B.E. (Mechanical Engineering)

III SEMESTER

S. No.	Code No.	Subject	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P/D	Duration in Hrs	CIE	SEE	
Theory Courses									
1	6BS303HS	Numerical Methods and Partial Differential Equations	3	1	-	4	40	60	4
2	6HS303HS	Human Value and Professional Ethics	2	-	-	2	40	60	2
3	6ES301CS	Programming for Problem Solving	3	-	-	3	40	60	3
4	6PC301ME	Thermodynamics	3	-	-	3	40	60	3
5	6PC302ME	Strength of Materials	3	-	-	3	40	60	3
6	6PC303ME	Metallurgy & Material Science	3	-	-	3	40	60	3
Practical / Laboratory									
7	6ES351CS	Programming for Problem Solving Lab	-	-	2	2	40	60	1
8	6PC351ME	Metallurgy and Material Testing Lab	-	-	3	3	40	60	1.5
9	6PC352ME	Computer Aided Machine Drawing	-	-	3	3	40	60	1.5
10	6MC351ME	Solid Edge Certification Course	-	-	2	2	50	*S/U	-
Total			**17**	**1**	**10**	**28**	**410**	**540**	**22**

*S=Satisfactory, U= Unsatisfactory

B.E. (Mechanical Engineering)

IV SEMESTER

S. No.	Code No.	Subject	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P/D	Duration in Hrs	CIE	SEE	
1	6ES403CS	Python Programming	3	-	-	3	40	60	3
2	6PC404ME	Applied Thermodynamics	3	1	-	4	40	60	4
3	6PC405ME	Manufacturing Processes	3	-	-	3	40	60	3
4	6PC406ME	Fluid Mechanics & Hydraulic Machines	3	-	-	3	40	60	3
5	6PC407ME	Kinematics of Machines	3	1	-	4	40	60	4
6	6MC402HS	Essence of Indian Traditional Knowledge	2	-	-	2	40	60	-
7	6ES453CS	Python Programming Lab	-	-	2	2	40	60	1
8	6PC453ME	Applied Thermodynamics Lab	-	-	2	2	40	60	1
9	6PC454ME	Manufacturing Processes Lab	-	-	2	2	40	60	1
10	6PC455ME	Fluid Mechanics & Hydraulic Machines Lab	-	-	2	2	40	60	1
Total			**17**	**2**	**8**	**27**	**400**	**600**	**21**

*S=Satisfactory, U= Unsatisfactory

Note : The students have to undergo an Internship of two weeks' duration after IV semester and credits will be awarded in V semester after evaluation.

B.E. (Mechanical Engineering)

SEMESTER-V

S. No.	Code No.	Subject	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P/D	Duration in Hrs	CIE	SEE	
Theory Courses									
1	6HS502HS	Managerial Economics and Financial Accounting (MEFA)	3	-	-	3	40	60	3
2	6HS503HS	Effective Technical Communication	2	-	-	2	40	60	2
3	6PC508ME	Computer Aided Design & Manufacturing	3	-	-	3	40	60	3
4	6PC509ME	Design of Machine Elements I	3	1	-	4	40	60	4
5	6PC510ME	Metrology and Machine Tools	3	-	-	3	40	60	3
6	PE	Professional Elective I / MOOC's	3	-	-	3	40	60	3
7	OE	Open Elective I**	3	-	-	3	40	60	3
Practical / Laboratory									
8	6PC556ME	Metrology and Machine Tools Lab	-	-	2	2	40	60	1
9	6PC557ME	CAD/CAM Lab	-	-	2	2	40	60	1
10	6PW551ME	Internship -I	-	-	2	2	40	60	1
11	6MC552ME	Skill Development Lab-2 /Value Added Course	-	-	2	2	50	*S/U	-
Total			**20**	**1**	**8**	**29**	**450**	**600**	**24**

Professional Elective I :

1. 6PE501ME Automobile Engineering
2. 6PE502ME Experimental Stress Analysis
3. 6PE503ME Modern Machining & Forming Methods
4. 6PE504ME Advances in Welding and Joining **(MOOC's-2C)**

