



K L UNIVERSITY

Department of Mechanical Engineering

Green Fields, Vaddeswaram, (via) K.C. Works P.O. - 522 502, Guntur District, A.P.
 Phones: 08645-246948, 246615 FAX:08645-247249, 0866-2577902

*Approved by A.S.T.E. Accredited by N.S.I.C with CGPA 3.76/4.00
 Accredited by N.B.A. ISO 9001:2000 Certified*

COURSE STRUCTURE FOR FOUR YEAR B.TECH DEGREE PROGRAMME 2011-12 Batch

VI Semester						
S No	Course Code	Course Title	L	T	P	Credits
1	11-ME305	Heat Transfer	3	0	2	4
2	11-ME306	Design of Machine Elements	3	1	0	4
3	14-ME307	Advanced Manufacturing Technology	3	0	2	4
4	Prof. elective – 2					3
5	Prof. elective – 3		3	0	0	3
6	11HS303/4/5/6	HS Elective	3	0	0	3
7	11-MP301	Mini project -3	0	0	2	1
Total Credits						22

Professional Elective-2	
11-ME335	Mechanical Vibrations
11-ME336	Automobile Engineering
11-ME337	Total Quality Management
11-ME338	Computer Integrated Manufacturing

Professional Elective-3	
11-ME339	Computer Aided Design
11-ME340	Non-Conventional Energy Sources
11-ME341	Management Information Systems
11-ME342	Cellular Manufacturing Systems

HEAT TRANSFER

11-ME305

L – T – P

3 – 0 – 2

Introduction: Units, definitions, Basic modes of Heat transfer, Thermal conductivity for various types of materials, convection heat transfer co-efficient, Stefan Boltzman's law of Thermal radiation. **One Dimensional Steady State Heat Conduction:** Thermal conductivity and other relevant properties, Heat diffusion equation in Cartesian coordinates, boundary and initial conditions. One dimensional, steady state heat conduction without and with heat generation through plane slabs, cylinders and spheres, Concept of thermal resistance, Electrical analogy. Heat transfer through composite slabs, cylinders and spheres, contact resistance. Critical thickness of insulation for cylinder and sphere. Steady state heat conduction through fins of uniform cross section, fin effectiveness and fin efficiency. **Multi-dimensional Steady State Heat Conduction:** Two-dimensional steady state conduction, analytical solution, conduction shape factor, finite difference and finite volume methods. **Unsteady State Heat Conduction:** Transient conduction in solids with negligible internal temperature gradients (lumped parameter), Biot number and Fourier number. One-dimensional transient conduction in slab and radial systems: exact and approximate solutions. Finite difference methods: explicit and implicit formulations. **Convection:** Flow over a body, velocity and thermal boundary layers, drag-co-efficient and heat transfer coefficient. Flow inside a duct; hydrodynamics and thermal entry lengths; fully developed and developing flow. Use of various correlations in forced convection heat transfer, flow over a flat plate, and flow across a single cylinder and tube bundles. Free convection heat transfer from vertical surface and vertical cylinder, horizontal surface and horizontal cylinders. **Heat Exchangers:** Heat exchanger types, flow arrangements, overall heat transfer coefficient, fouling factor, LMTD for parallel flow and counter flow heat exchangers. Effectiveness-NTU method, expression for effectiveness of a parallel flows and counter flow heat exchangers. Multi-pass and cross flow heat exchangers. **Boiling and Condensation:** Different regimes of boiling, mechanism of condensation, Nusselt's theory of film condensation on a vertical surface, use of correlations in solving film wise condensation on plane surfaces, horizontal tubes and tube banks. **Radiation Heat Transfer:** Definitions, concept of a black body, Kirchoff's law, Lambert's Cosine Law, Stefan-Boltzman's law, Plank's distribution law, Wein's displacement law, configuration factor. Radiation heat exchange between two parallel plates, radiation shielding, radiation heat exchange in an enclosure.

