course Title	HEAT TRANSFER					B. Tech. ME V Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803501	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

1. To enable the students to understand the fundamental principles and concepts of heat transfer.
2. This course provides the knowledge to understand the various modes of heat transfer like conduction, convection and radiation and also heat exchangers, fins efficiency.
3. To develop methodologies for solving a wide variety of practical engineering problems, and to provide useful information concerning the performance and design of particular systems and processes
4. To gain experience in designing experiments for thermal systems, the design, fabrication, and experimentation of a thin film heat flux gage will be attempted as part of laboratory requirements.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Formulate and analyze heat transfer system mathematically by conduction mode
CO 2	Apply the conduction heat transfer knowledge on fins which are used in various applications
CO 3	Apply the knowledge of fluid flow and convection heat transfer to analyze the thermal system
CO 4	perform thermal design of various heat exchangers

UNIT I

Introduction:

Modes, mechanisms and laws of heat transfer – Relationship between thermodynamics and heat transfer. Conduction Heat transfer: Fourier law of equation – General heat conduction equation in Cartesian, Cylindrical and spherical coordinates. One Dimensional steady state heat conduction in Homogeneous slab, hollow cylinders and spheres – Overall heat transfer coefficient – electrical analogy –with variable thermal conductivity– Composite systems and Logarithmic mean area and geometrical mean area - Critical radius / thickness of insulation - with internal heat sources or heat generation.

UNIT-II

One Dimensional Transient heat conduction: Systems with negligible internal resistance - Significance of Biot and Fourier Numbers – Chart solution of transient conduction systems – semi – infinite body and problems. Heat transfer through extended surfaces (or) fins: Extended surface (fins) heat transfer – Long Fin, Fin with insulated tip and short fin with problems

UNIT – III

Radiation heat transfer: Introduction, physical mechanism, radiation properties, Concept of black body ,grey body - laws of black body radiation – irradiation - laws of Planck's, wien,

kirchoff, Lambert and Stefan Bolt man law - concept of shape factor- Emissivity – Heat exchange between grey bodies – radiation shields – problems.

UNIT –IV

Convection heat transfer: Introduction of convective heat transfer, Concepts of Continuity, Momentum and Energy equation – Classification of convection.

Forced convention:

External flows: Concepts of hydrodynamic and thermal boundary layer and use of empirical correlation for convective heat transfer for flow over – Flat plates, Cylinders and spheres.

Internal flows: Division of internal flow through concepts of Hydrodynamic and thermal entry lengths – use of empirical correlations for convective heat transfer in Horizontal pipe flow, annular flow. Free **Convection:** Development of Hydrodynamic and thermal boundary layer along a vertical plate – convective heat transfer on vertical plates and cylinders.

UNIT – V

Heat Exchangers: Introduction, classification of heat exchangers – overall heat transfer coefficient and fouling factor, concepts of LMTD, Effectiveness and NTU method- problems.

Boiling and Condensation: Principles of Boiling-Pool boiling, Regimes and determination of heat transfer coefficient in nucleate boiling, Critical heat flux and film boiling. Condensation - film wise and drop wise condensation- Nusselt's theory of condensation on a vertical plate.
Introduction to mass transfer

TEXT BOOKS

1. Basics of Heat and Mass Transfer-D.S.Kumar, Katsons books
2. Holman.J.P, "Heat Transfer", Tata McGraw-Hill, 2008.
3. Fundamentals of Engg.Heat and Mass Transfer – R.C. Sachdeva, 3/E New age International,2009 4. Kothandaraman.C.P, Subramanyan.S, "Heat and Mass Transfer ", New age International, 7th edition, 2010

REFERENCES

1. Ozisik.M.N, "Heat Transfer", McGraw-Hill Book Co., 2003.
2. Nag.P.K, "Heat Transfer", Tata McGraw-Hill, New Delhi, 2006.
3. Heat and Mass transfer, R.K. Rajput, S.Chand & Company Ltd.,

DATA BOOK

1. Heat and Mass rransfer –Subramanyam and Domkondwar
2. Khurmi.R.S, "Steam Tables", S.Chand Publishers, 2012.

course Title	Design of Machine Elements-I				B. Tech. ME V Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1803502	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

1. To study the basic design principles and apply the principles to the design of various elements encountered in Mechanical machines and structures.
2. To determine the strength of the components.
3. To determine the failure conditions and apply them to real life Problems.
4. To design simple joints

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the concepts of design and perform stress analysis on members.
CO 2	Design members Under the action of Fluctuating forces based on failures of theories.
CO 3	Analyze members having welded and rivited joints.
CO 4	Apply Design Procedure for cotter joints ,shaft ,Keys and couplings.