****O.E.I→1**. 6OE501ME Start-up Entrepreneurship.

** Subject is not offered to the students of Mech. Engg. Department.

B.E. (Mechanical Engineering)
SEMESTER-VI

S. No.	Code No.	Subject	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P/D	Duration in Hrs	CIE	SEE	
Theory Courses									
1	6PC611ME	Dynamics of Machines	3	1	-	4	40	60	4
2	6PC612ME	Heat Transfer	3	-	-	3	40	60	3
3	6PC613ME	Design of Machine Elements- II	3	1	-	4	40	60	4
4	OE	Open Elective II**	3	-	-	3	40	60	3
5	PE	Professional Elective II / MOOC's	3	-	-	3	40	60	3
6	PE	Professional Elective III / MOOC's	3	-	-	3	40	60	3
7	6MC603HS	Indian Constitution	2	-	-	2	40	60	-
Practical / Laboratory									
8	6HS653HS	Soft Skills Lab	-	-	2	2	40	60	1
9	6PC658ME	Theory of Machines Lab	-	-	2	2	40	60	1
10	6PC659ME	Heat Transfer Lab	-	-	2	2	40	60	1
Total			**20**	**2**	**6**	**28**	**400**	**600**	**23**

O.E.II→1. 6OE602ME 3D Printing Technologies
** Subject is not offered to the students of Mech. Engg. Department

P.E.II →
1. 6PE605ME Power Plant Engineering (MOOC's-2C)
2. 6PE606ME Industrial Tribology
3. 6PE607ME Introduction to Composites (MOOC's-3C)
4. 6PE608ME Entrepreneurship (MOOC's-3C)

P.E.III →
1. 6PE609ME Turbo Machinery
2. 6PE610ME Introduction to Mechanical Vibrations (MOOC's-2C)
3. 6PE611ME Fundamentals of Additive Manufacturing Technologies (MOOC's-3C)
4. 6PE612ME Industrial Engineering.

Note : Students have to undergo summer internship of 4 weeks at the end of semester VI and credits will be awarded after evaluation in VII semester.

B.E. (Mechanical Engineering)

III SEMESTER

S. No.	Code No.	Subject	Scheme of Instruction				Scheme of Examination		Credits
			L	T	P/D	Duration in Hrs	CIE	SEE	
Theory Courses									
1	6BS303HS	Numerical Methods and Partial Differential Equations	3	1	-	4	40	60	4
2	6HS303HS	Human Value and Professional Ethics	2	-	-	2	40	60	2
3	6ES301CS	Programming for Problem Solving	3	-	-	3	40	60	3
4	6PC301ME	Thermodynamics	3	-	-	3	40	60	3
5	6PC302ME	Strength of Materials	3	-	-	3	40	60	3
6	6PC303ME	Metallurgy & Material Science	3	-	-	3	40	60	3
Practical / Laboratory									
7	6ES351CS	Programming for Problem Solving Lab	-	-	2	2	40	60	1
8	6PC351ME	Metallurgy and Material Testing Lab	-	-	3	3	40	60	1.5
9	6PC352ME	Computer Aided Machine Drawing	-	-	3	3	40	60	1.5
10	6MC351ME	Solid Edge Certification Course	-	-	2	2	50	*S/U	-
Total			**17**	**1**	**10**	**28**	**410**	**540**	**22**

*S=Satisfactory, U= Unsatisfactory

Course Code	Course Title						Core/Elective
3BS303HS	NUMERICAL METHODS & PARTIAL DIFFERENTIAL EQUATIONS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Basic Differentiation, Integration and Trigonometric results	3	1	-	-	40	60	4

COURSE OBJECTIVES:

The objective of this course is to make the student

- To learn an alternative methods and analytical methods in mathematical concepts.
- To apply numerical techniques in solving ordinary differential equations.
- To study Interpolation and numerical methods to fit a curve
- To formulate and solve partial differential equations.
- To study physical applications of partial differential equations

COURSE OUTCOMES :

After completion of the course, the student will be able to

CO1. Find the solution of algebraic and transcendental equations using numerical methods. (PO1, PO2).

CO2. Apply numerical techniques to solve ordinary differential equations and definite integrals. (PO1, PO2).

CO3. Apply numerical methods to interpolate values and fit different curves from given data. (PO1, PO2).

CO4 Find solutions of first order linear and non linear partial differential equations. (PO1, PO2).

CO5 Apply the solution of partial differential equations to physical problems. (PO1, PO2, PO4).

UNIT - 1:

Numerical Solutions of Algebraic and Transcendental Equations: Introduction, Bisection Method, Regula-False method, Iteration method and Newton Raphson method. Solving linear system of equations by Gauss-Jacobi and Gauss-Seidel method.