TEXT BOOKS:

1. Yunus A. Cengel., "Heat Transfer – A practical approach", Second Edition, Tata McGraw-Hill
2. Incropera. F.P.and Dewitt.D.P. "Introduction to Heat Transfer", John Wiley and Sons

REFERENCE BOOKS:

1. Lienhard, J.H., "A Heat Transfer Text Book", Prentice Hall Inc.,
2. Holman, J.P. "Heat Transfer", McGraw-Hill Book Co., Inc., New York
3. M. Necati Özışık, "Heat Transfer – A Basic Approach", McGraw-Hill

DESIGN OF MACHINE ELEMENTS

11-ME306

L-T-P
3-1-0

BASICS: Phases of design, General considerations and procedure in machine design, standardization, preferred numbers, Mechanical properties of materials.

DESIGN FOR STATIC STRENGTH: Simple Stresses - Combined stresses - Torsional and Bending stresses - Factor of safety and theories of failure. (12)

DESIGN FOR FATIGUE STRENGTH: Stress concentration – Methods of reducing stress concentration factor, Design for fluctuating stresses, Fatigue strength and Endurance limit, Goodman diagram and Soderberg methods for combination of stresses, applications of soderberg's equation. (12)

POWER SCREWS: Types - Mechanics of power screws, efficiency.

Design of Bolted joints (along with eccentric loading),

Welded joints: Design of Welded joints, Strength of welded joints, Welded joint with eccentric loading (12)

Design of springs: Types, Design of Helical against static and fluctuating loads, Torsion springs, Spiral springs, Leaf springs. (12)

Design of Shafts and couplings: Shaft and its design based on strength Design of shaft for variable load and based on stiffness. Introduction, types, uses, Design procedures for rigid and flexible rubber-bushed couplings.

Flywheel: Torque analysis, Solid disc flywheel, rimmed flywheel, stresses in rimmed flywheel. (12)

TEXT BOOKS

1. Design of machine elements by Bhandari, Tata McGraw Hill book Co.
2. Machine Design by Dr.N.C.Pandya & Dr. C.S.Shah, Charotar Publishing House

REFERENCE BOOKS

1. Shigley J.E, "Mechanical Engineering Design", McGraw-Hill, 1996.
2. Black P.H. and O. Eugene Adams, "Machine Design", McGraw Hill Book Co. Ltd.
"Usage of: "Design Data", P.S.G. College of Technology, Coimbatore. is recommended".

Advanced Manufacturing Technology

L-T-P: 3-0-2

INTRODUCTION: Need for Non Traditional machining methods, Classification of modern machining process Mechanical Energy Based Process: Abrasive jet machining, Water jet machining and Ultrasonic machining Basic principles, application and limitations. Chemical Energy Based Process: Study of process parameters and its variables of chemical machining.

Electro-Chemical Energy Based Process: Electro chemical machining, electro chemical grinding, Thermo Electric Energy Based Process: Study of process parameters and its variables of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes, Electron beam machining, Laser beam machining, Ion beam machining, Plasma arc machining.

METROLOGY: Introduction, Linear and angular measurements. Linear And Angular Measurements: Precision measurement bore gauges, straight edges, slip gauges, angle gauges, sine bars, spirit levels, auto collimator. **COMPARATORS:** Mechanical comparators, Reed comparators, Sigma comparators, electrical and electronic comparators.

Limits, Fits And Gauges: Limits, fits, Tolerance and allowance, Theory of limits and fits and their selection, Hole basis and shaft basis system, Indian standard system of limits and fits, simple problems. Interchangeability, selective assembly, Limit gauges, Taylor's principle of limit gauging, plug gauges, Ring gauges.

Non Destructive Testing Methods: Introduction, Ultrasonic testing, Liquid Penetrant test, Magnetic particle test, Radiography test.

