engines, Mathur M. L and R. P. Sharma, Dhanpat Rai Publication, 2005
3. Engineering Fundamentals of the Internal Combustion Engine, Pulkrabek, Willard W, Upper Saddle River, Pearson Prentice Hall, 2014.
4. A Textbook of Thermal Engineering (Mechanical Technology), Khurmi R. S and J. K. Gupta, S. Chand, 2008

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Classify the working principles of internal combustion engines.
2. Evaluate the combustion phenomena between SI Engines
3. Evaluate the combustion phenomena between C I Engines
4. Estimate the performance parameters of internal combustion engines.
5. Analyze the performance of compressors.

CO-PO MAPPING:

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

****End****

(A503308) DESIGN OF MACHINE ELEMENTS

B. Tech (ME): II Year II Semester	L	T	P	C
	3	0	0	3

Note: Design Data books are not permitted in the Examinations. The design must not only satisfy strength criteria but also rigidity criteria.
Prerequisites: Engineering mechanics, mechanics of solids.

UNIT – I: Introduction:
General considerations in the design of Engineering Materials and their properties, Selection, Manufacturing consideration in design, Tolerances and fits, BIS codes of steels, Design for Static Strength: Simple stresses, Combined stresses, Torsional and Bending stresses, Impact stresses, Stress - strain relationship, Theories of failure, Factor of safety, Design for strength and rigidity, Preferred numbers, The concept of stiffness in tension, Bending, Torsion and combined situations

UNIT – II: Design for Fatigue Strength:
Stress concentration, Theoretical stress Concentration factor–Fatigue stress concentration factor, Notch Sensitivity, Design for fluctuating stresses, Endurance limit, Estimation of Endurance strength, Gerber's curve, Goodman's line, Soderberg's line

UNIT – III: Riveted, Welded and Bolted 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
Bolted joints: Design of bolts with pre-stresses, Design of joints under eccentric loading – locking devices, bolts of uniform strength
.
UNIT – IV: Keys, Cotters and Knuckle Joints:
Design of keys, Stresses in keys, Cotter joints, Spigot and Socket, Sleeve and Cotter, Gib and Cotter joints, Knuckle joints

UNIT – V: Shafts and Couplings:
Design of solid and hollow shafts for strength and rigidity, Design of shafts for combined bending and axial loads, Shaft sizes, BIS code, Gaskets and seals (stationary and rotary)
Rigid couplings: Muff, Split muff and Flange couplings. Flexible couplings: Flange coupling (Modified)

TEXT BOOKS:
1. Mechanical Engineering Design, Joseph Edward Shigley, McGraw Hill, 10th Edition, 2022.
2. Design of Machine Elements, V.B. Bhandari, McGraw-Hill, 5th Edition, 2010.

REFERENCE BOOKS:
1. Theory of Machines, Dr. N.C. Pandya and Dr. C.S. Shah, Charotar Publishing House Pvt. Ltd., 21st Edition, 2022.
2. Design of Machine Elements – I, Anup Goel, Technical Publications, 2020.
3. Machine Design, Jindal, Pearson, 1st Edition, 2010.
4. Design of Machine Elements, V. M. Faires, Macmillan, 4th Edition, 1965.
5. Design of Machine Elements - I, M.H Annaiah, New Age International Publishers, 1st Edition, 2010

COURSE OUTCOMES:
On completion of the course students will be able to:
1. Analyze stress and strain in mechanical components and predict failure using appropriate criteria.
2. Design machine elements like bolts, riveted and welded joints based on static and dynamic loading.
3. Design shafts, couplings, and keys considering strength and rigidity.
4. Select and design helical and leaf springs for energy storage applications.
5. Apply appropriate design standards and codes to real-world design problems.

CO-PO MAPPING:

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

****End****

(A503309) KINEMATICS OF MACHINERY

B. Tech (ME): II Year II Semester

L	T	P	C
3	0	0	3

Pre-Requisites: Basic principles of Mechanics

UNIT – I:

Mechanisms: Elements or Links – Classification, Rigid Link, Flexible and Fluid link, Types of kinematic 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 machines, Kinematics chain, Inversions of mechanism, Inversions of quadric cycle chain, Single and double slider crank chains, Mechanical Advantage

UNIT – II:

Kinematics: Velocity and acceleration, Motion of link in machine, Determination of Velocity and acceleration, Graphical method, Application of relative velocity method.