UNIT – I

INTRODUCTION: General considerations of design, design process. Engineering Materials - properties

STRESSES IN MACHINE MEMBERS: Simple stresses – Combined stresses – Torsional and bending Stresses – impact stresses – stress -strain relation-Principal stresses.

UNIT – II

THEORIES OF FAILURE – Factor of safety – Design for strength and rigidity. Concept of stiffness in tension, bending, torsion and Combined cases

STRENGTH OF MACHINE ELEMENTS: Stress concentration –notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Gerber curve- Goodman's line – Soderberg's line.

UNIT – III

WELDED JOINTS: Introduction-types of welded joints- strength of transverse fillet and parallel fillet welded joints-Axially loaded unsymmetrical welded joints- Ecentrically loaded welded joints.

RIVITED JOINTS – Rivet types, rivet materials, failures of riveted joints, Joint Efficiency, Boiler Joints, Riveted Brackets, eccentrically loaded joints. Types of welded joints, Strength of butt and fillet welds, welded brackets with transverse and parallel fillet welds, eccentrically loaded welded joints.

UNIT – IV

SHAFTS: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code.

UNIT – V

COTTER JOINTS: Design of Cotter joints: spigot and socket, sleeve and cotter-Knuckle joints.

KEYS AND COUPLINGS: Design of Rigid couplings: Muff, Split muff and Flange couplings- Bushed pin type flexible coupling.

Text Books:

1. Design of Machine Elements, V.B. Bhandari , TMH Publishers, New Delhi, 2nd edition, 2013
2. Machine Design, R.S. Kurmi and J.K. Gupta , S.Chand Publishers, New Delhi
3. Machine Design, R.K.Jain, Khanna Publishers, New Delhi.

Reference Books:

1. Machine Design, Pandya and Shah, Charotar Publishers, Anand, 17th edition, 20
2. Mechanical Engineering Design, JosephE.Shigely,TMH Publishers, New Delhi, 9th edition, 2011
3. Design of Machine Elements, M.F.Spotts, PHI Publishers, New Delhi.
4. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2002
5. esign Data Books by KBalaveera Reddy andMahadevan.K

NOTE: Design data books are permitted in the examinations.

Course Title	METROLOGY				B. Tech. ME V Sem			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803503	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

The student will learn to

1. Inspection of engineering parts with various precision instruments.
2. Design of part, tolerances and fits.
3. Principles of measuring instruments and gauges and their uses.
4. Evaluation and inspection of surface roughness.
5. Inspection of spur gear and thread elements
6. Machine tool testing to evaluate machine tool quality

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	understand the Limits, Fits and Tolerances, Indian standard system
CO 2	know the principles of working of the most commonly used instruments for measuring linear and angular distances
CO 3	Apply different types of Comparators, optical measuring instruments, flatness measurement methods and measuring methods of surface roughness
CO 4	Analyze Screw thread elements and measuring methods, Gear tooth profile measurement, CMM, Alignment tests on lathe, milling and drilling machine tools.

UNIT – I

SYSTEMS OF LIMITS AND FITS: Introduction, Definitions, fits and their types –unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly.

UNIT – II

LINEAR MEASUREMENT: Length standard, line, ends & wavelength standards slip gauges – calibration of the slip gauges, Dial indicator, micrometers.

MEASUREMENT OF ANGLES AND TAPERS: Different methods – Bevel protractor – angle gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.

LIMIT GAUGES: Plug, Ring, Snap, Gap, Taper, Profile and Position gauges. Taylor's principle Design of Go and No Go gauges.

UNIT – III

OPTICAL MEASURING INSTRUMENTS: Tool maker's microscope – collimators, optical projector – optical flats and their uses, interferometer.

FLATNESS MEASUREMENT: Measurement of flatness of surfaces – straight edges–surface plates – optical flat and auto collimator.

SURFACE ROUGHNESS MEASUREMENT: Differences between surface roughness and surface waviness- Numerical assessment of surface finish – CLA, R.M.S Values – Ra ,Rz

UNIT IV

SCREW THREAD MEASUREMENT: Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch- profile thread gauges. MACHINE TOOL ALIGNMENT TESTS: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling,portabl radial drilling machine tools.

UNIT V

GEAR MEASUREMENT: Gear measuring instruments, Gear tooth profile measurement: Measurement of diameter, pitch, pressure angle and tooth thickness. Coordinate Measuring Machines: Types of CMM and Applications of CMM.