TEXT BOOKS:

1. Manufacturing Technology - Kalpakjian
2. Metrology by R.K.Jain, Kahanna publishers.
3. Modern Machining process – P.C.Pandey & H.S.Shan

REFERENCE BOOKS:

1. Engineering Metrology by D. M. Antony
2. A Text Book of Engineering Metrology – by I.C. Gupta.
3. Production Technology – HMT – TMH, New Delhi

MECHANICAL VIBRATIONS

11-ME335

L-T-P
3-0-0

Fundamentals of Vibration:- Introduction, Definitions, vector method of representing Harmonic motions, Addition of two simple Harmonic motion of the same frequency, Beats phenomenon.

Undamped Free Vibrations of single Degree of freedom systems:- Introduction, Derivations of differential equations, solution of differential equation,

Torsional vibrations, Equivalent stiffness of spring combinations, Energy method.

Damped free vibrations of single degree of freedom systems:- Introduction, Different types of damping, Free vibrations with viscous damping, Logarithmic Decrement, Viscous dampers, Coulomb damping.

Forced vibrations of single degree of freedom systems:- Introduction, Forced vibrations with constant Harmonic excitation, Forced vibration with rotating and reciprocating unbalance, forced vibrations due to excitation of the support, Vibration isolation and Transmissibility, Critical speed of a light shaft having a single disc without damping, Vibration measuring instruments.

Two Degrees of Freedom systems:- Introduction, principal modes of vibration, other cases of simple two degrees of freedom systems, combined rectilinear and angular modes, undamped forced vibrations with harmonic excitation, undamped dynamic vibration absorber, centrifugal pendulum absorber.

Multi-Degree of freedom systems – Exact analysis:- Introduction, Free vibrations – Equations of motion, co-ordinate coupling, Eigen values and Eigen vectors.

Text Books:

1. G.K.Grover, Mechanical Vibrations, Neem Chand & Bros. 7th Edition
2. W.T.Thomson Mechanical Vibrations, Pearson education ,2nd Edition

Reference Books:

1. S.S.Rao , Mechanical Vibrations, Pearson education, 4th edition
2. Altair Hyper works suit Help

AUTOMOBILE ENGINEERING

11-ME336

L – T – P

3 – 0 – 0

Introduction to Automobiles: Classification of vehicles – applications, options of prime movers, Components, Requirements of Automobile Body; Vehicle Frame, Separate Body & Frame, Unitised Body, Car Body Styles, Bus Body & Commercial Vehicle Body Types; Front Engine Rear Drive & Front Engine Front Drive Vehicles, Four Wheel Drive Vehicles, Safety considerations; Safety features of latest vehicle; Future trends in automobiles. **Engine:** Engine Classification, types of combustion chambers for petrol and diesel engines, valves, valve arrangements and operating Mechanisms, pistons, piston rings, Firing order; Crankshafts, Flywheel. Fuel Supply systems for Petrol Engines, Fuel pumps. Mechanical and Electrical Diaphragm pumps, Carburetors, Electronic petrol injection. **Cooling Systems:** Coolants, properties, Air and water cooling systems. **Lubrication System:** Lubricants, Properties, Splash, semi-pressure and full pressure Lubricating systems. **Chassis:** Components of an automobile, Layout, Specifications, Articulated and rigid vehicles, Front wheel drive, rear wheel drive, 4- wheel drive, frame, types, aerodynamic considerations, energy absorbing bumpers. **Emission:** Emission from automobiles-pollution standards, national and international-pollution control techniques. **Transmission:** Clutches: single and Multi-plate clutches, Centrifugal clutches, wet and dry type, actuating mechanisms, Gear Box - Four speed and Five Speed Sliding Mesh, Constant mesh & synchromesh type, selector mechanism, automatic transmission, overdrive, propeller shaft, differential - principle of working. **Suspension:** systems, springs, shock absorbers, axles – front and rear, different methods of floating rear axle, front axle and wheel alignment. **Vehicle Control:** steering mechanisms and power steering, types of brakes and brake actuation mechanisms (air and hydraulic).