Plane motion of body: Instantaneous center of rotation, Centrodes and Axodes, Three centers in line theorem, Graphical determination of instantaneous center, Determination of angular velocity of points and links by instantaneous center method, Klien's construction, Coriolis acceleration, Determination of Coriolis component of acceleration

Analysis of Mechanisms: Analysis of slider cranks chain for displacement, Velocity and Acceleration of slider, Acceleration diagram for a given mechanism.

UNIT – III:

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, Problems

UNIT – IV:

Cams and Followers: Definitions of cam and followers and their uses, Types of followers and cams, Terminology, Types of follower motion, Uniform velocity, Simple harmonic motion,Uniform acceleration and retardation, Maximum velocity and maximum acceleration during outward and return strokes

Tangent cam with Roller follower, Circular arc cam with straight, concave and convex flanks

UNIT – V

Gears and Gear Trains: 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 involutes profiles, Phenomena of interference, Methods of interference, Condition for minimum number of teeth to avoid interference, Expressions for arc of contact and path of contact of Pinion, Gear, Pinion and Rack Arrangements, Introduction to Helical, Bevel and worm gearing

Introduction to Gear Trains, Types, Simple, Compound and reverted gear trains, Epicyclic gear trains, Methods of finding train value or velocity ratio of Epicyclic gear trains, Selection of gear box, Differential gear for an automobile

TEXT BOOKS:

1. Theory of Machines and Mechanisms, Uicker, J J Pennock G R and Joseph Edward Shigley, Oxford University Press, 4th Edition, 2014
2. Theory of Machines, Thomas Bevan, CBS Publishers and Distributors, 3rd Edition, 2005

REFERENCE BOOKS:

1. Theory of Machines, S S Rattan, Tata McGraw-Hill, 4th Edition, 2014
2. Mechanism and Machine Theory, Rao J. S and Dukkipati R.V, Wiley Eastern Ltd., 2nd Edition, 1992
3. A textbook of Theory of Machines, R K Bansal and J S Brar, Laxmi Publications, 5th Revised Edition, 2010
4. Theory of Machines, Sadhu Singh, Pearson Education, 3rd Edition, 2012

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Analyze the mobility concepts of machines & mechanisms.
2. Analyze for velocity & acceleration on various mechanisms.
3. Analyze various motion mechanisms.
4. Design cam profiles and analyze for resulting follower motions on specified contours.
5. Design and analyze various power transmission drives.

CO-PO MAPPING:

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

****End****

(A500501) COMPUTATIONAL MATHEMATICS LABORATORY
(Using Python software)
(Common for All Branches)

B. Tech (ME): II Year II Semester

L	T	P	C
0	0	2	1

Visualize all solutions graphically through programs

PROGRAMS:

UNIT-I: Eigen values and Eigenvectors:
WEEK 1
Write a program to find solution of system of homogenous linear equations(trivial and non-trivial)
WEEK 2
Write a program to find solution of system of non-homogenous linear equation (unique and infinite)
WEEK 3
Write a program to obtain the eigen values and eigen vectors for dynamically generated matrix
Write a program to obtain matrix from quadratic form and orthogonalize the matrix
WEEK 4&5

UNIT-II: Solution of Algebraic and Transcendental Equations
Write a program to find real root of a given algebraic/transcendental equation using Bisection method.
WEEK 6&7
Write a program to find real root of a given algebraic/transcendental equation using Newton Raphson Method**.**

UNIT-III: Linear system of equations:
Jacobi's iteration method and Gauss-Seidal iteration method
WEEK 8
Write a program to find solution of given system of linear equations using Jacobi's method
WEEK 9
Write a program to find solution of given system of linear equations using Gauss-Seidal method.

UNIT-IV: First-Order ODEs
Exact and non-exact equations, Applications: exponential growth/decay, Newton's law of cooling.
WEEK 10
Write a program to **s**olve exact and non-exact equations
WEEK 11
Write a program to solve Newton's law of cooling problems and exponential growth/decay

UNIT-V: Higher order linear differential equations with constant coefficients
WEEK 12
Write a program to solve homogeneous ODEs
Write a program to solve non-homogeneous ODEs
WEEK 13
Write a program to solve Partial Derivatives and Jacobian of several variables
WEEK 14
Write a program for finding Maxima and Minima of functions of two variables

TEXT BOOKS
1. The fundamentals of Python: First Programs, Kenneth A. Lambert, CengageLearnings, 2011.
2. Think Python First Edition, by Allen B. Downey, Orielly publishing.