UNIT - 2:

Numerical integration: Trapezoidal Rule, Simpson?s 1/3rd and 3/8th Rule. Numerical solutions of Ordinary Differential Equations: Solution of ordinary differential equations by Taylor's Series, Picard?s method of Successive approximations, Euler?s and Modified Euler?s methods, Fourth Order Runge-Kutta Method.

UNIT - 3 :

Interpolation: Newton's Forward and Backward difference interpolations, Lagrange's interpolation, Newton's divided difference interpolation. **Curve Fitting:** Fitting a linear, second degree, exponential curve by method of least squares for the discrete data.

UNIT - 4 :

Differential Equations: Formation of first and second order partial differential equations, solution of first order equations, Lagrange's equation, Nonlinear first order equations, Charpit's method, higher order linear equations with constant coefficients.

UNIT 5 :

Applications to Partial Differential Equations: Classification of linear second order partial differential equations, Separation of variables method , solution of one dimensional heat and wave equations, Two dimensional Laplace's equation.

TEXT BOOKS :

1. Dr.B.S.Grewal, Higher.Engineering Mathematics, Khanna Publicatins, 43rd Edition.
2. S.S.Sastry, Introductory Methods of Numerical Analysis, 5th Edition, PHI Learning Pvt. Ltd.
3. B.V.Ramana, Higher Engineering Mathematics, 3rd Edition.

REFERENCES/SUGGESTED READING :

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley, 9th Edition.
2. M.K.Jain, S.R.K.Iyengar and R.K. Jain, Numerical Methods for Science and Engineering Computation,6th Edition, New Age International Publishers.
3. Peter. V. O' Neil, Advance Engineering Mathematics, 7th Edition.

Course Code	Course Title	Core/Elective					
6HS303HS	HUMAN VALUES	Mandatory Course					
	AND PROFESSIONAL	L	T	P/ D	Cred its	CIE	SEE
	ETHICS	2	0	0	0	40	60

Pre-requisites : Adaptive

COURSE DESCRIPTION :

The methodology of this course is universally adaptable, involving a systematic and rational study of the human being vis-à-vis the rest of existence. It is free from any dogma or value prescriptions. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with and within the student himself/herself finally.

COURSE OBJECTIVE :

The objective of this course is :

1. To create an awareness on Human Values and Engineering Ethics.
2. To move from discrimination to commitment.
3. To understand social responsibility of an engineer.
4. To appreciate ethical dilemma while discharging duties in professional life.
5. To encourage students to discover what they consider valuable in life.

COURSE OUTCOMES :

On completion of this course, the students will be able to

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession.
2. Assess their own ethical values and the social context of problems.
3. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
4. Understand the role of a human being in ensuring harmony in society and nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

COURSE CONTENT :

UNIT-I :

Introduction to Value Education

1. Value Education, Definition, Concept and Need for Value Education.
2. The Content and Process of Value Education.
3. Self-Exploration as a means of Value Education.
4. Happiness -Sukh, Suvidha, Sanyam &Swasthya.

UNIT - II:

Harmony in the Human Being

1. Human Being is more than just the Body.
2. Harmony of the Self ('I') with the Body.
3. Understanding Myself as Co-existence of the Self and the Body.
4. Understanding Needs of the Self and the Needs of the Body.

UNIT - III :

Harmony in the Family and Society and Harmony in Nature

1. Family as a basic unit of Human Interaction and Values in Relationships
2. The Dynamics of Mutual respect in Today's World – Affection, Care, Guidance, Reverence, Gratitude and Love.
3. Comprehensive Human Goals: The Five dimensions of Human Endeavour – Justice, Trust, Competence, Right Attitude and Mutual Tolerance.

UNIT - IV:

Social Ethics

1. The Basics for Ethical Human conduct
2. Challenges to ethical conduct in existence
3. Holistic perception of Harmony in existence
4. Social Hierarchy - Ethical Conduct and Mutual Co-existence

UNIT - V:

Professional Ethics

1. Sanctity of Human values
2. Definitiveness of Ethical Human Conduct
3. Basics for Humanistic Education

TEXT BOOKS

1. A.N Tripathy, "Human Values", New Age International Publishers, 2003.
2. T2. Bajpai. B. L., Indian Ethos and Modern Management, New Royal Book Co., Lucknow, Reprinted, 2004.
3. Bertrand Russell Human Society in Ethics & Politics, Taylor and Francis, 2007.