TEXT BOOKS:

1. Automotive Mechanics – Crouse / Anglin, TMH.
2. Automotive Mechanics, Principles & Practices – Joseph Heitner, EWP.

REFERENCE BOOKS:

1. Motor Automotive Technology by Anthony E. Schwaller – Delmer Publishers, Inc.
2. The Motor Vehicle – Newton steeds Garrett, Butter Worths.

TOTAL QUALITY MANAGEMENT

11-ME337

L-T-P

3-0-0

(Pre-requisite = NIL) 3 Credits

Introduction, Quality and improvement, and evolution of TQM, Quality assurance, quality system, quality loss function, link between quality and productivity.

Philosophy of Deming, Juran, Crosby.

Seven tools of TQM - Control charts, check sheets, flow charts, graphs, histograms, pareto chart, cause-effect diagram, scatter diagram,

Quality function deployment – Introduction, benefits, process, quality circle, zero-defect programme .

Quality control charts for variables, attributes, (\bar{X} bar, R, p, c, np, U charts), Process capability, Acceptance sampling – introduction, definition, objectives, benefits, different sampling plans, O.C.curve- construction, properties (for single sampling plan)

Bench marking, quality costs, total productive maintenance

ISO 9000- Introduction, series of standards, benefits, requirements, implementation, documentation, quality auditing.

Continuous process improvement – basic concepts of KAIZEN, 5S, POKAYOKE, JIT & KANBAN, PDSA cycle, Six sigma, Taguchi methods.

TEXT BOOKS

1. D. Besterfield, Total Quality Management, 2007, PHI.
2. E. L. Grantt, Statistical Quality Control, 7th Edition, 2008, Tata Mc-Graw Hill.

REFERENCES

1. P.Charntimath, Total Quality Management, 2006, Pearson Education.
2. L.Suganthi, Anand A. Samuel, Total Quality Management, 2004, PHI.
3. D. Besterfield, Quality Control, 7th Edition, 2008, Pearson Education.
4. D.C. Montgomery, Introduction to Statistical Quality Control, 4th Edition, 2008, Wiley India.

COMPUTER INTEGRATED MANUFACTURING

11-ME338

L-T-P
3-0-0

INDUSTRIAL AUTOMATION: Definition of Automation, Type of Automation, Reason for Automating, Automation Strategies, production concepts and mathematical models, Merits and Demerits of Automation. **NUMERICAL CONTROL:** Introduction, Need of Numerical Control, Basic Components of an NC systems, Types of NC systems, Problems with Conventional NC, Direct Numerical Control, Computer Numerical Control. **GROUP TECHNOLOGY:** Role of group technology in CAD/CAM integration, Methods for developing part families, Classification and coding- MICLASS, OPITZ, CODE systems, Facility design using group technology, Benefits of G.T., Cellular Manufacturing. **FMS:** Components of FMS, Types of FMS, FMS workstation, Material Handling and Storage Systems, FMS Layout, Computer control system, Application and Benefits. **FUNDAMENTALS OF CAD/CAM:** Computer Aided Design-Application of computers in design, a typical CAD system; Computer aided manufacturing-manufacturing planning, manufacturing control; Computer Integrated manufacturing. **COMPUTERIZED MANUFACTURING PLANNING SYSTEMS:** Computer aided process planning- Retrieval CAPP, Generative CAPP; Benefits of CAPP., Computer integrated production planning systems, Material requirements planning-Fundamental concepts in MRP, Inputs to the MRP system, Benefits of MRP., Capacity planning. **SHOP FLOOR CONTROL AND AUTOMATIC IDENTIFICATION TECHNIQUES:** Shop floor control, Factory Data collection systems, Automatic Identification systems, Bar code technology, automated data collection systems. **COMPUTER NETWORKS FOR MANUFACTURING:** Hierarchy of computer in manufacturing, Local area networks, Manufacturing Automation Protocol. **THE FUTURE AUTOMATED FACTORY:** Trends in manufacturing, The future Automated Factory, Human workers in the future automated Factory, The social impact.