REFERENCES
1. An Introduction to Python, John C. Lusth, The University of Alabama, 2011.
2. Introduction to Python, CDave Kuhlman, 2008.

COURSE OUTCOMES:
On completion of the course students will be able to:
1. Develop Python programs to compute the eigenvalues and eigenvectors of a matrix.
2. Implement Python code to solve algebraic and transcendental equations, as well as systems of linear equations.

3. Write Python programs to obtain solutions for first-order ordinary differential equations and higher-order linear differential equations with constant coefficients.
4. Develop Python code to solve partial differential equations
5. Determine maxima and minima of functions.

CO-PO MAPPING:

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

****End****

(A503505) INSTRUMENTATION AND CONTROL SYSTEMS LABORATORY

B. Tech (ME): II Year II Semester

L	T	P	C
0	0	2	1

Pre-Requisites: Basic principles of Instrumentation and Control Systems

List of Experiments:

Calibration and Study of:

1. Pressure Gauges.
2. Transducer for temperature measurement.
3. LVDT transducer for displacement measurement.
4. Strain gauge for temperature measurement.
5. Thermocouple for temperature measurement.
6. Capacitive transducer for angular displacement.
7. Photo and magnetic speed pickups for the measurement of speed.
8. Resistance Temperature Detector (RTD) for temperature measurement.
9. Rotameter for flow measurement.
10. Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. McLeod gauge for low pressure.

LAB MANUALS:

1. Laboratory Manual for Instrumentation and Control Engineering, S. R. Vijayalakshmi, VikasPublishing House, 2021.
2. Instrumentation and Control Systems Lab Manual, Dr. A. K. Mittal and Dr. A. K.Bandyopadhyay, S. K. Kataria and Sons, 2020.

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Characterize and calibrate measuring devices.
2. Identify and analyze errors in measurement.
3. Analyze measured data using regression analysis.
4. Calibrate Pressure Gauges, temperature,
5. Calibrate LVDT, capacitive transducer, rotameter

CO-PO MAPPING:

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

****End****

(A503504) PRODUCTION TECHNOLOGY LABORATORY

B. Tech (ME): II Year II Semester

L	T	P	C
0	0	2	1

Pre-Requisites: Production Technology

Minimum of 12 Exercises need to be performed

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 & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Brazing – 1 Exercise
5. Plasma welding- 1 Exercises

III. Mechanical Press Working:

1. Blanking and Piercing operation and study of simple, compound and progressive press tool
2. Hydraulic Press: Deep Drawingand extrusion operation.
3. Bending and other operations

IV. Processing of Plastics

1. Injection Moulding
2. Blow Moulding

REFERENCE BOOK:

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

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Design and make Patterns, Test sand Properties.
2. Operate different types of welding machines
3. Prepare different types of joints in welding.
4. Perform operations on mechanical press.
5. Get familiarity with processing of Plastics.

CO-PO MAPPING:

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

****End****

(A503507) THERMAL ENGINEERING – I LABORATORY

B. Tech (ME): II Year II Semester

L	T	P	C
0	0	2	1

Pre-Requisites: Thermodynamics, Thermal Engineering – I

List of Experiments:

Fuel and Lubrication:

1. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Abels Apparatus
2. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Pensky MartensApparatus
3. Carbon residue test for Fuels.
4. Determination of Viscosity of Liquid lubricants and Fuels using: Saybolt Viscometer
5. Determination of Viscosity of Liquid lubricants and Fuels using: Redwood Viscometer-I
6. Determination of Viscosity of Liquid lubricants and Fuels using: Redwood Viscometer-II

I.C. Engines:

1. Valve, Port Timing Diagrams.
2. Disassembly, Assembly of Engines.
3. Performance Test for 2 Stroke SI engines.
4. Performance Test for 4 Stroke SI engines.
5. Performance Test for 4 Stroke CI engines at constant speed.
6. Volumetric efficiency of Air Compressor Unit.

