Curriculum and Syllabus
For B.Tech (Mechanical Engineering) (R15UG)
(III & IV Semester)

Kandula Srinivasa Reddy Memorial College of Engineering
(Autonomous)

KADAPA – 516 003 (A.P.)

(Affiliated to AICTE, Accredited By NBA & NAAC, Affiliated JNTUA, Anantapur)
(An ISO 14001 : 2004 Certified Institute)

CURRICULUM FOR MECHANICAL ENGINEERING STREAM

III Semester

S. No	Subject code	Subject	Subject Category	L	T	P	IM	EM	Credits
1.	1503301	Engineering Mechanics	PN	3	1	0	30	70	3
2.	1511302	Mechanics of Solids	PN	3	1	0	30	70	3
3	1599303	Basic Electrical & Electronics Engineering	PN	3	1	0	30	70	3
4	1503304	Material Science and Metallurgy	PJ	3	1	0	30	70	3
5	1503305	Thermodynamics	PJ	3	1	0	30	70	3
6	1503306	Machine Drawing	PJ	1	0	4	30	70	3
7	1503307	Material Science Lab & Mechanics of Solids Lab	PJ	0	0	3	50	50	2
8	1503308	Manufacturing Technology Lab	PJ	0	0	3	50	50	2
9	1503309	Aptitude (Audit Course)	PJ	2	0	0	30		0
		Total		18	5	10	280	520	22

IV semester

S. No	Subject code	Subject	Subject Category	L	T	P	IM	EM	Credits
1.	1521401	Probability and Statistics	BS	3	1	0	30	70	3
2.	1503402	Composite and Nano materials	PJ	3	1	0	30	70	3
3	1511403	Mechanics of Fluids	PN	3	1	0	30	70	3
4	1503404	Kinematics of Machinery	PJ	3	1	0	30	70	3
5	1503405	Thermal Engineering – I	PJ	3	1	0	30	70	3
6	1503406	Manufacturing Technology	PJ	3	1	0	30	70	3
7	1511407	Fluid Mechanics and Hydraulic Machines Lab	PN	0	0	3	50	50	2
8	1599408	Basic Electrical & Electronics Engineering Lab	PN	0	0	3	50	50	2
		Total		18	06	06	280	520	22

III Sem

L	T	P	C
3	1	0	3

(1503301) ENGINEERING MECHANICS

COURSE OBJECTIVE:

To develop the ability, in the engineering student, to understand, formulate, and solve a given problem in a logical manner and to apply it to solve a few basic problems in engineering mechanics like static equilibrium of particles and rigid bodies, Analysis of trusses and friction, Properties of surfaces and volumes, Dynamic equilibrium of particles, Dynamic equilibrium of rigid bodies.

UNIT I
BASIC CONCEPTS - System of forces– Moment of forces and its Application– Couples and Resultant of Force System- Equilibrium of system of forces- Free body diagrams –Types of Supports –Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT II
ANALYSIS OF PERFECT FRAMES: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints.

FRICTION: Types of friction– laws of Friction–Limiting friction–Cone of limiting friction– static and Dynamic Frictions – Motion of bodies – Wedge and Screw jack

UNIT III
CENTROID AND CENTER OF GRAVITY: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies

UNIT IV
AREA MOMENT OF INERTIA - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures
MASS MOMENT OF INERTIA: Moment of Inertia of Simple solids, Moment of Inertia of composite masses.(Simple problems only)

UNIT V
Kinematics: Rectilinear and curvilinear motion- Velocity and acceleration- Motion of a rigid body- Types and their analysis in planar motion
 Kinetics : Analysis as particles and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation

TEXT BOOKS:
1. Engineering Mechanics, Shames & Rao – Pearson Education.
2. Engineering Mechanics, Fedrinand L.Singer – B.S. Publishers.
3. Engineering Mechanics, Bhavikatti and Rajasekharappa

REFERENCES:
1. Engineering Mechanics-Statics and dynamics, A.Nelson, Tata McGraw-Hill Company
2. Mechanics of Materials by Timoshenko & Gere, CBS
3. Engineering Mechanics – B. Bhathacharya- Oxford University Publications
4. Mechanics of Materials - Dr. B. C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publication
5. Engineering Mechanics –Arthur P. Boresi and Richard J. Schmidt. – Brooks/Cole – Cengage Learning

III Sem

L	T	P	C
3	1	0	3

(1511302)   MECHANICS OF SOLIDS

COURSE OBJECTIVE:

The objective of the subject is to learn the fundamentals concepts of stress, strain and deformation of solids with applications to bars and beams. The students shall understand the theory of elasticity including strain/displacement and hooks law relationship. To accesses stresses and deformation through the mathematical models of beams for bending and bars for twisting or combination of both. The knowledge of this subject will help in the design & theory of machines courses

UNIT – I
SIMPLE STRESSES & STRAINS : 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 modulli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock 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, U.D.L., 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
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.
DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging
beams.