MEASUREMENT THROUGH COMPARATORS: Comparators – Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses

TEXT BOOKS:

1. Engineering Metrology ,Mahajan, DhanpatRai
2. Engineering Metrology, R.K. Jain, Khanna Publ.

REFERENCES:

1. BIS standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
2. Fundamentals of Dimensional Metrology , Connie Dotson ,4e, Thomson 3. Handbook of Tribology: Materials, Coatings, and Surface Treatments, Bharat Bhushan and B.K.Gupta.
4. Surface Engineering with Lasers, Dehosson J.T.
5. Surface Engineering for corrosion and wear resistance, JR Davis, Woodhead Publ.

course Title	DYNAMICS OF MACHINERY				B. Tech. ME V Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803504	**PCC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

1. To introduce the laws of precession.
2. To learn about the working of different types of brakes and dynamometers,
3. To able to design the flywheel for an IC engine,
4. To introduce different types of Governors,
5. To analyze the unbalanced forces acting in rotating and reciprocating system and to know the balancing methods of different mechanical systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Solve the numerical problems on brakes and understand the working of Dynamometers
CO 2	Apply gyroscopic principles on aero planes, ships, four wheel and two wheel vehicles.
CO 3	Understand the basics of Governors and forces acting on various governors.
CO 4	Solve the numerical problems on Balancing of Rotating masses and reciprocating masses.
CO 5	Analyze the response of single degree freedom systems with free and forced vibration, and can evaluate the critical speed of the shaft.

UNIT I :

BALANCING: Balancing of rotating masses- single and multiple masses- single and different planes Balancing of Reciprocating masses- Primary and secondary balancing of reciprocating masses-graphical methods. Unbalanced forces and couples- V- engine, multi cylinder in line and radial engine for primary and secondary balancing.

UNIT II :

TURNING MOMENT DIAGRAMS AND FLYWHEELS: Turning moment diagrams for IC engine and multi cylinder engine. Crank effort- coefficient of fluctuation of energy, coefficient of fluctuation of speed- Flywheels and their design, flywheels for punching machines.

UNIT III :

GOVERNORS: Watt, Porter and Proell governors. Spring loaded governors- Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting. Effort and power of a governor.

UNIT IV :

BRAKES AND DYNAMOMETERS: Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers- absorption and transmission types. General description and methods of operation.

PRECESSION: Gyroscopes, effects of precession motion on the stability of moving vehicles such as motor car, motor cycle, aeroplanes and ships.

UNIT V :

VIBRATION: Free and forced vibration of single degree of freedom system, Role of damping, Whirling of shafts and critical speeds. Simple problems on free, forced and damped vibrations. Vibration isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method. Torsional vibrations- two and three rotor systems.

Text Books:

1. Theory of Machines, S.S.Rattan,5 th edition, MGH Publishers
2. Kinematics and Dynamics of Machinery R.L.Norton, Tata McGraw Hill

Reference Books:

1. Theory of Machines, Thomos Bevan, Pearson,
2. Theory of Machines , J.E.Shiegley. McGraw Hill
3. Theory of Machines and Mechanisims by Shigley and co, 4th edition, Oxford International Student Edition.

course Title	MANAGERIAL ECONOMICS				B. Tech. ME V Sem			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1825505	HSMC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

To teach and develop skills in applying economic concepts to take managerial decisions through various pricing strategies regarding Market conditions, various Projects evaluation and facing competition.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	**Acquire knowledge** in principles and concepts of Economics and demand analysis.
CO 2	**Understand** the production function, cost analysis and breakeven point.
CO 3	**Describe** different types of Markets as well as competition and Methods of Pricing.
CO 4	**Predict** the future value and estimate the present value of money of various Projects using capital budgeting techniques.

UNIT – I: ECONOMICS AND MANAGERIAL ECONOMICS

Economics – Micro economics – Macro economics – Factors affecting micro economics at firm level and macro economics at industry level.
Managerial economics: Definition, nature and scope– relation with other disciplines.

UNIT – II: DEMAND ANALYSIS

Demand analysis : Determinants, Law of Demand and its exceptions – Elasticity of Demand – Types and Measurement of Elasticity of Demand – Methods of Demand Forecasting.

UNIT – III: THEORY OF PRODUCTION AND COST ANALYSIS

Production Functions: Law of variable proportion, Isoquants and Isocost, least cost combination of inputs, Returns to Scale and Cobb- Douglas production function. Internal and external economies of scale.
Cost Analysis: Cost concepts – Break-Even Analysis (BEA) – Break Even Point – significance and limitations of BEA(simple problems).

UNIT – IV: MARKET STRUCTURES AND PRICING METHODS

Markets structures: Perfect and Imperfect competition – Features of Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly. Price- Output determination under perfect competition, monopoly and monopolistic competition – Price rigidity in Oligopoly. **Methods of pricing:** cost plus pricing, marginal cost pricing, skimming pricing, penetration pricing, differential pricing and administrative pricing.

