MECHANICAL ENGINEERING

VII SEMESTER

COURSE CODE	THEORY/LAB	L	T	P	C
AME1130	CAD/CAM	4	0	0	4
AME1131	Robotics	4	1	0	4
AME1132	Finite Element Method	4	0	0	4
AME1133	Mechatronics	4	1	0	4
	Elective-I	4	0	0	4
AME1134	Design Optimization				
AME1135	Non-Conventional Sources of Energy				
AME1136	Rapid Prototyping				
AIT1114	Data Structures for Engineering Applications	4	1	0	4
	Elective-II	4	0	0	4
AME1137	Mechanics of Composites				
AME1138	Power Plant Engineering				
AME1139	Project Management				
AME1149	Introduction to Aircraft Systems	4	0	0	4
AME1140	Mechatronics Lab& Instrumentation Lab	0	0	3	2
AME1141	CAD/CAM Lab	0	0	3	2
AME11MP	Industry Oriented Mini-Project	-	-	-	2
	Total	**24**	**2**	**6**	**30**

* Mini Project to be carried out during the summer vacation after VI Semester examination

* Evaluation at the beginning of the VII Semester

CAD/CAM

Course Code: AME1130

L	T	P	C
4	0	0	4

AIM AND OBJECTIVES:

To provide the students basic understanding of modern trends in design and manufacturing using CAD/CAM

UNIT-I

Introduction to CAD/CAM, Product cycle, Design process, Application of computers for design, benefits of CAD.

CAD / CAM hardware: Design workstation, graphics terminal, input devices, output devices, CPU, storage devices.

UNIT-II

Computer Graphics: Coordinate systems, database structures for graphic modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT-III

Geometric modeling: Requirements, geometric models, geometric construction methods, wire frame model, curve representation methods, surface model, surface representation methods, modeling facilities desired.

UNIT-IV

Drafting and Modeling systems: An overview of CAD software, basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling, constraint based modeling.

UNIT-V

Numerical control: Basic components of NC system, NC procedure, Coordinate systems, NC motion control systems, applications, economics of NC, CNC, DNC, adaptive control, machining centers.

UNIT-VI

CNC Programming: Part programming fundamentals, manual part programming, preparatory functions, miscellaneous functions, canned cycles, Computer Aided Part Programming, APT language structure, geometry commands, motion commands, post processor commands.

UNIT-VII

Group Technology: Part family, parts classification and coding, machine cells, benefits of group technology, computer aided process planning.

Computer Aided Quality Control: Terminology in quality control, computer in QC, contact inspection methods, noncontact inspection methods, integration of CAQC with CAD/CAM.

UNIT-VIII

Flexible manufacturing systems: FMS equipment, system layouts, FMS control, case study.

CIM: Integration, CIM implementation, Benefits of CIM, lean manufacturing.

TEXT BOOKS:

1. P.N. Rao, CAD / CAM Principles and Applications, TMH, second edition, 2008
2. M.P. Groover and E.W. Zimmers, CAD/CAM , PHI, First edition, 1995

REFERENCES:

1. Ibrahim Zeid, CAD / CAM Theory and Practice,TMH, special Indian edition, 2007
2. T.K. Kundra, P.N. Rao and N.K. Tewari, Numerical control and computer aided manufacturing,TMH, first edition, 2002
3. Chris McMahon and Jimmie Browne, CAD/CAM principles, practice and manufacturing management, Pearson education, second edition, 2001.

ROBOTICS

Course Code: AME1131

L	T	P	C
4	1	0	4

AIM AND OBJECTIVES:

1. To study various industrial robots and their applications.
2. To study kinematics and dynamics associated with the robot linkages.

UNIT-I

INTRODUCTION : Automation and Robotics, CAD/CAM and Robotics, An over view of Robotics, present and future applications, classification by coordinate system and control system.

UNIT-II

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom; Requirements and challenges of end effectors, determination of the end effectors.

UNIT- III

MOTION ANALYSIS : Homogeneous transformations as applicable to rotation and translation – problems.

UNIT-IV

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation, joint coordinates and world coordinates, Forward and inverse kinematics – problems.