UNIT – V
THIN CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains –changes in diameter, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.
Thick cylinders–lame's equation – cylinders subjected to inside & outside pressures –compound cylinders.

TEXT BOOKS :
1. Strength of materials by R.K Bansal, Lakshmi publishers, 5th edition 2012
1. Strength of materials by Bhavikatti, Lakshmi publications.
2. Solid Mechanics, by Popov

REFERENCES :
1. Strength of Materials -By Ramamrutham, Dhanpat rai Publications.
2. Strength of Materials- By R.K. RAJAPUT, S.Chand and company,5th edition 2012
3. Strength of Materials by Dr. sadhu singh, Khanna publishers, 10th edition 2013
4. Strength of Materials by S.Timshenko
5. Strength of Materials by S.S Rattan, McGraw-Hill companies, 2nd 2011

III Sem

L	T	P	C
3	1	0	3

(1599303) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

PART-A: ELECTRICAL ENGINEERING

UNIT I

Electrical Circuits: Basic concepts, Classification of elements, Kirchhoff's Laws, R-L-C Series, Parallel Circuits and Star – delta transformations.

UNIT II

DC Machines: Principle & Construction of DC Generator – EMF equation – Types. Principle of Operation of DC motor- Types – Torque Equation – Losses and Efficiency, Swinburne's Test and Load Test on D.C. Shunt Motor.

Transformers: Principle & Construction of single phase transformer –Types- EMF Equation- Equivalent circuit– Losses, Efficiency and Regulation (Definitions Only). OC and SC tests.

UNIT: III

AC Machines: Principle & Construction of Three Phase Induction Motor –Types, Slip – Torque Characteristics – Applications. Principle & Construction of Alternator –EMF equation- Regulation by synchronous impedance method.

Text Books:

1. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH   Publication.
2. Basic Electrical Engineering by Kothari and Nagarath, TMH Publications, 2nd Edition.
3. Principles of Electrical and Electronics Engineering by V. K. Mehta, S. Chand & Co.

Reference Books:

1. Fundamentals of Electrical and Electronics Engineering by T. Thyagarajan, 5th Edition SCITECH Publications, 2007.
2. Fundamentals of Electrical Engineering and Technology by William D. Stanley, John R. Hackworth, Richard L Jones – Thomson Learning.

PART-B: ELECTRONICS ENGINEERING

UNIT-IV

Diode and its Characteristics: PN Junction diode, Symbol, V-I characteristics, Diode Applications, Rectifiers-Half Wave, Full Wave and Bridge Rectifiers (Simple Problems).

UNIT-V

Transistors: PNP and NPN Junction Transistors, Transistor as an Amplifier, Single Stage CE Amplifier, Frequency Response of CE Amplifier, Concepts of Feedback Amplifier, Necessary conditions for Oscillators, SCR Characteristics.

UNIT-VI

Logic circuits: Number systems, Logic gates, Boolean algebra.
CRO measurements: Measurements of Amplitude, Frequency and Phase angle using CRO..

Text books:

1. R.L.Boylestad and Louis Nashelsky, "Electronic devices and circuits", 9th Edition, 2006, PEI/PHI.
2. G.K.Mittal, "Industrial Electronics".
3. Albert D.Helfrick, Willam D.Cooper, "Modern Electronic Instrumentation and Measurement Techniques".PHI.
4. Morris Mano, "Digital Design", PHI.

Reference Books:

1. Jacob Millman and C. Halkias, "Electronic devices and circuits", McGraw Hill.
2. K. Lal Kishore, "Electronic Devices and Circuits", BSP. 2nd Edition, 2005

III Sem

L	T	P	C
3	1	0	3

(1503304) MATERIAL SCIENCE AND METALLURGY

COURSE OBJECTIVE:
To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

UNIT I
CRYSTAL STRUCTURE OF METALS:Introduction to engeineering materials and its properties and classifications, Mechanism of crystallization of metals, Recovery Recrystallization and grain growth, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.
CONSTITUTION OF ALLOYS: introduction, Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds.