UNIT – V: TIME VALUE OF MONEY AND CAPITAL BUDGETING

Internal and External sources of Finance – Time value of money – Types of Projects.
Capital Budgeting Process – Methods of capital budgeting: Payback Period Method, Accounting Rate of return (ARR) and Net

Present Value Method (NPV), Internal Rate of Return (IRR) and Profitability Index (PI) (simple problems).

Text Books:

1. DM Mithani, Managerial Economics Theory and Applications, Himalaya Publications House, 2009
2. A.R. Aryasri, Managerial Economics and Financial Analysis, McGrawHill Publications
3. M.Sugunatha Reddy, Managerial Economics and Financial Analysis, Research India Publication, New Delhi, 2013.

REFERENCES :

1. Varshney & Maheswari: Managerial Economics, Sultan Chand Publishers, 2009.
2. Dominick Salvatore : Managerial Economics – Principles and world wide applications, Oxford university Press, 2012.
3. Paul Samuelson and William Nordhaus : Economics, Mic Graw Hill Publication. 19th Edition.
4. P.L Mehtha: Managerial Economics, Sulthan Chand Publishers
5. K K Dewett - Managerial Economics ,S. Chand Publishers

course Title	AUTOMOBILE ENGINEERING				B. Tech. ME V Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
1803506	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- Know the anatomy of the automobile in general
- Understand the location and importance of each part
- Learn the functioning of the engine and its accessories, gear box, clutch,
- brakes, steering, axles and wheels
- Understand the Suspension, frame, springs and other connections
- Know Emissions, ignition, controls, electrical systems and ventilation

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify the different parts of the automobile.
CO 2	Explain the working of various parts like engine, transmission, clutch,brakes
CO 3	Describe how the steering and the suspension systems operate.
CO 4	Understand the environmental implications of automobile emissions
CO 5	Develop a strong base for understanding future developments in the automobile industry

UNIT I:

Types of automobiles, vehicle construction and layouts, chassis, frame and body, vehicleaerodynamics, IC engines-components, function and materials, variable valve timing (VVT).

UNIT II:

Transmission systems, clutch types & construction, gear boxes- manual and automatic gear shiftmechanisms, over drive, transfer box, flywheel, torque converter, propeller shaft, slip joints,universal joints, differential and rear axle, Hotchkiss drive and Torque tube drive.

UNIT III:

Steering geometry and types of steering gear box, power steering, types of front axle, types ofsuspension systems, pneumatic and hydraulic braking systems, antilock braking system (ABS), electronic brake force distribution (EBD) and traction control.

UNIT IV:

Alternative energy sources, natural gas, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels inautomobiles, modifications needed, performance, combustion & emission characteristics ofalternative fuels in SI and CI engines, Electric and Hybrid vehicles, application of Fuel Cells

UNIT V:

Engine auxiliary systems, electronic injection for SI and CI engines, unit injector system, rotarydistributor type and common rail direct injection system, transistor-based coil ignition & capacitivedischarge ignition systems, turbo chargers (WGT, VGT), engine emission control by 3-way catalyticconverter system, Emission norms (Euro & BS).

Text books:

1. Kirpal Singh, Automobile Engineering, vol I& II 7th ed.,Standard Publishers, New Delhi,
2. Jain K.K.and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi, 2002.
3. S.Srinivasan, Automotive Mechanics, 2nd ed., TATA McGraw Hill, New Delhi
4. Heisler H., Advanced Engine Technology, SAE International Publ., USA,

REFERENCE BOOKS:

1. Automobile engineering, R. k Rajput Lakshmi publications
2. Automobile engineering. K. k. Ramalingam Scitech publications

Course Title	Manufacturing Methods in Precision Engineering					B. Tech. ME V Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803506	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	-	0	3	30	70	100
Mid Exam Duration: 2Hrs						**End Exam Duration: 3Hrs**		

Course Objectives:

- To understand the concepts of precision engineering.
- To obtain knowledge in micro and nano engineering
- To understand various manufacturing methods in precision engineering
- To understand various technologies and processes to applications.
- The course related topics in precision, micro and nano manufacturing,

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Develop and present a conceptual design solution to a precision machine operating in the micro and nano range.
CO 2	Use simulation modeling software to design and analysis a precision mechanical system.
CO 3	Identify and understand the various stages involved in IC manufacture, and be familiar with the main process performance indicators.
CO 4	Calculate Power requirements and process performance in laser cutting.

UNIT – I

INTRODUCTION TO MANUFACTURING AND PRECISION ENGINEERING

Introduction to precision engineering and manufacturing process, conventional and unconventional machining process, micromachining, precision machining and finishing operations. Methods of measurements: during machining and during assembly.