UNIT-V

ROBOT DYNAMICS : Differential transformation and manipulators, Jacobians – problems. Dynamics: Lagrange-Euler and Newton- Euler formations – Problems.

UNIT-VI

TRAJECTORY PLANNING AND PROGRAMMING : Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion, straight line motion; Robot programming languages and software packages.

UNIT-VII

ROBOT ACTUATORS AND FEED BACK COMPONENTS: Actuators: Pneumatic, Hydraulic actuators, Servo motors, Stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders; Velocity sensors; Tactile, Proximity and Range sensors.

UNIT-VIII

ROBOT APPLICATIONS IN MANUFACTURING : Material Transfer - Material handling, loading and unloading; Processing - spot and continuous arc welding & spray painting; Assembly and Inspection.

TEXT BOOKS:

1. Groover M P, "Industrial Robotics", 3rd Edition, Pearson Edu, 2002.
2. Mittal R K & Nagrath, "Robotics and Control ", 2nd Edition, TMH, 2008.

REFERENCES:

1. Fu K S, "Robotics", 1st Edition, McGraw Hill, 2004.
2. P. Coiffet and M. Chaironze, "An Introduction to Robot Technology", Kogam Page Ltd., 1983 London.
3. Richard D. Klafter, "Robotic Engineering", Prentice Hall, 1998.
4. John J Craig, "Introduction to Robotics", Pearson Edu. 2005.
5. Mark W. Spong and M. Vidyasagar, "Robot Dynamics & Control", John Wiley & Sons (ASIA) Pte Ltd.

FINITE ELEMENT METHOD

Course Code: AME1132

L	T	P	C
4	0	0	4

AIM AND OBJECTIVES:

The present course introduces the final year student to the theory behind the fundamental concepts of FEM like discretization, nodes, degrees of freedom, , global stiffness matrix, Load vector, isoparametric representation etc.

At the end of the course the student will be in a position to use as well as validate if necessary, related software.

UNIT-I

Introduction to Finite Element Method for solving field problems, Stress and Strain, Equilibrium equations, Strain–Displacement relations, Stress–Strain relations.

UNIT-II

One-Dimensional problems: Finite element modeling, coordinates and shape functions. Potential Energy approach, Galerkin approach, Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT-III

Analysis of Plane Trusses**:** Local and Global Coordinate systems, Transformation matrix, Element stiffness matrix, Stress calculations.

Analysis of Beams**:** Element stiffness matrix for two node, two degrees of freedom per node beam element.

UNIT-IV

Two dimensional problems using constant strain triangles, Isoparametric representation, Problem modeling and boundary conditions.

UNIT-V

Axisymmetric solids subjected to axisymmetric loading with triangular elements.

UNIT-VI

Two dimensional four noded isoparametric elements and numerical integration.

UNIT-VII

Steady state heat transfer analysis: one dimensional analysis of a fin and two dimensional analysis of thin plate.

UNIT-VIII

Dynamic Analysis: Formulation of finite element model, element matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam.

TEXT BOOK:

1. Chandrupatla TR, and Belegundu AD, Introduction to Finite Elements in Engineering, Prentice Hall of India, 3rd Edition, 2009.

REFERENCES:

1. SS Rao, The Finite Element Methods in Engineering, Pergamon Press, second edition, 1999.
2. JN Reddy, An introduction to Finite Element Method, McGraw Hill, 3rd edition, 2007.
3. Zienkiewicz, The Finite Element Method in Engineering Science, McGraw Hill, 1971.

MECHATRONICS

Course Code: AME1133

L	T	P	C
4	1	0	4

AIM:

Mechatronics is the new industrial discipline for understanding how complex systems integrate various elements in the mechanical, fluid power, and controls domain, combined with the ability to work in a team environment with people of different areas of expertise.

OBJECTIVE:

Students will learn the necessary background and technical skills to build simple home made projects using electronic devices integrating with mechanical principles/systems.

UNIT-I

Introduction to Mechatronics: Elements of Mechatronic system, system, measurement systems, control systems - open loop, closed loop systems, feed back and feed forward control systems, servomechanisms, applications of mechatronic systems; An overview of different sensors and transducers.