UNIT II
EQUILIBRIUM OF DIAGRAMS: Experimental methods of construction of equilibrium diagrams, phase rule, Lever rule, Interpretations of phase diagrams, types of phase diagrams, Isomorphous alloy systems ,eutectic, peritectic, eutectoid, and peritectoid systems and reactions.

Transformations in the solid state – allotropy, Study of important binary phase diagrams of iron-iron carbon (Fe-Fe3C) equilibrium diagram, Effect on Alloying elements on Fe-Fe3C system on steels. Relationship between equilibrium diagrams and properties of alloys. Cu-Ni-, Al-Cu.

UNIT III
CAST IRONS AND STEELS: introduction to cast irons and steels,classification of cast irons, Structure and properties of White Cast iron, Malleable Cast iron, greycast iron, Spheriodal graphite cast iron, Alloy cast irons.

Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

UNIT IV
HEAT TREATMENT OF ALLOYS:Importanes of Heat treatment ofalloys, Heattreatment cycles, Introduction to TTT diagrams, Classification of Heat treatment processes: Annealing, normalizing, tempering, Hardening, Hardenability,   surface – hardening methods, Age hardening treatment.
POWDER METALLURGY: Production of metal powder condition compaction, sintering and secondary operations, advantages, limitations and applications of powder metallurgy.

UNIT V
NON-FERROUS METALS AND ALLOYS: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys

Text Books:
1. Introduction to Physical Metallurgy, Sidney H. Avner, US, 2nd Edition, 2007 Tata McGraw-Hill, Noida, 1985.
2. Essential of Materials Science and Engineering, Donald R.Askeland, USA, 3rd Edition, Cengage Publisher,2013.
3. Material science, V. Raghavan, PHI, 5th edition

Reference Books:
1. Material Science and Metallurgy, U.C. Jindal, Pearson educations, 2011,
2. Elements of Materials Science and Engineering, Lawrance H. Van Vlack, Pearson educations, 6th Edition,2002.
3. Material Science and Metallurgy, kodgire V.D, 12th Edition, Everest Publishing House, 2002.
4. Engineering Mechanics of Composite Materials- Isaac and M Daniel, Oxford University Press, 1994, 2nd Edition 2013
5. Mechanics of Composite Materials, R. M. Jones, McGraw Hill Company, New York, 1975.
6. Science of Engineering Materials, Agarwal, TMH.
7. Materials Science and Engineering, William D. Callister, 8th Edition, 2010
8. Elements of Material science, V. Rahghavan, PHI, 5th Edition
9. Engineering Materials and Their Applications – R. A Flinn and P K Trojan, Jaico Books
10. Engineering materials and metallurgy, R.K.Rajput, S.Chand, 1st Editon,2008
11. Material Science and Metallurgy Dr L.krishna reddy

III Sem

L	T	P	C
3	1	0	3

(1503305) THERMODYNAMICS

COURSE OBJECTIVE:

      This course provides the basic knowledge about thermodynamic laws and relations, and their application to various processes. Understand the thermodynamic laws and their applications, Know the concept of entropy and availability, Know about the properties of steam and the use of steam tables and Mollier chart and Know about thermodynamic relations

UNIT I

BASIC CONCEPTS: Macroscopic and Microscopic Approaches, Thermodynamic System, State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium, Quasi-static Process, Zeroth Law of Thermodynamics,

WORK & HEAT TRANSFER: Work transfer, types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

UNIT II

FIRST LAW OF THERMODYNAMICS: First Law applied to a process and a cycle, Energy - aproperty, Forms and transformation of Energy, Internal Energy and Enthalpy, PMM I.

FLOW SYSTEMS: Control Volume, Steady Flow Process, Mass balance and Energy Balance, Applications of Steady Flow Processes.

UNIT III

Second Law of Thermodynamics: Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, Carnot cycle and Carnot's Theorem, Thermodynamic Temperature Scale, Efficiency of Heat Engine, PMM II Entropy: Clausius' Theorem, Entropy as a property, T-s Plot, Clausius Inequality, Principle of Entropy Increase and its applications. Available Energy, Quality of Energy, definitions of Dead state, Availability

UNIT IV

Pure Substances: P-v, P-T, T-s diagrams of Pure Substances, Mollier Diagram, Dryness Fraction, Use of Steam Tables for Thermodynamic Properties Thermodynamic Relations: Maxwell's equations, TDS equations, Joule-Kelvin Effect, Clausiusclapeyron equation.