REFERENCE BOOKS :

1. Corliss Lamont, Philosophy of Humanism, Humanist Press.
2. Gaur. R.R. , Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books.
3. Gaur. R.R. , Sangal. R , Bagaria. G.P, Teachers Manual Excel Books.
4. Mortimer. J. Adler, – Whatman has made of man, Hardcover.

Course Code	Course Title						Core/Elective
6ES301CS	PROGRAMMING FOR PROBLEM SOLVING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Mathematical Knowledge, Logical and Analytical Thinking	3	-	-	-	40	60	3

COURSE OBJECTIVES

The objective of this course is to make the student

1. To introduce the basic concepts of Computing environment, algorithms and flowcharts.
2. To acquire knowledge about the basic concept of writing a program
3. To understand modular and structured programming constructs in C
4. To learn the usage of structured data types, data handling and memory management using pointers

COURSE OUTCOMES

After completion of the course, the student will be able to

1. Formulate algorithmsand learn fundamental program methodologies of C programming.
2. Understand control statements and interpret derived data types with mathematical and engineering problems.
3. Develop modular programming techniques to solve searching, sorting and file system problems
4. Recognize pre-processor directives and user defined usage.

UNIT – I

Introduction to Computers: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Algorithm, Flowchart / Pseudo code with examples

Introduction to C Language: History of C, Features, Structure of C program, Character set, Tokens,Variables, Data types, I/O statements, Type conversion Syntax and Logical Errors in compilation, object and executable code.

UNIT - II

Operators and Control Structures: Operators, Operator precedence, Arithmetic expressions, Conditional Branching and Loops, Writing and valuation of conditionals and consequent branching Arrays: Arrays (1-D, 2-D), Strings and its library functions.

UNIT - III

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble and Selection).

Functions: Functions, storage classes, Parameter passing techniques Passing arrays to functions, Recursion Concept, Command line arguments.

UNIT - IV

Pointers: Idea of pointers, Defining pointers, array of pointers, pointer arithmetic, dynamic memory allocation,

Structure: Structures, Defining structures and Array of Structures, self – referential structures, Unions concept, Functions and structures, Enum, Bitfields.

UNIT - V

Pre-processor Directives: File Inclusion, Macros Substitutions, Conditional Compilation. File Handling: Introduction to File Handling, Types of files, File operations, File input/output statements.

TEXT BOOKS :

1. Computer Science A structured programming approach usingC, Behrouz A. Forouzan and Richard F. Gilberg, Cengage Learning, 2007, Third Edition (Unit 1-5).
2. Schaum's Outline of Programming with C, ByronGottfried, McGraw-Hill, 2019, Fourth Edition (Unit 1-5).
3. Data Structures and Program Design in C, Robert Kruse, Bruce Leung,Tondo, Pearson, II Edition.

REFERENCES/SUGGESTED READING :

1. C Programming Language, Brian W Kenningham, Dennis M Ritchie, Pearson, II Edition.
2. How to solve it by Computer, R G Dromey, Pearson Edition.

Course Code	Course Title						Core/Elective
6PC301ME	THERMODYANAMICS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Basics of Physics, Chemistry and Engineering mathematics	3	-	-	0	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

1. To familiarize the students to understand the fundamentals of thermodynamics
2. To understand laws of thermodynamic.
3. To understand power cycles and derivation.
4. To perform thermal analysis on their behavior and performance.
5. To make use of standard and approved Steam Table, Mollier Chart, and Psychrometric Chart.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO1. Apply concept of temperature andtemperature scale.

CO2. Apply the first law of thermodynamicsfor simple open and closed systems under steady and unsteady conditions.

CO3. Apply second law of thermodynamics to open and closed systems and calculate entropy and availability.

CO4. Apply Rankine cycle to steam power plant and compare few cycle improvement methods.

CO5. Derive simple thermodynamic relationsof ideal and real gases.

UNIT - I:

Introduction: Basic Concepts: System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility

– Energy in State and in Transition, Types, Work transfer and Heat transfer, Point and Path function. Thermodynamic Equillibrium. Zeroth Law of Thermodynamics– Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale.

UNIT - II:

Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process and cycle – applied to a flow system – Steady Flow Energy Equation. PMM-I, throttling and free expansion processes – Equation of state for ideal gas, deviations from perfect gas model – Vanderwaals equation of state – compressibility charts –specific heats and gas constant.