UNIT-II

Signal Conditioning: Introduction, Analog signal processing; Noise reduction and filtering, Passive and active filters, types of filters; Operational amplifiers-circuits for inverting, non inverting, difference amplifiers, integrator, differentiator, comparator and sample and hold applications (no analytical treatment.); ADC; DAC; Data acquisition; Digital signal processing.

UNIT-III

Actuation systems: Pneumatic and Hydraulic systems, overview of components of hydraulic system, Overview of components of electro-pneumatic systems; Basic hydraulic circuits-single acting cylinder, double acting cylinder, sequencing circuit

Electrical actuating systems: Relays, types of DC motors, AC motors, Stepper motor, servo motor, Induction motor.

UNIT-IV

Introduction to Digital Logic: Logic gates-AND, OR, NOT, NAND, NOR, XOR, Boolean algebra, Simple applications of Logic Gates, Sequential logic, Introduction to Flip-Flops, Registers.

UNIT-V

Microprocessors and Microcontrollers Overview: Structure of microcomputer, block diagram of microprocessor, block diagram of microcontroller, application of microprocessor control: temperature monitoring system, washing machine system.

UNIT-VI

Programming Logic Controllers: Basic Structure, Programming, Ladder diagram, Timers, Internal Relays, Counters, Shift Registers, Master and Jump Controls, Data Handling and manipulation.

UNIT-VII

Basic System Models: Basic concepts on mechanical, electrical, fluid and thermal systems building blocks; System transfer functions: Laplace transforms and applications to first order functions; Process controllers-P, PI, PID Control modes.

UNIT-VIII

Programmable Motion Controllers: Multi axis Interpolation, PTP, Linear,

Circular; Core functionalities: Home, Record position, Go to Position;

Design of mechatronic system: coin counter, engine management system, antilock brake system, automatic camera.

TEXT BOOKS:

1. K. P. Ramachandran, et al, Mechatronics-integrated mechanical Electronic systems, 1st edition, Wiley India pvt, Ltd., 2008.
2. R.K. Rajput, A text book of Mechatronics, 1st edition, S. Chand and Company Ltd., 2007

REFERENCES:

1. Bolton W., Mechatronics – Electronics Control Systems in Mechanical and Electrical Engineering, 3rd edition, Pearson Education Press, 2005
2. Histand B.H., Alciatore D.G., Introduction to Mechatronics and Measurement Systems, 3rd edition ,Tata McGraw Hill Publishing Company Ltd, 2007.

DESIGN OPTIMIZATION

(ELECTIVE - I)

Course Code: AME1134

L	T	P	C
4	0	0	4

AIM:

The student will be able to:

- acquire the insights into different optimization methods, technology and terminology
- analyse, formulate and solve optimization problems
- evaluate the optimization results and suggest possible changes in the existing design solution

OBJECTIVES:

- To provide basic knowledge in recent design optimization methods
- To demonstrate the optimal design of typical problems in engineering

UNIT-I

Introduction, General Characteristics of mechanical elements, adequate and optimum design, principles of optimization, formulation of objective function, design vector, design constraints, constraint surface, Classification of optimization problems.

UNIT-II

Classical optimization techniques: Single variable optimization - Multivariable optimization without constraints - Multivariable optimization with equality constraints: direct substitution method and method of Lagrange multipliers.

UNIT-III

Unconstrained nonlinear single variable optimization: Unimodal function, Exhaustive search, Interval halving method, Golden Section method, Quadratic search, Newton method.

UNIT-IV

Unconstrained nonlinear multivariable optimization: Univariate search,

Steepest descent (Cauchy's) method, Fletcher-Reeves method, Newton's method.

UNIT-V

Constrained nonlinear optimization problems: Characteristics - Interior penalty function method and exterior penalty function method

UNIT-VI

Geometric programming: Introduction - Solution by differential calculus - Solution by arithmetic-geometric inequality - Degree of difficulty - Optimization of zero degree of difficulty problems.

UNIT-VII

Concepts of Multi-objective optimization and Multi-stage optimization.

Introduction to Genetic Algorithms, Simulated Annealing and Neural Networks.

UNIT-VIII

Engineering applications: Optimal design of beams and torsionally loaded shafts- Optimal design of springs.