UNIT V

Properties of Gases and Gas Mixtures: Ideal Gas, Equation of State, Avogadro's Law, Internal Energy and Enthalpy of Ideal Gas, Entropy Change of Ideal Gas, Mixture of Gases- Dalton's Law of Partial Pressure, Specific Heats, Internal Energy and Enthalpy of Gas Mixtures Gas Power Cycles: Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, their applications, comparison of Otto, Diesel and Dual cycles, Second Law Analysis of Gas Power Cycles

Text Books:

1. Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi, 5th Edition, 2013.
Reference Books:
1. Engineering Thermodynamics by P. Chattopadhyam, Oxford, 1st Revised, 2011.
2. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen, John Wiley & sons (ASIA) Pte Ltd, 7th Edition, 2009.
3. Thermodynamics – An Engineering Approach – YunusCengel& Boles, TMH,7th Edition 2011.
4. Thermodynamics – J.P.Holman, McGrawHill, 2nd Edition company New York 1975.
5. An introduction to Thermodynamics, YVC Rao, Universities press, 2009 Revised Edition,
6. Engineering Thermodynamics – J.B. Jones & R.E.Dugan, PHI ,1st Edition, 2009.
7. Thermodynamics an engineering approach, Yunus Cengal and Boles,TMH,7 th edition

III Sem

L	T	P	C
1	0	4	3

(1503306) MACHINE DRAWING

COURSE OBJECTIVE:

To enable the students to prepare a detailed assembly drawing for given machine Components. Understand Indian standards for machine drawing. Prepare assembly drawing of joints, couplings and machine elements.

I. Machine Drawing Conventions:
Need for drawing conventions – introduction to IS conventions
a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
d) Title boxes, their size, location and details – common abbreviations & their liberal usage
e) Types of Drawings – working drawings for machine parts.

II. Drawing of Machine Elements and simple parts
Selection of Views, additional views for the following machine elements and parts with every drawing proportion
a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
b) Keys, cotter joints, spigot and socket joint, knuckle joint and Shaft couplings.
c) Riveted joints for plates

III. Assembly Drawings:
Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions
a) Machine parts – Screws jacks, Machine Vices Plummer block, Eccentrics, Milling machine Tailstock, Journal, pivot and collar foot step bearings and air cock.
b) Engine parts and valves – stuffing boxes, cross heads, Petrol Engine connecting rod, piston assembly, spring loaded safety valve and feed check valve.

NOTE: (i) First angle projection to be adopted. The student should be able to provide working drawings of actual parts.
   (ii) UNIT-III Part (b) only for practice not for examination purpose

Text Books:
1. Machine Drawing- K.L. Narayana, P.Kannaiah & K.Venkata Reddy, New Age Publishers, 4th

Edition, 2012
2. Machine Drawing- Dhawan, S.Chand Publications, 1st Revised Edition, 1998.

Reference Books:
1. Machine Drawing- P.S. Gill, S.K. Kataria & Sons, 17th Edition, 2012
2. Machine Drawing- Luzzader, PHI Publishers, 11th Edition.
3. Machine Drawing – Rajput, S. Chand Pub.
4. Textbook of Machine Drawing-K.C.John, 2009, PHI learning, 1st Edition.

Note: The End exam will be for 4 hrs in the following format.
All questions are to be answered
Q1 – Questions set on section I & II of the syllabus 2 out of 3 or 2 out of 4 to be answered with a weightage of 4 marks each – 08 marks
Q2– Questions set on Section II of the syllabus 2 out of 3 to be answered with a weightage of 10 marks each – 20 marks
Q3 – Drawing of assembled views of Section III items of Syllabus with a weightage of 42 marks
Note: All answers should be on the drawing sheet only. Answers on the drawing sheet only will valued

Suggestions:
Student should buy a book mentioned under Text books and study all the exercises given at the end of each chapter to equip him/her with the required ammunition.
Student should visit an automobile shop while the unit is being disassembled / assembled.
Student should go through the exercises given under assembly drawings refereeing to various books in the library to improve his assimilation capacity.

III Sem

L	T	P	C
0	0	3	2

(1503307) MATERIAL SCIENCE LAB AND MECHANICS OF SOLIDS LAB

(A) MATERIAL SCIENCE LAB:
Preparation and study of the Micro Structure of pure metals like, Cu and Al & stain les steels
Preparation and study of the Microstructure of low carbonsteels, medium CSteels&high C steels.
Study of the Micro Structures of white, malleable and grey Cast Irons
Study of the Micro Structures of Non-Ferrous alloys.
Study of the Micro structures of Heat treated steels.
Hardeneability of steels by Jiminy End Quench Test
To find out the hardness of various treated and untreated steels.