UNIT – II

CONCEPTS OF ACCURACY: Introduction - concept of accuracy of machine tools - spindle and displacement accuracies, Errors due to numerical interpolation - Displacement measurement system and velocity lags.

UNIT – III

PRECISION MEASURING SYSTEMS: Units of length - legal basis for length measurement – Traceability - Processing system of nanometer, accuracies - LASER light source - LASER interferometer - LASER alignment telescope - LASER micrometer-on-line and in-process measurements of diameter and surface roughness using LASER - Micro holes and topography measurements -.- In processing or insitu measurement of position of processing point-Post process and on-machine measurement of dimensional features and surface mechanical and optical measuring systems.- Straightness and flatness measurement

UNIT IV

MICROMACHINING: Electro Discharge Machining process: General principle and applications of electric discharge machining, electric discharge grinding and electric discharge wire cutting processes – power circuits for EDM, mechanics of metal removal in EDM, process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection - Wire EDM, principle, applications

UNIT – V

NANO POSITIONING SYSTEMS OF NANO ACCURACY & REPEATIBILITY:

Guide systems for moving elements - Servo control systems for tool positioning - Computer Aided digital and ultra precision position control.

TEXT BOOKS:

1. M. V. Suryaprakash ,"Precision Engineering" Narosa publications.
2. V C Venkatesh ," Precision Engineering "McGraw HILL Publications
3. Hiromu Nakazawa" Principles of precision engineering" Oxford University Press

Refrences

1. Kluwer, "A new direction in manufacturing", Academic Publishers, London, 1997
2. Kalpakjian, "Manufacturing engineering & technology", Addison – Wesley, 2nd Edition
3. Debitson A., "Hand book of precision engineering"
4. J. A. McGeough, "Advanced methods of machining", Chapman and Hall, London, 1988
5. Jain V. K., "Introduction to micromachining", Narosa Publishers
6. M. Madou, "Fundamentals of microfabrication"
7. Momber A. W. and Kovacevic R., "Principles of water jet machining", Springer – Verlag
8. R. L. Murthy., "Precision engineering manufacturing", New Age International
9. G. Chryssolouris, "Laser machining – theory and practice", Springer Verlag, New York, 1991

course Title	MECHANICAL BEHAVIOR OF METALS				B. Tech. ME V Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803506	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- To impart the knowledge in the fields of strengthening mechanism.
- To understand the creep ,fatigue and failures of metals.
- TO know the properties of creep ,toughness,strength,and fatigue.
- To know the properties of advanced and modern metallic materials.

5.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	To employ the various strengthening mechanism
CO 2	Iilstrate the fatigue properties of metals
CO 3	Describe the creep mechanism
CO 4	Illustrate the fracture and fatigue mechanism

UNIT I

BASIC CONCEPTS OF MATERIAL BEHAVIOR :

Elasticity in metals and polymers– Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – . Griffith's theory,– Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps.

UNIT II

BEHAVIOUR UNDER DYNAMIC LOADS AND DESIGN APPROACHES :

Stress intensity factor and fracture toughness – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law.- Safe life, Stress life, strain-life and fail - safe design approaches -Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

UNIT III

SELECTION OF MATERIALS :

Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing –

UNIT IV

MODERN METALLIC MATERIALS :

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials. Fabrication of glass by blowing ,flat drawing and rolling

UNIT V

NON METALLIC MATERIALS :

Polymeric materials – Formation of polymer structure – Production techniques of fibers reinforced materials by pultrution , pre preg process, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al2O3, SiC, Si3N4 CBN and diamond – properties, processing and applications.

REFERENCES:

1. Ashby M.F., materials selection in Mechanical Design 2nd Edition, Butter worth 1999.
2. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., Selection and use of engineering materials, (34d edition), Butterworth-Heiremann, 1997.
3. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico, 1999.
4. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988
5. Metals Hand book, Vol.10, Failure Analysis and Prevention, (10th Edition), Jaico, 1999.
6. Thomas H. Courtney, Mechanical Behavior of Materials, (2nd edition), McGraw Hill, 2000

course Title	Renewable Energy Technologies				B. Tech. ME V Sem			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1803506	**PE**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- Explain non-conventional sources of energy.
- Familiarize the principles of photo voltaic and MHD power generation.
- Focuses the concepts of various renewable energy generation methods.
- Outline the utilization of renewable energy sources for domestics and industrial applications.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Possess the knowledge of various renewable energy sources and their utilization
CO 2	Understand the solar PV, wind and MHD power generation systems
CO 3	Familiar with the operations of ocean, geothermal, bio-mass, battery and fuel cell energy conversion systems
CO 4	Compare different energy conversion systems.
CO 5	Apply pollution preventive measures in various energy conversion systems.