TEXT BOOKS:

1. Singerusu S. Rao, Engineering Optimization -Theory and Practice, New Age International, 2006.
2. Kalyanmoy Deb, "Optimization for Engineering Design-Algorithms and Examples", PHI, 1996.

REFERENCES:

1. Ashok D. Belegundu and Tirupathi R. Chandrupatla, Optimization Concepts and Applications in Engineering, Pearson Education, Asia, 2002
2. Johnson, Ray C., Optimum Design of Mechanical Elements, Johnson Wiley & Sons, Ic., NY, 1980.
3. Goldberg D. E., Genetic Algorithms in search, Optimization and Machine, Addison-Wesley, NY

NON CONVENTIONAL SOURCES OF ENERGY

(ELECTIVE –I)

Course Code: AME1135

L	T	P	C
4	0	0	4

AIM:

To introduce and familiarize the student with the various renewable sources of energy.

OBJECTIVE:

Renewable sources of energy is an area of research and development especially for countries like India. So the student should be in a position to take up small scale projects, as entrepreneurs, since the cost of investment is minimal in some of the sources.

UNIT-I

Introduction to various renewable sources of energy.

SOLAR RADIATIONS: Extra terrestrial radiation, Spectral distribution, Solar constant, Solar radiations on earth, Measurement of solar radiations, Solar radiation geometry, Longitude, Latitude, Declination angle, Surface azimuth angle, Hour angle, Zenith angle, Solar altitude angle expression for angle between incident beam and the normal to a plane surface (no derivation), Local apparent time, Apparent motion of sun, Day length, Solar radiation data for India.

UNIT-II

SOLAR ENERGY : Solar thermal power and its conversion, Solar collectors, Flat plate, Performance analysis of flat plate collector, Solar concentrating collectors, Types of concentrating collectors, Cylindrical collectors, Thermal analysis of solar collectors, Tracking CPC and solar swing . Solar thermal energy storage, Different systems, Solar pond. Applications - Water heating, Space heating & cooling, Solar distillation, solar pumping, solar cooking, Greenhouses, Solar power plants.

SOLAR PHOTOVOLTAIC SYSTEM : Photovoltaic effect, Efficiency of solar cells, Semiconductor materials for solar cells, Solar photovoltaic system, Standards of solar photovoltaic system, Applications of PV system, PV hybrid system.

UNIT-III

WIND ENERGY: Properties of wind, Availability of wind energy in India, wind velocity, Wind machine fundamentals, Types of wind machines and their characteristics, Horizontal and Vertical axis wind mills, Elementary design principles, performance characteristics, Betz criteria Coefficient of performance of a wind mill rotor, Aerodynamic considerations in wind mill design, Selection of a wind mill, Wind energy farms, Economic issues, Recent developments.

UNIT-IV

BIO-MASS AND BIO-GAS: Principles of Bio-Conversion, Photosynthesis, Bio gas production, Aerobic and anaerobic bio-conversion process, Raw materials, Properties of bio gas, Producer gas, Transportation of bio gas, bio gas plant technology & status, Community biogas plants, Problems involved in bio gas production, Bio gas applications, Biomass conversion techniques, Biomass gasification, Energy recovery from urban waste, Power generation from liquid waste, Biomass cogeneration, Energy plantation, Fuel properties, Biomass resource development in India.

UNIT-V

OCEAN ENERGY: Principle of ocean thermal energy conversion, Wave energy conversion machines, Power plants based on ocean energy, Problems associated with ocean thermal energy conversion systems, Thermoelectric OTEC, Developments of OTEC.

TIDAL POWER: Tides and waves as sources of energy, Fundamentals of tidal power, Use of tidal energy, Limitations of tidal energy conversion systems.

UNIT-VI

GEOTHERMAL ENERGY: Structure of earth's interior, Geothermal sites, earthquakes & volcanoes, Geothermal resources, Hot springs, Steam ejection, Principle of working, Types of geothermal station with

schematic representation, Site selection for geothermal power plants. Advanced concepts, Problems associated with geothermal conversion.