(B) MECHNICS OF SOLIDS LAB:

1. Direct tension test
2. Bending test on
a) Simply supported beam
b) Cantilever beam
3. Torsion test
4. Hardness test
5. Brinells hardness test
6. Rockwell hardness test
7. Test on springs
8. Compression test on cube
9. Impact test
10. Punch shear test

NOTE:
Minimum of 4 from (A) and 6 from (B) experiments need to be performed

III Sem

L	T	P	C
0	0	3	2

(1503308) MANUFACTURINGTECHNOLOGY LAB

1. Pattern making
2. Foundry
3. Permeability test
4. Preparation of T joint using arc welding.
5. Study of spot welding machine.
6. Weld bead geometry using arc welding.
7. Sand compression strength test.
8. Hydraulic press
9. Taper turning using lathe.
10. Knurling using lathe.
11. Threading using lathe.
12. Shaping.
13.

Note: Any 10 of the above 12 experiments are to be conducted.

III Sem

(1503309) APTITUDE
(AUDIT COURSE)

L	T	P	C
2	0	0	0

PURPOSE

To enhance holistic development of students and improve their employability skills

INSTRUCTIONAL OBJECTIVES

1. To improve aptitude, problem solving skills and reasoning ability of the student.
2. To collectively solve problems in teams & group.

UNIT I–NUMBERS

Types and Properties of Numbers, LCM, GCD, Fractions and decimals, Surds

UNIT II-ARITHMETIC – I

Percentages, Profit & Loss, Simple Interest & Compound Interest, Clocks & calendars

UNIT III-ALGEBRA-I

Logarithms, Problems on ages

UNIT IV-MODERN MATHEMATICS - I

Permutations, Combinations, Probability

UNIT V-REASONING

Logical Reasoning, Analytical Reasoning

REFERENCES

1. Agarwal.R.S – Quantitative Aptitude for Competitive Examinations, S.Chand Limited 2011
2. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Tata McGraw Hill, 3rd Edition, 2011
3. Edgar Thrope, Test Of Reasoning for Competitive Examinations, Tata McGraw Hill, 4th Edition, 2012
4. Other material related to quantitative aptitude

IV Sem

L	T	P	C
3	1	0	3

(1521401) PROBABILITY AND STATISTICS
(For ME and CSE branches only)

Internal Assessment	: 30	L	T	C
End Examination	: 70	3	1	3

Objectives:
- To train the students in getting a thorough understanding of the fundamentals of probability theory and distributions.
- To help the students in getting a thorough understanding and usage of statistical techniques like testing of hypothesis, correlation and regression and statistical quality control.

Unit I: **Random Variables**: Random variables - Discrete random variables - Continuous random variables –Probability distribution function – Discrete and continuous probability distributions – Mathematical Expectation, Variance and standard deviation of probability distributions.

Unit II: **Probability Distributions**: Discrete distributions-Binomial and Poisson distributions with related properties. Continuous distributions- Uniform and Normal distributions with related properties

Unit III: **Test of Hypothesis**: Population and Sample - Confidence interval of mean from normal distribution- Statistical hypotheses - level of significance. Test of significance - Tests based on normal distribution –z -test for means and proportions. Small samples: t-test - F-test - Chi-square test (testing of goodness of fit and independence).

Unit IV: **Correlation and Regression**: Correlation- Scatter diagram – Karl Pearson's Coefficient of Correlation – Computation of the Correlation Coefficient – Rank Correlation – Repeated Ranks - Regression- Linear Regression - Lines of Regression- Properties of Regression Coefficients - Relation between Correlation and Regression Coefficients.

Unit V: **Statistical Quality Control**: Concept of quality of a manufactured product - defect and defectives - Causes of variation - Random and assignable causes - The principle of Shewhart control chart – Charts for attributes and variable quality characteristics - Construction and operation of X-bar chart and R-chart, p-chart and c-chart.

Text Books:
1. Higher Engineering Mathematics by Dr. B.S.Grewal, Khanna Publishers-43 edition.
2. Probability and Statistics for Engineers and Scientists by Walpole and Myers, Seventh edition, Pearson Education Asia, 2002

Reference Books:
1. Probability and Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publishers.
2. Probability and Statistics for Engineers by B. Rama Bhupal Reddy, Research India Publications.
3. Statistical Methods by S.P.Gupta, S Chand Publications.

Out comes:
- The students become familiar with the applications of probability theory and distributions to engineering problems.
- The students will be able to analyze the problems of engineering and industry using the techniques of testing of hypothesis, statistical quality control and draw appropriate inferences.