TEXT BOOKS:

1. Mikell.P.Groover “Automation, Production Systems and computer integrated manufacturing”, Pearson Education, 2007.

REFERENCE BOOKS:

1. Mikell.P.Groover and Emory Zimmers Jr., “CAD/CAM”, Prentice Hall of India Pvt. Ltd., 2008.
2. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe “Computer Integrated Design and Manufacturing”, McGraw-Hill Inc.
3. Yorem koren, “Computer Integrated Manufacturing System”, McGraw-Hill, 1983.

COMPUTER AIDED DESIGN

11-ME339

L-T-P
3-0-0

INTRODUCTION: Fundamentals of CAD, Design process, Applications of computer for design, Benefits of CAD, Computer peripherals for CAD work station, Graphic terminal, CAD software, CAD database and structure.

DISPLAY DEVICES: Video display devices – Raster scan display, CRT , DVST, Inherent memory display devices, Random Scan Display, Raster scan systems – Video controller, Random scan systems – Graphic monitors and work station, Input devices.

PRIMITIVES: Points and Lines, Line drawing algorithms, DDA algorithm, Bresenham's line algorithm, Circle generation algorithm, Mid point circle algorithm.

GEOMETRIC MODELING: 2D wire frame modeling, 3D Wire frame modeling, Wire frame models , Entities and their definitions. Concept of Parametric and nonparametric representation of curve, Curve fitting techniques, Definitions of cubic splines.

SURFACE MODELING: Surface modeling and entities, Algebraic and geometric form, Parametric space of Surface, Blending functions, Reparametrisation of surface patch, Sub dividing cylindrical surface, Ruled surface, Surface of revolution, Spherical surface, Composite surface.

SOLID MODELING: Solid models, Solid entities, Solid representation, Sweep representation, Constructive solid geometry and Boundary representation, Solid modeling based applications.

GEOMETRIC TRANSFORMATIONS: Transformation Principles, Translation, Scaling, Rotation, Matrix Representations and Homogeneous Coordinates, Composite transformations and other transformations

WINDOWS and CLIPPING: Introduction, The Viewing Transformation, Viewing transformation implementation, Clipping operation.

TEXT BOOKS:

1. CAD/CAM by Mikel P. Groover and Emory W. Zimmers, Prentice Hall of India , Delhi
2. CAD/CAM by P.N. Rao, Tata McGrawhill , Delhi
3. CAD by Ibrahim Zeid, Tata McGrawhill, Delhi.
1. Principles of Interactive Computer Graphics by Newman and Sproull, McGrawhill

NON-CONVENTIONAL ENERGY SOURCES

11-ME340

L – T – P
3 – 0 – 0

Introduction & Energy Overview: Classification of Energy Sources; Advantages of Non Conventional Energy Sources over Conventional Sources. Economics, Impact on Environment. **Solar Energy Collection:** flat plate collectors, concentrating collectors. Effects of various parameters on the performance Solar energy Utilization:- Application of solar energy in heating, cooling, pumping, power production, distillation, drying, solar cookers, solar pond, solar furnace. Solar Energy Storage Methods of storage such as sensible, latent heat & thermo chemical storage. **Energy From Ocean:** Tidal Power:- types of tidal plants such as single and two basin plants, operation of tidal power plant and power generation, Ocean thermal energy conversion system., Open & Closed OTEC cycles, Wave energy: Wave energy conversion machines and recent advances. **Wind Power:** Wind speed data, power in the wind, wind power development, types of wind mills, application for pumping and power generation. **Biomass Energy Resources:-**Mechanism of green plant photo-synthesis, efficiency of conversion, solar energy plantation. **Biogas** Types of biogas plants, factors affecting production rates, Pyrolysis, Gasifiers - Types & classification. **Geothermal Energy Resources,** power generation methods like vapour dominated, water dominated, flash steam, binary fluid and total flow concept of power generation. **Direct Energy Conversion:-** Photo voltaic cells:- Principle, concept of energy conversion, Conversion efficiency, power output and performance, storage. **Fuel Cells:** Principles types of fuel cells, conversion efficiency. Magneto hydrodynamic generators Operating principle power output, analysis of MHD, seeding, power generation.