UNIT - III:

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 itsspecialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility, PMM-III – Thermodynamic Potentials, [Gibbs and Helmholtz Functions, Introduction to Maxwell Relations] – Elementary Treatment of the Third Law of Thermodynamics.

UNIT - IV :

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. Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

Mixture of Gases: Mole fraction and mass fraction, Partial pressure and Dalton's Law, Amagat-Leduc Law of Partial volumes, Relation between partial pressure, mole fraction and volume fraction; Gas Constant, molecular mass and specific heats of the gas mixtures; relation between volumetric and gravimetric analysis

UNIT-V:

Power Cycles: Otto, Diesel, Dual Combustion cycles, 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. Nag.P.K "Engineering Thermodynamics" 5th Edition, Tata McGraw-Hill, N-Delhi.
2. R.K.Rajput, "A Text Book Of Engineering Thermodynamics.
3. Yunus a. Cengel & michael a. Boles, "Thermodynamics".

REFERENCE BOOKS :

1. Fundamentals of Thermodynamics- Sonntag R.E., Borgnakke C. & Van Wylen C. J.
2. Fundamentals of Engineering Thermodynamics - Moran M. J. & Shapiro H. N.
3. Fundamentals of Thermal-Fluid Sciences-- Y A Cengel & R H Turner. 4.Applied Thermodynamics -- Eastop T.D. & Mc conkey A.
5. Engineering Thermodynamics -- Rogers G.F.C. & Mayhew Y.R.

Course Code	Course Title						Core/Elective
6PC302ME	STRENGTH OF MATERIALS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engineering Mechanics	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

1. To understand the basic concept of stress and strains for different materials
2. To know the mechanism of the development of shear force and bending moment in beams and the stresses in thin cylinders.
3. To know the theory of simple bending, direct & bending stress and distribution of shear stress.
4. To analyse and understand shear stress, Torsional stress and spring applications
5. To study the deflections and its applications.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO1. Explain the theory of elasticity including strain displacement and Hooke's law relationships and analyzing Stress-Strain diagram.

CO2. Analyse the shear forces and bending moment diagrams with various types of loads.

CO3. Evaluate the bending and shear stresses in beams and Strain energy in bars due to various loads.

CO4. Evaluate the slope and deflections in beams subjected to transverse loads.

CO5. Analyze various situations of structural members subjected to combined stresses andsolve the torsion problems in bars and stiffness of springs.

UNIT – I

Simple stresses and strains: Types of Stresses and Strains. Hook's Law, Stress-Strain curve for Ductile materials, Modulus of Elasticity, Poisson's ratio, Volumetric strain, Relation between Elastic Constants, Bars of varying sections, Bars of Uniform Strength, Compound bars and Temperature stresses.

Compound Stresses: Stresses on oblique planes, principal stresses and principal planes. Mohr circle of stresses.

UNIT - II

Shear Force and Bending Moment: Relation between Intensity of loading, Shear force and Bending moment. Shear force and Bending moment diagrams for Cantilever

and Simply supported and Overhanging beams with Point load, Uniformly distributed load and Uniformly varying loads.

Thin Cylinders: Derivation of formulae for longitudinal stress, Circumferential (hoop) stress, Volumetric strains, Changes in diameter and volume.

UNIT-III

Theory of simple bending: Introduction, Derivation of bending equation: M/I = F/y = E/R Modulus of Section, Moment of Resistance.

Direct and Bending Stresses: Basic concepts, Core of sections for Rectangular, Solid and Hollow Circular and I sections.

Distribution of Shear stress: Equation of Shear stress, Distribution across Rectangular sections.

UNIT-IV

Deflections: Deflections of Cantilever and Simply Supported Beams including Overhanging beams for Point loads and Uniformly Distributed Loads by double integration and Macaulay's methods.

Strain Energy: Strain Energy in bars due to Gradually Applied loads, Sudden Loads, Impact loads and Shock loads.

UNIT-V

Torsion-Theory of Pure Torsion- Derivation of basic equation T/J = q/R = G?/L and Hollow circular shafts, Transmission of power, Combined Bending and Torsion.

Springs: Close and open coiled Helical springs subjected to Axial loads and Axial couples, strain energy in springs.

TEXT BOOKS

1. S. Ramamrutham, Strength of Materials, Dhanpat Rai & Sons.
2. Dr. R K bansal, Strength of Materials- Laxmi Publications.