IV Sem

L	T	P	C
3	1	0	3

(1503402) COMPOSITE AND NANO MATERIALS

Course Objective:
To understand the variety of composite materials (anisotropic material) vis a vis metals and alloys from the view point of industrial applications.
To understand manufacturing methods of composites for economic production
To understand methods of analysis to help effective product design.

UNIT – I
INTRODUCTION TO COMPOSITES
Fundamentals of composites - need for composites – Role of Interface in Composite Performance and Durability, classification of composite materials, Particle reinforced composites - Fiber reinforced composites- structural composites
Fiber glass reinforced composites- Fabrication of Fiber reinforced composites by pultrusion, Prepreg production process Applications of various types of composites

UNIT II
MATRIX COMPOSITES
Functions of matrix phase, essential requirements of good matrix material, properties governed by matrix phase
Polymer matrix composites (PMC) - Metal matrix composites (MMC) - Ceramic matrix composites (CMC) - Carbon – Carbon composites (CCC), Properties and applications.

UNIT III
CERAMIC COMPOSITE MATERIALS (Concretes)
Characteristics, Various types of ceramic composite materials, Portland Cement Concretes (PCC), Reinforced Cement Concrete (RCC), Pre stressed Concrete (PC), Post Tensioning in Reinforced Concrete (PTRC), Particulate Composites- Hybrid composites, Properties and applications.

UNIT IV
CERAMIC MATERIALS
Classification of ceramic materials – properties – advantages – limitations and applications of ceramic materials.
GLASSES
Types of glasses – Fabrication of glass by Blowing- Flat Drawing – Rolling – Pressing in to moulds- Casting – Spinning – crystalline ceramics.

UNIT V
MODERN MATERIALS
Introduction to nano phase materials, Characteristics, properties and applications
Shape memory alloys - properties and applications
Smart materials alloys- properties and applications

Advanced Ceramics – Cermets - properties and applications

Text Books:
1. Mathews F.L. and Rawlings R.D., Composite materials: Engineering and Science, Chapman and Hall,London, England, 1st edition, 1994.
2. Chawla K.K., Composite materials, Springer – Verlag, 1987
3. Materials Science & Engineering, Shashi Chawla.

Reference Books:
1. Clyne T.W. and Withers P.J., Introduction to Metal Matrix Composites, Cambridge University Press,1993.
2.Strong A.B., Fundamentals of Composite Manufacturing, SME, 1989.
3.Sharma S.C., Composite materials, Narosa Publications, 2000.
4.Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy, IIT- Madras, December 2001.

IV Sem

L	T	P	C
3	1	0	3

(1511403) MECHANICS OF FLUIDS

COURSE OBJECTIVE:

In essence, this course introduces the fundamental of fluid mechanics & Hydraulic machinery for engineers. The emphasis is on basis of fluid statics and fluid motion with application in a variety of engineering fields. This subject will introduce to study the various fluid properties and their significance in engineering problems and basic concepts of fluid flow, both kinematics and dynamics including the derivation of equation needed for the analysis of fluid flow problems. Students shall become familiar on different types of hydraulic turbines and their performances, efficiencies, velocity diagrams & Derivation of the equations , solving the problems associated with centrifugal and reciprocating pumps and their fundamentals.

UNIT I

FLUID STATICS: Dimensions and units, physical properties of fluids –mass density, specific weight, specific gravity, viscosity, surface tension, vapor pressure, compressibility, elasticity and their influence on fluid motion – atmospheric, gauge and vacuum pressure, measurement of pressure – piezometer, U-tube and differential manometers – hydro static forces on plane and curved surfaces.

UNIT II

FLUID KINEMATICS: Introduction – velocity and acceleration - Stream line, path line and streak line - stream tube - classification of flows – equation of continuity for one dimensional flow and three dimensional flow – circulation and vorticity – velocity potential and stream function –flow net.
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

PIPE FLOW: Reynold's experiment – types of flow - Darcy Weisbach equation – Hagen Poiseuille equation Minor losses in pipes – pipes in series and pipes in parallel – total energy line hydraulic gradient line
MEASUREMENT OF FLOW: Velocity measurement - Pitot tube, venturi meter, and orifice meter, Flow nozzle, Turbine flow meter – flow through orifices and mouth pieces – notches and weirs

UNIT IV

Boundary Layer Theory: Boundary gap layer – definition – growth over a flat plate – boundary layer thickness – nominal, displacement, momentum and energy thickness – laminar sub layer –

Momentum integral equation of boundary layer - separation of boundary layer- methods of controlling the boundary layer

UNIT V
FORCES ON SUBMERGED BODIES: Introduction – types of drag – drag on a sphere – drag on a cylinder – drag on flat plate – drag on airfoil – effect of compressibility on drag – development of lift on circular cylinder – Magnus effect – lift on an airfoil.