Note: Perform a minimum of any 10 out of the 12 Exercises.

LAB MANUALS:

1. Internal Combustion Engines Laboratory Manual, Dr. K. Sudhakar and Dr. S. Ramasamy, VSRD Academic Publishing, 2021.
2. Thermal Engineering Lab Manual, Er. R.K. Rajput and Er. R.S. Khurmi, S. Chand Publications, 2022

COURSE OUTCOMES:

On completion of the course students will be able to:

1. Determine the flash and fire point of liquid fuels.
2. Determine the carbon residue of liquid fuels
3. Distinguish the different I.C. Engines.
4. Draw valve/Port Timing diagrams
5. Evaluate the performance of an I.C. engine system for a given set of conditions and inspect the ways to improve the efficiency of engines.

CO-PO MAPPING:

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

****End****

(A503702) DATA ANALYTICS USING PYTHON FOR ENGINEERS
(SKILL DEVELOPMENT COURSE – 2)

B. Tech (ME): II Year II Semester

L	T	P	C
0	0	2	1

UNIT - I: Python Fundamentals for Engineering Applications:
Basic Python Programming: Writing simple Python scripts for arithmetic, loops, and functions.
Application: Calculate mechanical or electrical parameters (e.g., stress, power, resistance).
Data Types and Structures: Practice using lists, dictionaries, tuples, sets. Application: Storing sensor data, part specifications and material properties.
File Handling in Python: Read/write data from .txt, .csv files. Application: Reading experimental or log data from machines.

UNIT - II: Data Handling and Processing:
Data Import and Cleaning using Pandas: Load data from Excel/CSV, handle missing data, remove outliers. **Application:** Clean experimental datasets from lab instruments.
Data Transformation and Aggregation: Grouping, filtering, and summarizing data. **Application:** Analyze machine run times, failure logs, or production efficiency.
Data Visualization with Matplotlib and Seaborn: Line plots, bar charts, histograms, box lots.
Application: Visualize stress, strain graphs, sensor trends, or energy consumption.

UNIT - III: Statistical Analysis and Engineering Insights:
Descriptive Statistics: Mean, median, mode, standard deviation, variance
Application: Analyze tolerance distribution, process variations.
Correlation and Regression Analysis: Perform and interpret linear regression.
Application: Predict thermal efficiency, or material behavior with respect to time/temp.
Hypothesis Testing: Perform t- tests and ANOVA. Application: Test impact of material changes on performance metrics.

UNIT - IV: Applied Data Analytics:
Sensor Data Analysis: Analyze time series data from IoT or sensor logs. **Application:** Predict motor failure or anomalies in temperature/humidity.
Real-time Data Dashboard (Optional with Jupyter / Streamlit): Build a basic data dashboard using Python tools. **Application:** Monitor lab machine metrics or simulate process control.

UNIT - V: Mini Projects / Case Studies:
Engineering Case Study – Predictive Maintenance: Analyze historical machine data to predict failure using regression/classification.
Energy Audit Data Analytics: Load and analyze power consumption data from equipment.
Optimization using Python (Sci Py): Solve basic optimization problems (e.g., minimize cost, material use).

TEXT BOOKS:

1. Python for Data Analysis, Wes McKinney, O'Reilly Media, 3rd Edition, 2022
2. Think Python: How to Think Like a Computer Scientist, Allen B. Downey, Green Tea Press /O'Reilly Media, 2nd Edition, 2015.

REFERENCE BOOKS:

1. Python Programming: An Introduction to Computer Science, John M. Zelle and Franklin, Beedleand Associates Inc., 3rd Edition, 2016
2. Data Analytics: Made Accessible, Anil Maheshwari, Amazon Digital Services / Create Space Independent Publishing, 1st Edition, 2014.

Tools and Library to be Use: Python, Jupyter Notebook, Pandas, Num Py, Matplotlib, Seaborn, Sci Py, Scikit-learn (introductory)

COURSE OUTCOMES:
On completion of the course students will be able to:
1. Write Python programs for engineering computations and data processing.
2. Clean and transform data using Pandas.
3. Create visualizations using Matplotlib and Seaborn.
4. Perform descriptive and predictive statistical analyses.
5. Analyze engineering datasets for performance insights.

CO-PO MAPPING:

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

****End****