UNIT I

Introduction to sources of renewable energy and its overview and importance.
Photo voltaic power generation: Spectral distribution of energy in solar radiation, solar cell configurations, voltage developed by solar cell, photo current and load current, practical solar cell performance, commercial photo voltaic systems, test specifications for PV systems, applications of super conducting materials in electrical equipment systems.

UNIT II **MHD and Wind energy:** Principles of MHD Power generation, ideal MHD generator performance, practical MHD generator, MHD technology.
Wind Energy conversion, power from wind, properties of air and wind, types of wind Turbines, operating characteristics.

UNIT III **Tidal energy Wave energy:** Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation.
Wave energy conversion, properties of waves and power content, vertex motion of waves, device applications. Types of ocean thermal energy conversion systems, applications of OTEC systems .

UNIT IV **Miscellaneous energy conversion systems:** coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion, principles of EMF generation, Co-generation, combined cycle co-generation, energy storage.

UNIT V **Fuel cells:** Types of fuel cells, H2-O2 fuel cells, Application of fuel cells – Batteries, Description of Batteries, Battery application for large power. Environmental effects of energy conversion systems, pollution from coal and preventive measures, steam stations and pollution, pollution free energy systems.

TEXTBOOKS:

1. Wengenmayr, R. and Bührke, T. (2011), Renewable energy: Sustainable energy the future, John Wiley & Sons.
2. John Twidell & Tony Weir, Renewable Energy Resources, CRC Press , (2015).
3. G.D. Rai, Non conventional Energy sources, Khanna Publishers.

REFERENCES:

1. D.P.Kothari, K.C. Singal, Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, PHI (2009).
2. C.S.Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI 2015.
3. Rakosh Das Begamudre, Energy Conversion Systems, New age International publishers, New Delhi (2007)

E Resources:

1. nptel.ac.in/courses/112105051/
2. mnre.gov.in
3. https://www.journals.elsevier.com/renewable-energy/
4. www.ijrer.org

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Course Objectives:

Course outcomes:

After successful completion of this course the student will be able to

CO1
CO2
CO3
CO4
CO5 **Course Articulation Matrix:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	3	3	-	-	-	-	2	1	1	-
CO2	2	3	3	2	-	3	3	-	-	-	-	2	1	2	-
CO3	2	2	3	3	-	3	3	-	-	-	-	2	1	2	-
CO4	2	2	3	3	-	3	3	-	-	-	-	2	1	2	-
CO5	2	2	3	3	-	3	3	-	-	-	-	2	1	2	-

Course Title	SUPPLY CHAIN MANAGEMENT				B. Tech. ME V Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803506	PE	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	-	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

The student will able to

Understand fundamental supply chain management concepts.

Impart knowledge and understanding to students on Supply Chain Management and its relevance to today's business decision making

Gain knowledge to evaluate and manage an effective supply chain.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the Concepts of supply chain , which are aligned with business models for manufacturing and service companiesand warehousing.
CO 2	Determine the decision support system requirements for supply chain management.
CO 3	Design implementation processes for partnerships, such as vendor managed inventory, that involve information sharing and shared governance of processes and infrastructure.
CO4	Evaluate strategic alliances for logistics and retailer-supplier relationships, such as vendor managed inventory.

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UNIT I:

Supply Chain definition – Objectives – Types – Various definitions – Drivers – Need for SCM – SCM as a profession – SCM decisions and skills – Strategy formulation in SCM – Value in Supply Chain – Tradeoffs – CRM Strategy relationship matrix

UNIT II:

Strategic Sourcing – Source evaluation – collaborative perspective – BuyerSupplier Relationship – Partner Selection – develop of Partnership – importance of inventory – imbalances – uncertainties – inventory costs – inventory turnover ration

UNIT III:

Transportation Selection – Tradeoff – modes of transportation – models for transportation and distribution – factors affecting network effectiveness – 3 PL advantages – Indian transport infrastructure – IT solutions – EDI, e-Commerce, eProcurement – Bar Coding and RFID technology

UNIT IV:

Critical business processes and information systems – DBMS – benefits of ERP –information system and bull whip effect – SCM software packages – modeling concepts – Vendor analysis model – Coordinated SCM – Simulation modeling- Reverse Vs forward supply chain – types of reverse flows – collaborative SCM's andCPFR – agile systems – sources of variability – characteristics – supplier interface – internal processes

Unit V:

Supply Chain Management and profitability – quality management – mass customization and globalization – ethical Supply Chains – e-business and SCM – Balanced Score Card – Benchmarking, Performance measurement

Text Books:

1.Mohanty R.P, S.G Deshmuki "Supply Chain Management" Biztantra, New Delhi

2.Sunil Chopra, Peter Meindl, Dharam Vir Kalra " supply Chain Management, Strategy, Planning, Operation" Sixth Edition, Pearson Publications

Course Title	THERMAL ENGINEERING LAB				B. Tech. ME V Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
		L	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
1803507	PCC	3	-	0	1.5	50	50	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

1. To provide knowledge on testing of properties of fuels and lubricating oils
2. To demonstrate and conduct experiments, interpret and analyze data and report results of IC Engine testing
3. To expose the students to the basic knowledge of thermal equipments and help them to develop experimental skills.
4. To study the concepts, applications of the thermal engineering laboratory.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Compute the property of fuels and lubricating oils using suitable tests.
CO 2	Demonstrate the performance of internal combustion engines and air compressors On successful completion of the courses
CO 3	Interpret the emission characteristics of internal combustion engines.
CO 4	Determine heat transfer enhancement mechanisms, estimate the size and type of heat exchangers.

LIST OF EXPERIMENTS:

1. Valve / Port Timing Diagrams of an I.C. Engines cut models.
2. Optimal cooling water flow rate for an I.C. Engine.
3. Performance Test on 2-Stroke Petrol engine
4. V T D of R.N. engine cut model.
5. Retardation test.
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on 7 H.P. Kirlosker engine
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.
12. Heat balance test on 10 H.P Kirlosker Engine.

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

course Title	CAD LAB				B. Tech. ME V Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
1803508	PCC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	--	1.5	50	50	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

CO1: Acquire fundamental understanding of the principles of CAD/CAE/CAM, drawing, geometric and surface and feature-based design And Analysis

CO2: Applying CAD/CAM concept to product design and manufacturing

CO3 : Exposure to CAD/CAM software's

CO4: To introduce fundamentals of the analysis software, its features andapplications.

CO5: To know the application of various CNC machines like CNC lathe, CNC Vertical Machining center,

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Develop 2D and 3D models using modeling softwares.
CO 2	Understand CAD/CAM concept to product design and manufacturing
CO 3	Apply CNC control in modern manufacturing system.
CO 4	prepare CNC part programming and perform manufacturing

List of experiments

1.3D Modelling of Given part diagram
2.3D modelling of Flange Coupling
3. 3D Modelling of Piston
4. 3D Modelling & Assembly of cross head
5. Static Structural analysis CAE Software
6.Modal analysis using CAE software
7.Thermal Analysis using CAE Software
8.Step turning
9.Taper turning
10.Thread cutting
11.Linear & Circular interpolation related operations in CNC Mill
12.Drilling and pocketing operations in CNC Mill

Use the following Softwares:

CAD: Autocad,Croe,Catia,Dassault 3D experience,Solidworksetc
CAE: Ansys,Hypermesh,Abaqus solidworks simulations etc
CAM: CNC Train, Master cam, Delcam, Solid cam etc

SUBJECTCODE: ME 1803510	**Additive Manufacturing**	REGULATION:R18	3 – 0 – 0	Credits

COURSE OUTCOME(S): At the end of the course, the student shall be acquainted with the knowledge of:

CO1	Importance of AM in Manufacturing
CO2	Different AM Technologies
CO3	Select suitable materials for AM
CO4	Different methods for Post-processing of AM parts
CO5	"Design for manufacture" for AM
C06	Process Analysis
C07	Applications of AM in Automobile, Aerospace, Bio-medical etc.
C08	Future Directions of AM

COURSE OBJECTIVE(S):

1. The main objective of this course is to acquaint students with the concept of AM, various AM technologies, selection of materials for AM, modeling of AM processes, and their applications in various fields.
2. Additive Manufacturing (AM) is an economically viable alternative to conventional manufacturing technologies for producing highly complex parts.
3. The course will also cover AM process plan includingbuilding strategies and post-processing.

SYLLABUS:

UNIT-I

Introduction to Additive Manufacturing: Introduction to AM, AM evolution, Distinction between AM & CNC machining, Advantages of AM, **AM process chain**: Conceptualization, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build , removal and clean up, post processing.

Classification of AM processes: Liquid polymer system, discrete particle system, molten material systems, and solid sheet system.

UNIT-II

Design for AM: Motivation, DFMA concepts and objectives, AM unique capabilities, Exploring design freedoms, Design tools for AM, Part Orientation, Removal of Supports, Hollowing out parts, Inclusion of Undercuts and Other Manufacturing Constraining Features, Interlocking Features, Reduction of Part Count in an Assembly, Identification of markings/ numbers etc.