Text Books:
1. Hydraulics, fluid mechanics including hydraulic machines by Modi and Seth, Standard Publishers, 19th Edition,2013
2. Fluid Mechanics and Fluid Power Engineering by D. S. Kumar, Kotaria& Sons, 7th Edition, 2011
Reference Books:
1. Fluid Mechanics and hydraulic Machines by R.K. Bansal, Laxmi Publications,9th Edition,2010
2. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand,5th Edition,2013
3. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International, 1st Edition
4. Hydraulic Machines by Banga& Sharma, Khanna Publishers, 7th Edition,2007

IV Sem

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(1503404) KINEMATICS OF MACHINERY

COURSE OBJECTIVE:
To understand the terms, types, and design related to mechanisms.
To understand the working principles of common mechanisms
To perform kinematic analysis on various mechanisms
To draw the cam profile
 To study about types of cams and cam terminologies.
To analyze mechanism for finding its displacement, velocity, acceleration
To know kinematics of gears

UNIT – I

MECHANISMS AND MACHINES: 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 constrained and incompletely constrained. Mechanisms and machines: classification of mechanisms and machines, kinematic chain, inversion of Mechanisms: inversions of quadric cycle chain, single and double slider crank chain. Mobility of mechanisms

UNIT II

STRAIGHT LINE MOTION MECHANISMS- Exact and approximate, copiers and generated types –Peaucellier, Hart and Scott Russel – Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph

STEERING MECHANISMS: Conditions for correct steering – Davis Steering gear, Ackermanns steering gear. Hooke's Joint (Universal coupling) -Single and double Hooke's joint — applications – Simple problems.

UNIT III

KINEMATICS: Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine –Determination of Velocity and acceleration – Graphical method – Application of relative velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, Coriolis acceleration, and determination of Coriolis component of acceleration. Kleins construction. Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method

INSTANTANEOUS CENTRE METHOD: Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centres in-line theorem – Locating instantaneous centres for simple mechanisms and determination of angular velocity of points and links.

UNIT IV

CAMS: Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes and Drawing of cam profiles

UNIT V

GEARS: Higher pairs, friction wheels and toothed gears types, law of gearing, condition for constant velocity ratio for transmission of motion, Forms of tooth: cycloidal and involute profiles, Velocity of sliding, phenomena of interference, Methods to avoid interference, Condition for minimum number of teeth to avoid interference, Expressions for arc of contact and path of contact.

TEXT BOOKS:

1. Theory of Machines, S.S. Rattan, Tata McGraw Hill Publishers, 3rd Edition, 2013.

2. Kinematics and dynamics of machinery, R.L Norton, Tata McGraw Hill Publishers,1st Edition, 2009.

3. Theory of machines, R.S Khurmi

REFERENCE BOOKS:

1. Theory of Machines and Mechanisms, 3rd Edition, J.E. Shiegley et. al, Oxford International Student Edition.

2. Theory of Machines, Thomas Bevan, Pearson (P) 3rd Edition, 2012.

IV Sem

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(1503405) THERMAL ENGINEERING – I

COURSE OBJECTIVE:

On completion of this course, the students are expected to understand the concept and working of I.C Engines, types of fuel systems, Testing and performance of different types of engines, air compressors.

UNIT I

I.C. ENGINES: Definition of Engine And Heat Engine, I.C Engine Classification – Parts of I.C.Engines, Working of I.C. Engines, Two Stroke & Four Stroke I.C.Engines SI & CI Engines, Valve and Port Timing Diagrams.

UNIT II

Fuel System: S.I. Engine: Fuel Supply Systems, carburetor types Air Filters, Mechanical and Electrical Fuel Pump – Filters– Gasoline Injection Systems.. Cooling & Lubrication Systems: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo Siphon, Water And Forced Circulation System; Lubrication Systems-Flash, Pressurized and Mist Lubrication. Ignition System: Function Of An Ignition System, Battery coil Ignition System, Magneto Coil Ignition System, Electronic Ignition System using Contact Breaker, Electronic Ignition using Contact Triggers – Spark Advance And Retard Mechanism.

UNIT III

Fuels and Combustion: S I engine :Normal Combustion and Abnormal Combustion – Importance of Flame Speed and Effect of Engine Variables – Type of Abnormal Combustion, Pre-Ignition and Knocking (Explanation) – Fuel Requirements and Fuel Rating, Anti Knock Additives, Combustion Chambers.