TEXT BOOKS

1. Power Plant Technology, M.M. El-Wakil McGraw Hill
2. Nonconventional Energy Resources By Philip R. Pryde,

REFERENCE BOOKS

1. Non-conventional Sources of Energy by G.D. Rai, Khanna Publishers
2. Non-Conventional Energy by Ashok V Desai, Wiley Eastern Ltd. New Delhi

MANAGEMENT INFORMATION SYSTEMS

11- ME341 / 11-OE304

L-T-P
3-0-0

(Pre-requisite = NIL) 3 Credits

Introduction to MIS, MIS-A Support to the management, MIS_A tool for management, MIS-An organization, MIS-business planning, Basics of Management Information System – Decision making concepts, Decision methods, Tools and Procedures. Information-Information concepts, Information ; A quality product.

MIS Systems-System concepts, System controls, system analysis and design-Introduction, the need for system analysis,; system analysis of existing system, system analysis of new requirements. Development of MIS: The factors of success and failure, choice of information Technology and the Management Information systems.

Applications of Management Information systems-Applications in production management, MIS: Service industry, Deterministic systems (DSS), Enterprise Resource Planning Systems (ERP).

Technology in management Information system-Introduction to Technology of Information System, Data Base Concepts, Introduction to Object – Oriented Technology, Introduction to Networks.

Business Process Re-Engineering (BPR) – Introduction, Business Process, MIS & BPR, Electronic Business Technology, Introduction to E-Business, Models of E-Business, MIS & E-Business, Web : A Tool for business management, Internet and web and process of management, Strategic management under web, MIS in web environment.

TEXT BOOK

1. Management Information Systems (Second Edition) – W.S. Jawadekar, Tata McGraw Hill

REFERENCES

1. Management Information Systems The Managers View (4th Edition) – Robert Sculthers & Mary Sumner
2. Management Information System – Laudon, Pearson Education.

CELLULAR MANUFACTURING SYSTEMS

11-ME342

L-T-P
3-0-0

Concept of group machining, Terminologies associated with Cellular manufacturing, cell characteristics objectives of cellular manufacturing, areas of applications of Cellular Manufacturing, benefits – introduction of Cellular Manufacturing, factors influencing success of Cellular Manufacturing, comparison between tradition and Cellular Manufacturing System. **Classification and coding systems,** flow analysis, production flow analysis, component flow analysis, introduction to cell formation techniques, design and manufacturing attributes, cell formation techniques such as rank order clustering, similarity coefficient methods, Classification Identification Algorithms, Bond Energy Algorithms, Data Structures and its influence on solutions, other factors in cell design consideration. **Processing exceptional Cell Manufacturing,** factors influencing, study of elementary models, algorithms for evaluation of cells such as measures of effectiveness, machine utilization, grouping efficiency, cell efficiency, cell evaluation by points method, measure of cell flexibility, selection of solution, cell size, number of cells and its influence , performance of cells. **Production control activities in cell manufacturing,** scheduling in cell manufacturing, study of elementary models, line balancing in cellular manufacturing, study of elementary models, inventory control in cellular manufacturing, study of elementary models. **Implementation issues in Cellular Manufacturing,** economic justification of cellular manufacturing, benefits of cellular manufacturing, organizational and behavioral issues in the implementation of cellular manufacturing. Case study on application of cellular manufacturing.

Text Books:

1. BS Nagendra Parashar (2009), Cellular Manufacturing Systems and Integrated Approach, PHI Publications, New Delhi)

Reference Books:

1. Nancy L Hayer, Wemmerlov.U (2002), Reorganizing the factory– competing through cellular manufacturing, productivity press publications, USA