UNIT-VII

ELECTROCHEMICAL EFFECTS AND FUEL CELLS: Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells, Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells

HYDROGEN ENERGY: Properties of hydrogen in respect of its use as source of renewable energy, Sources of hydrogen, Production of hydrogen, Storage and transportation, Problems with hydrogen as fuel, Development of hydrogen cartridge, Economics of hydrogen fuel and its use.

UNIT-VIII

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule-Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, Hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects.

TEXT BOOK:

Rai G.D, Non-Conventional energy Sources, Khanna Publishers, Fourth Editon, 2008

REFERENCE:

Kothari D.P., Renewable energy resources and emerging tech., Prentice Hall of India Pvt. Ltd, 1st Edition, 1990.

RAPID PROTOTYPING

(ELECTIVE - I)

Course Code: AME 1136

L	T	P	C
4	0	0	4

AIM:

- Generating a good understanding of RP and applications.
- Expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.

OBJECTIVES :

The student will able to:

- Understand the principles of RP and its applications.
- Acquaint with different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.

UNIT-I

INTRODUCTION: Prototype, Historical Development, Fundamentals of Rapid Prototyping, Advantages of Rapid Prototyping, Applications, Commonly Used Terms, Classification of RP System.

Rapid Prototyping Process Chain: Process Chain, Data Conversion and Transmission, Checking and Preparing, Building, Post processing.

UNIT-II

LIQUID BASED RAPID PROTOTYPING SYSTEMS : Principle of operation, process details, data preparation, data files, machine details and applications - Stereo lithography Apparatus (SLA), Solid Ground Curing (SGC)

UNIT-III

SOLID BASED RAPID PROTOTYPING SYSTEMS: Principle of operation, process details, data preparation, data files, machine details and applications - Laminated Object Manufacturing (LOM), Fused Deposition Modeling (FDM), Paper Lamination Technology (PLT)

UNIT-IV

POWDER-BASED RAPID PROTOTYPING SYSTEMS : Principle of operation, process details, data preparation, data files, machine details and applications - Selective Laser Sintering (SLS), Three- Dimensional Printing (3DP), Laser Engineered Net Shaping (LENS), Direct Shell Production Casting (DSPC).

UNIT-V

RAPID TOOLING : Indirect Rapid tooling - Silicon rubber tooling - Aluminum filled epoxy tooling Spray metal tooling, Cast kirksite, 3D keltool; Direct Rapid Tooling - AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, ProMetal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

UNIT-VI

RAPID PROTOTYPING DATA FORMATS AND SOFTWARE: STL Format, STL File Problems, Consequences of Building a Valid and Invalid, Tessellated Model, Overview of Solid view, magics, mimics, magic communicator. Collaboration tools, Rapid Manufacturing Process Optimization: factors influencing accuracy, data preparation errors, Part building errors, Error in finishing, influence of build orientation.

UNIT-VII

REVERSE ENGINEERING : Meaning and uses of RE, Relationship between Reverse Engineering and Rapid Prototyping, Legal Aspects of Reverse Engineering. The generic processes of RE, Phase 1–scanning, Contact Scanners, Noncontact Scanners, Phase 2–Point Processing, Phase 3–Application Geometric Model Development, Reverse Engineering–Hardware and Software.

UNIT -VIII

METHODOLOGIES and Techniques for Reverse Engineering: Computer Vision and Reverse Engineering, Coordinate Measuring Machines, Active Illumination 3-D Stereo, Data Collection, Mesh Reconstruction, Surface Fitting. Integration of reverse engineering and rapid prototyping.

TEXT BOOKS:

1. Chua, C. K., K. F. Leong and C. S. Lim, 2003, Rapid Prototyping: Principles and Applications, World Scientific, River Edge, NJ.
2. Amitabha Ghosh, 1997, Rapid Prototyping - A Brief Introduction, Affiliated East West Press Pvt. Ltd.

REFERENCES:

1. Peter D. Hilton, Hilton/Jacobs, Paul F. Jacobs, Rapid Tooling: Technologies and Industrial Applications, CRC press, 2000.
2. Ali K. Kamrani, Emad Abouel Nasr, Rapid Prototyping: Theory and practice, Springer, 2006.
3. Liou W. Liou, Frank W. Liou, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press, 2007
4. Ingle Kathryn A., Reverse Engineering, McGraw Hill Publication Ltd.