C.I. Engines: Stages Of Combustion – Delay Period And Its Importance – Effect Of Engine Variables – Diesel Knock– Combustion Chambers (DI And IDI), 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

Air Compressors: Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors, Problems Related to Reciprocating Compressors, Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors.

Text Books:

1. Internal Combustion Engines / V. Ganesan- TMH, 4th Edition,2012

2. Thermal Engineering / Rajput / Lakshmi Publications, 9th Edition,2013

Reference Books:

1. IC Engines – Mathur& Sharma – DhanpathRai& Sons, ,2010

2. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI, 2nd Edition,2009

3. Thermal Engineering, Rudramoorthy – TMH, 10th Edition,2010

4. Thermodynamics & Heat Engines, B. Yadav, Central publishing house., Allahabad, 2002

5. I.C. Engines fundamentals, Heywood, McGrawHIll, 1st Edition,2011

6. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand, 15th Edition,2012

IV Sem

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(1503406) MANUFACTURING TECHNOLOGY

COURSE OBJECTIVE:

By this subject the students will understand how manufacturers use technology to change raw Materials into finished products. The students shall also introduce the basic concepts of casting, pattern preparation, gating system and knowledge on basic features of various welding and cutting processes. And also to study the concepts of surface treatment process, their characteristics and applications

UNIT I
CASTING: Definition, elements, Steps involved in making a casting– Types of patterns – Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction. Principles of Gating, Gating ratio and design of gating systems, Moulds: definition, mould materials, types of moulds, moulding methods, moulding machines, tests. Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys

UNIT II
SPECIAL CASTING PROCESSES: Process Mechanics, characteristics, parameters and applications of Centrifugal, Die, and Investment casting.
RISERS – Types, function and design, casting design considerations, Design of feeding systems i.e., sprue, runner, gate and riser, moulding flasks
METHODS OF MELTING: Crucible melting and cupola operation, steel making processes, Casting inspection and defects

UNIT III
A) **WELDING** : Classification of welding processes types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding.
B) **CUTTING OF METALS**: Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, nonferrous metals

UNIT IV
Mechanics, characteristics, process parameters, applications of Inert Gas welding, TIG & MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering &Brazing and adhesive bonding, Heat affected zones in welding; welding defects , causes and remedies ,destructive and non-destructive testing of welds

UNIT V

EXTRUSION OF METALS: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion

FORGING PROCESSES: Principles of forging – Tools and dies – Types Forging – Smith Forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects.

Text Books:
1. Manufacturing Technology, Vol I P.N. Rao, Tata Mc Graw Hill, 4th Edition,2013
2. Manufacturing Technology, Kalpakjain, Pearson education, 4th Edition,2002
3. Workshop Technology, Volume 1,Hajarachowdary
4. Productuction Technology,Volume I ,L.Krishna reddy

Reference Books:
1. Production Technology, K.L Narayana, I.K. International Pub, 3rd Edition,2013
2. Manufacturing Process Vol. I, H.S.Shah Pearson, 2013,
3. Principles of Metal Castings, Rosenthal, Tata McGraw Hill ,2nd Edition,2001
4. Welding Process, Parmar.
5. Manufacturing Technology, R.K. Rajput, Laxmi Pub, 1st Edition,2007
6. Workshop Technology – B.S.Raghuwanshi – Vol I.

IV B.Tech. - II Sem

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(1511407) FLUID MECHANICS AND HYDRAULIC MACHINES LAB

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flow meter.
Note: Any 10 of the above 12 experiments are to be conducted.

IV Sem

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(1599408) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

Part – A: Electrical Lab

1. Verification of KCL and KVL.
2. Swinburne's test on DC shunt machine
3. Determination of equivalent circuit parameters of 1- ø Transformer using O.C & S.C Test
4. Brake test on 3-Phase Induction motor
5. Brake test on D.C shunt motor.
6. Regulation of Alternator by Synchronous Impedance Method.

Part – B: Electronics Lab

1. Study of CRO (Measurement of voltage, frequency and phase of periodic signals)
2. V-I Characteristics of PN junction Diode.
3. Half Wave Rectifier with and without capacitive filter.
4. Full Wave Rectifier with and without capacitive filter
5. Input and output characteristics of Common Emitter (CE) configuration.
6. Frequency response of a single stage CE amplifier.

Note: Any 10 of the above experiment are to be conducted, at least 5 from each part.