UNIT-III

Guidelines for process selection: Introduction, selection methods for a part, challenges of selection, example system for preliminary selection, production planning and control ,**AM Applications:** Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development,

UNIT-IV

Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defense, automobile, Bio-medical and general engineering industries

Post processing of AM parts: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.

UNIT-V

Future Directions of AM: Introduction, new types of products and employment and digiproneurship.

Text Book(s):

1. Ian Gibson, David W. Rosen and Brent Stucker, Additive manufacturingtechnologies: rapid prototyping to direct digital manufacturing, Springer, 2010.
2. C.K. Chua, K.F. Leong and C.S. Lim, Rapid prototyping: Principles andapplications, 3rd Edition, World Scientific, 2010.

Reference(s):

1. Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010
3. Ali K. Kamrani, Emand Abouel Nasr, "Rapid Prototyping: Theory & Practice", Springer, 2006.
4. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001
1. Andreas Gebhardt, Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing, Hanser Publishers, 2011.
2. J.D. Majumdar and I. Manna, Laser-assisted fabrication of materials, SpringerSeries in Material Science, 2013.
3. L. Lu, J. Fuh and Y. S. Wong, Laser-induced materials and processes for rapidprototyping, Kluwer Academic Press, 2001.
4. Zhiqiang Fan and Frank Liou, Numerical modeling of the additive manufacturing(AM) processes of titanium alloy, lnTech, 2012.

course Title	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS				B. Tech. ME V Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
1825505	**HSMC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	1	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- Provide knowledge of managerial economics through differential economics concepts, accounting concepts are necessary to analyze and solve complex problems relating financial related matters in bog industries.
- An understanding of professional and ethical responsibility and ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in a global and societal context.
- Recognition of the need for, and an ability to engage in life-long learning and to meet contemporary issues.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	understand and enhancing the knowledge regarding managerial concepts and obtaining optimal solutions to get an idea of analysis of firm's financial position with the techniques of financial analysis and ratio analysis
CO 2	Get an idea of analysis of firm's financial position with the techniques of financial analysis and ratio analysis
CO 3	Familiarize the students with the fundamental principles of economics and make them understand the relevance of economics in business decisions
CO 4	Develop the skills needed to analyze financial statements
CO 5	Gain knowledge on the preparation of financial statements.

UNIT – I:

INTRODUCTION TO MANAGERIAL ECONOMICS

Definition, nature and scope of Managerial Economics – relation with other disciplines. Demand analysis – Determinants, Law of Demand and its exceptions – Elasticity of Demand – Types and Measurement of Elasticity of Demand – Methods of Demand Forecasting.

UNIT – II:

THEORY OF PRODUCTION AND COST ANALYSIS

Production Functions: Law of variable proportion, Isoquants and Isocost, least cost combination of inputs, Returns to Scale and Cobb- Douglas production function. Internal and external economies of scale. Cost Analysis: Cost concepts – Break-Even Analysis (BEA) – Break Even Point – significance and limitations of BEA.

UNIT – III:

INTRODUCTION TO MARKETS AND PRICING Markets structures:

Perfect and Imperfect competition – Features of Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly. Price- Output determination under perfect competition, monopoly and monopolistic competition – Price rigidity in Oligopoly. Methods of pricing – cost plus pricing, marginal cost pricing, skimming pricing, penetration pricing, differential pricing and administrative pricing.

UNIT – IV:

BUSINESS ORGINATIONS AND CAPITAL BUDGETING

Business Organizations: Types of business organizations- Sole Proprietorship, Partnership, Joint Stock Company, Public Ltd and Private Ltd companies, Public Private Partnership (PPP). Capital Budgeting: Types of capital, methods and sources of raising Capital. Capital Budgeting Techniques: Payback Period Method, Accounting Rate of return (ARR) and Net Present Value Method (NPV) (simple problems).

UNIT – V:

FINANCIAL ACCOUNTING AND ANALYSIS

Double Entry Book keeping, Journal, Ledger, Trail Balance – Final Accounts (Preparation of Trading Account, Profit and Loss Account and Balance Sheet without adjustments). Analysis and interpretation of financial statements through ratios (Liquidity, Profitability and Activity Ratios) (Simple problems).

TEXT BOOKS:

1. Varshney & Maheswari: Managerial Economics, sultan chand, 2009.
2. Prasad and K.V.Rao: Financial Accounting, jaibharth Publishers, Vijayawada.

REFERENCES:

1. P.L Mehtha: Managerial Economics, Sulthan Chand publishers
2. K K Dewett - Managerial Economics ,S. Chand Publishers
3. S.P Jain & K.L Narang: Financial Accounting, Kalyani publishers.
4. M.Sugunatha Reddy: Managerial Economics and Financial Analysis, Research India Publication, New Delhi, 2013