DATA STRUCTURES FOR ENGINEERING APPLICATIONS

(ELECTIVE - I)

Course Code: AIT1114

L	T	P	C
4	0	0	4

AIM:

To empower students to build efficient software applications with suitable data structures.

OBJECTIVE:

To introduce various data storage and organization techniques and enable the students to implement them.

UNIT-I

RECURSION AND LINEAR SEARCH : Preliminaries of algorithm, Algorithm analysis and complexity, Recursion: Definition, Design Methodology and Implementation of recursive algorithms, Linear and binary recursion, recursive algorithms for factorial function, GCD computation, Fibonacci sequence, Towers of Hanoi.

Chapters 1, 2 from Text Book 1;Chapters 1, 2 from Text Book 2.

UNIT- II

SEARCHING TECHNIQUES : Introduction, Linear Search, Transpose Sequential, Search, Interpolation Search, Binary Search, Fibonacci Search.

Chapter 15 from Text Book 2.

UNIT-III

SORTING TECHNIQUES : Basic concepts, insertion sort, selection sort, bubble sort, quick sort, merge sort.

Chapter 12 from Text Book 1

UNIT-IV

STACKS : Basic Stack Operations, Representation of a Stack using Arrays, Stack Applications: Reversing list, Factorial Calculation, in-fix-to postfix Transformation, Evaluating Arithmetic Expressions.

Chapter 3 from Text Book 1.

UNIT-V

QUEUES : Basic Queues Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack.

Chapter 4 from Text Book 1.

UNIT-VI

APPLICATIONS OF QUEUES : Applications of Queues- Enqueue, Dequeue, Circular Queues, Priority Queues.

Chapter 4 from Text Book 1.

UNIT-VII

LINKED LISTS : Introduction, single linked list, representation of a linked list in memory, Operations on a single linked list, merging two single linked lists into one list, Reversing a single linked list, Circular linked list, Double linked list.

Chapter 6 from Text Book 2.

UNIT-VIII

TREES : Basic tree concepts, Binary Trees: Properties, Representation of Binary Trees using arrays and linked lists, operations on a Binary tree , Binary Tree Traversals (recursive), Creation of binary tree from in-order and pre(post)order traversals.

Chapter 8 from Text Book 2.

TEXT BOOKS:

1. Richard F, Gilberg & Behrouz A. Forouzan : Data Structures, 2nd Edition, Thomson, 2007.
2. GAV PAI: Data Structures and Algorithms, 1st Edition, Tata McGraw-Hill, 2010.

REFERENCES:

1. Seymour Lipschutz, Data Structure with C, 1st Edition, TMH, 2009.
2. Debasis ,Samanta, Classic Data Structures, 2nd Edition, PHI, 2009
3. Horowitz,Sahni, Anderson :Fundamentals of Data Structure in C, 2nd Edition, Freed, University Press, 2009.

MECHANICS OF COMPOSITES

(ELECTIVE - II)

Course Code: AME1137

L	T	P	C
4	0	0	4

AIM:

The aim of the course is to teach the mechanics of composites and various manufacturing methods of composites.

OBJECTIVE:

In under graduate student know about mechanics of isentropic materials only. Today most of the industrial applications the conventional materials are replaced with composites. So in postgraduate students has to understand the concepts of mechanics and ma manufacturing methods of composites.

UNIT-I

INTRODUCTION AND BASIC CONCEPTS : Geometric and Physical definitions, types and classification of composites - Fibres, Matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon fibre composites, natural and man-made composites, Aerospace and structural applications.

UNIT-II

REINFORCEMENTS: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT-III

MICROMECHANICS: Prediction of Elastic constant, Halpin-Tsai equations, Transverse stresses. mechanics of load transfer from matrix to fibre. Unidirectional composites, constituent materials and properties,

elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations.

UNIT-IV

COORDINATE TRANSFORMATIONS: Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation, Graphic interpretation of stress – strain relations. Off - axis, stiffness modulus, off - axis compliance.