REFERENCE BOOKS

1. R.K. Rajput, Strength of Materials, S. Chand & Co.
2. B.C. Punmia, Strength of Materials and Theory of Structures, Laxmi Publishers, Delhi.
3. Ferdinand P Beer et.al. Mechanics of Materials, Tata McGraw-Hill.
4. G.H. Ryder, Strength of Materials, Third Edition in SI units, Macmillan Indian Limited, Delhi.
5. S.S. Bhavikatti, Strength of Materials, Vikas Publications.
6. D.S. Prakash Rao, Strength of Materials - A practical Approach, Universities Press.

Course Code	Course Title						Core/Elective
6PC303ME	METALLURGY & MATERIAL SCIENCE						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Physics & Chemistry	3	-	-	-	40	60	3

COURSE OBJECTIVES:

It is intended to make the students to :

1. Enable to understand structure property relations, analyse the failures of metals and their prevention.
2. To broad understanding of phase diagrams.
3. Acquire basic knowledge in various heat treatment operations, their purpose and applications.
4. Understand various modes of failure and suggest mechanisms for preventions of failures.
5. Understand applications of conventional metals and alloys.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO 1: Explain the structure of materials at various levels and testing their mechanical properties

CO 2: Describe fatigue, creep failure and experimentally determine fatigue, creep strength, also list different types of fracture.

CO 3: Explain phase diagrams and identify various phases, composition by analyzing the phase diagrams.

CO 4: Classify different types of plain carbon steels & cast irons, explain various heat treatment techniques applied to steels,

CO 5: Explain the properties of non-ferrous metals, ceramics, polymers, composites and choose a particular material for an application.

UNIT-I

Introduction to Materials engineering, Space lattice, unit cell, crystal structure, crystal directions and planes, crystal imperfections. Effect of slip and twinning on the plastic deformation, Hall-Petch equation, Orange peel effect, cold and hot working, strain hardening and Bauchinger effect. Recovery, Recrystallisation, Grain growth and its effect on mechanical properties of metals.

Mechanical properties of materials - Tensile properties, stress-strain diagrams, elasticity, plasticity, ductility, toughness, modulus of elasticity, resolved shear stress, tensile and compression test, hardness and its measurement, Charpy and Izod impact tests.

UNIT-II:

Fracture: Ductile and Brittle fracture, modes of fracture, ductile to brittle transition, crack initiation and propagation.

Fatigue: S-N curve, Structure of fatigue fracture specimen, Fatigue crack propagation, Effect of metallurgical variables on fatigue of metal, Experimental determination of fatigue strength (RR-Moore Test). Creep: Creep strength, Creep curve, Creep deformation mechanisms, Creep Test, Differences between creep curve and stress rupture curve.

UNIT-III

Structure of Alloys: Types of solid solution, Hume Rothary's rules for Substitutional solid solutions, Intermediate phases and phase rule Construction and interpretation of Binary equilibrium diagram, Isomorphous, Eutectic and Peritectic diagrams, , Iron-Iron Carbide equilibrium diagram, construction and interpretation. Types of Plain Carbon Steels, CastIron and their properties and Characteristics.

UNIT-IV

Alloy Steels: Effects of alloying elements like Nickel, Chromium, Manganese, Silicon Tungsten, Titanium. Study about Stainless steels, HSS, Maraging steels, their composition and Properties.

Heat Treatment: Annealing, Normalising, Hardening, Tempering, Construction and interpretation of T.T.T Curve. Austempering and Martempering. Case Hardening: Carburising, Nitriding, Carbo-nitriding, Flame Hardening, Induction Hardening. Brief introduction of Age Hardening.

UNIT-V

Non-ferrous metals and alloys: Properties and applications of Copper and its alloys, Aluminium and itsalloys, Age hardening, Ti and its alloys, Ni- based alloys, their composition and properties. Ceramics, Polymers and Composites: Ceramics, crystalline ceramics, glasses, properties and applications of ceramics, polymers-polymerization, thermoplastics and thermosetting plastics, properties and applications of polymers. Composites: concept of composites, matrix and reinforcement, rule of mixtures, classification of composites, applications of composites.

TEXT BOOKS:

1. V.D.Kodgiri, Material Science And Metallurgy For Engineers, Everest Publishing House
2. S.H. Avner, Introduction to Physical Metallurgy, Tata McGraw Hill.
3. S.P. Nayak, Engineering Metallurgy and Material Science, Charotar Publishing House.

REFERENCE BOOKS:

1. E. Dieter, Mechanical Metallurgy, Metric Editions, Tata McGraw Hill.
2. Robert M Jones, Mechanics of Composite Materials, Taylor and Francis. 3.V.Raghavan, Material Science and Engineering, Prentice Hall of India Ltd.

Course Code	Course Title						Core/Elective
6ES351CS	PROGRAMMING FOR PROBLEM SOLVING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Mathematical Knowledge, Logical and Analytical Thinking	-	-	-	2	40	60	1

COURSE OBJECTIVES

The objective of this course is to make the student

1 Understand the fundamentals of programming in C Language.
2 Write, compile and debug programs in C.
3 Formulate solution to problems and implement in C.
4 Effectively choose programming components to solve computing problems.

COURSE OUTCOMES

After completion of the course, the student will be able to

1. Choose appropriate data type for implementing programs in C language.
2. Design and implement modular programs involving input output operations, decision makingand looping constructs.
3. Apply derived data types and implement programs to store data in structures and files.
4. Develop confidence for self-education and ability towards lifelong learning need of computer languages.

LIST OF EXPERIMENTS

1. Finding maximum and minimum of given set of numbers, finding roots of quadratic equation.
2. Sin x and Cos x values using series expansion.
3. Generating Pascal triangle, pyramid of numbers.
4. Factorial, Fibonacci, GCD recursive and non-recursive procedures
5. Linear search and binary search using recursive and non-recursive procedures.
6. Bubble sort and selection sort.
7. Matrix addition and multiplication using arrays,
8. Programs on pointers: pointer to arrays, pointer to functions.
9. Programs on structures, union, enum and string manipulations.
10. File handling programs (Reading, Writing, Copying files)
11. Program illustrating using Command Line Arguments.

Course Code	Course Title						Core/Elective
6PC351ME	METALLURGY & MATERIAL TESTING LAB						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
L	T	D	P				
Engg. Chemistry	-	-	-	3	40	60	1

COURSE OBJECTIVES :

It is intended to make the students to :

1. Acquire basic knowledge by understanding iron-carbide diagram and its application in engineering.
2. Expose to Metallographic study and analysis of various metals.
3. Acquire knowledge in determining the hardness of metals before and after various Heat treatment operations.
4. Understand differences between different heat treatment methods.
5. Expose to T-T-T curve and its application in engineering metallurgy.
6. Understand the relation between micro structure and properties.

COURSE OUTCOMES:

After completing the course, student will be able to:

CO1. Prepare specimen for metallographic observation

CO.2 Analyse and identify low, medium and high carbon steels, different types of cast irons,non-ferrous alloys, from the study of their microstructure

CO3. Underlines the importance of grain size in evaluating the desired mechanical properties.

CO4. Correlate the heat treatment methods and the mechanical properties obtained.

CO5. Analyse and identify microstructures after annealing, normalizing, hardening and tempering.

LIST OF EXPERIMENTS:

A: Metallurgy Experiments:

1. Study of: Metallurgical Microscope, Iron-Iron Carbide diagram, Procedure for specimen preparation.
2. Metallographic Study of Pure Iron& Low carbon steel.

3. Metallographic Study of Medium carbon steel, Eutectoid steel& Hyper Eutectoid steel
4. Metallographic Study of, White cast-iron, Malleable cast iron, Nodular cast iron &Grey cast-iron
5. Metallographic Study of Aluminium, Brass & Bronze
6. Jominy Quench test or Study of microstructure after heat treatment
7. Heat treatment of Metals, Annealing, Normalizing and Quenching

B: Materials testing Lab

1. Uni-axial tension test, to draw stress- strain diagram, and estimate modulus of elasticity, % of elongation and toughness.
2. To determine the impact strength of specimen by conducting Charpy & Izod tests.
3. To find the Hardness number for the given metal specimen using Brinell and Rockwel hardness testers.
4. To determine the Rigidity Modulus of the given specimen by conducting Torsion Test.
5. To determine the Young's Modulus (E) of given material by conducting the deflection test on Cantilever beam, simply supported beam.

   To determine the stiffness and rigidity modulus of the given spring by Conducting compression tension tests.

Note: At least ten experiments should be conducted in the Semester

Course Code	Course Title						Core/Elective
6PC352ME	Computer Aided Machine Drawing						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Engg Graphics	-	-	-	3	40	60	1.5

COURSE OBJECTIVES :

It is intended to make the students to :

1. Read & Interpret technical drawings correctly.
2. Learn the use of CAD software - non-parametric & parametric.
3. Learn drawings of orthographic views of simple machine components.
4. Learn part modelling of assemblies using parametric software
5. Learn Assembly & motion analysis using parametric software
6. Learn generation of orthographic views & BOM Tables using parametric software

COURSE OUTCOMES:

After completing the course, student will be able to:

CO1. Create templates for reuse in AutoCAD with suitable conventions.

CO2. Apply AutoCAD commands to draft orthographic views of machine parts to contain all technical details.

CO3. Apply the knowledge of draft orthographic views of assemblies like Rivets, Fasteners, Joints & Couplings.

CO4. Use parametric software to model parts of machine assemblies in 3D.

CO5. Use parametric software to generate drawings of machine parts & assemblies with Bill of Materials & Ballooning.

LIST OF EXPERIMENTS

Part A - AutoCAD

1. Creating templates with drawing layouts, title blocks, linetypes, lineweights, colours & blocks.
2. Orthographic views of sectioned machine components.
3. Riveted & screwed joints.
4. Joints - Socket Spigot Joint & Knuckle Joint.
5. Couplings - Flanged Coupling & Universal Coupling.

Part B - Solidworks / Creo Elements Pro / Solid Edge / Fusion 360 / Inventor

6. Modelling & part drawings of all parts from Screw Jack assembly.
7. Assembly & its Drawings of screw jack assembly along with Bill of Materials & balloon labelling.
8. Modelling of all parts from Stuffing Box assembly.
9. Modelling of all parts of Plummer Block assembly.
10. Assembly & drawings of the Crosshead assembly.
11. Assembly & drawings of the Tail stock assembly.
12. Assembly & drawings of the Machine Vice Assembly.
13. Assembly & drawings of the Eccentric Assembly.

Course Code	Course Title						Core/Elective
6MC351ME	SOLID EDGE CERTIFICATON COURSE						
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Auto CAD	-	-	2	-	50	*S/U	-

COURSE OBJECTIVES :

1. To train students to use synchronous and ordered modelling techniques for modelling mechanical parts in solid edge.
2. To train students in assembling, finding interferences & carrying out motion analysis of complex machinery using solid edge.
3. To train students in modifying geometries imported in neutral formats like IGES, STEP & Para-solid as per requirements.
4. To train students in using solid edge simulations to analyse & optimise parts & assemblies.
5. To train the students in developing drawings & rendered images of products.

COURSE OUTCOMES :

After going through this course, the students will be able to

1. Model 3D mechanical parts using synchronous and ordered modelling techniques in solid edge.
2. Assemble, find interference & analyse motion of complex machinery using solid edge.
3. Modify geometries imported in neutral formats like IGES, STEP & Para-solid as per requirements.
4. Carry out simulations to analyse & optimise parts & assemblies using solid edge.
5. Understand development of production drawings & tools to produce rendered images of products.

1. Introduction to Solid-edge, Registration for Educational Version & Installation, Solid Edge Help & Learning Tools, Environments, User Interface, Creating, Opening & Saving Solid Edge Files.
2. Sketch Plane Locking, Creation of sketches, Sketch regions, Sketch tools, Using Intellisketch, Manipulating tools, Relationships to sketches, Dimension types, Reference Planes, Reference Plane Creation, Creating base features

3. Modelling Exercises on sketches & using inspection tools to find areas, perimeters.
4. Modelling exercises on simple machine parts & using inspection tools to verify volume, mass, Moments of inertia.
5. Modifying exercises by Moving faces, Steering Wheel, Rotating faces, Selecting faces, Design Intent, Relate Faces.
6. Exercises on constructing assembly & applying motion constraints on parts placed into the assembly.
7. Creating 2D drawings from a part or assembly, Placing multiple views of assemblies, Modifying drawing views, Creating additional drawing sheets
8. Open models from Draft to edit, Tracking changes in model dimensions within a drawing, Dimensioning of drawings, Annotation of drawings.
9. Introduction to simulation using Solid-edge, List of studies that can be simulated, experiments using parameters.
10. Introduction to Key-Shot rendering. Rendering of Derby Car Exercise.