UNIT-V

ELASTIC BEHAVIOR OF UNIDIRECTIONAL COMPOSITES: Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

UNIT-VI

STRENGTH OF UNIDIRECTIONAL LAMINA: Micro mechanics of failure, Failure mechanisms, Strength of an orthotropic lamina, Strength of a lamina under tension and shear, maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects. Micro mechanical predictions of elastic constants.

UNIT-VII

ANALYSIS OF LAMINATED COMPOSITE PLATES

Introduction, thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory.

UNIT-VIII

MANUFACTURING METHODS: Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

TEXT BOOKS:

1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1975.
2. Engineering Mechanics of Composite Materials by Isaac and M.Daniel, Oxford University Press, 1994.

REFERENCES:

1. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980.
2. L.R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York, 1969.

POWER PLANT ENGINEERING

(ELECTIVE - II)

Course Code: AME1138

L	T	P	C
4	0	0	4

AIM AND OBJECTIVES:

Through this course the student gains knowledge and develops an awareness of the different technologies adopted in the world for the generation of electrical energy or energy conversion from steam, natural water, fossil fuels like gas and Diesel oil and nuclear materials. The course also includes pollution control measures and the economic aspects of power plant operation and a brief introduction to non-conventional energy sources like solar energy, wind energy and so on.

UNIT-I

THERMAL POWER PLANTS-I: Introduction to energy sources, conventional and non-conventional, power development in India

Constituents of a thermal power plant, plant layout and different circuits and schematic diagrams showing material flow, types of coal, ash content, grades of coal, coal handling and choice of equipment, crushing, grinding and pulverizing of coal, coal storage and stockyards, auto-ignition of coal, dust suppression, associated problems.

UNIT-II

THERMAL POWER PLANTS-II: Combustion of coal, effects of ash content, different stokers, spreaders, combustion needs and draught system, cyclone furnace details, coal burners, fluidized beds, cooling towers, feed water treatment and corrosion control, dust collection methods like bag filters, cyclones and electrostatic precipitators.

UNIT-III

HYDRO-ELECTRIC POWER PLANTS: Water power, concepts of potential energy and available head, calculation of available power, hydrological cycle, flow measurement, hydrographs, drainage, reservoirs,

dams, spillways, storage and pondage, classification, typical layouts with main and ancillary equipment like draft tubes and surge tanks, suitability of Pelton wheel, impact and reaction turbines, cavitation, pumped storage plants, plant operation

UNIT-IV

DIESEL POWER PLANTS: Range of power generation, comparison with thermal power plants, turbo-charging, advantages and limitations and applications, role as captive power plant, grades of suitable Diesel oils, storage in tanks, transport of fuel to the engine, starting of plant, lubrication and cooling water circuits, total plant layout

UNIT-V

GAS TURBINE POWER PLANTS: Range of power generation, availability and types of fuels, open and closed cycle layouts, combustion chambers and materials of constructions, comparison with other methods of power generation, limitations, plant auxiliaries, combined cycle power plants, advantages and comparison with other types, typical schematic flow diagrams

UNIT-VI

NUCLEAR POWER PLANTS: Principles of nuclear fission, chain reactions, uncontrolled and controlled, radio-active materials, nuclear fuels, breeding and fertile materials, radio-activity, nuclear reactors and classifications, essential components of reactors, PWR, BWR systems, cooling of reactors, shielding, radiation hazards and nuclear waste disposal, introduction to nuclear fusion

UNIT-VII

POWER PLANT ECONOMICS AND IMPACT ON ENVIRONMENT: Factors affecting type of power plant selection, considerations in plant location, demand and connected load, load curves, load duration curves, average load, maximum demand, various factors in operation, load factor, demand factor, utilization factor, diversity factor, their calculation, cost components plant construction and operation, plant life cycle, replacement

Pollutants from power plants, impact on environment, pollution control standards and pollution control methods

UNIT-VIII

NON-CONVENTIONAL ENERGY SOURCES: Introduction, solar energy, wind energy, tidal energy, geo-thermal energy, biomass, conversion, bio-gas plants, fuel cells

TEXT BOOKS:

1. R. K. Rajput, A text book of power plant engineering, Laxmi Publications, New Delhi
2. P. K. Nag, Power plant engineering , Tata McGraw-Hill, New Delhi

REFERENCES:

1. El-Wakil , Power station engineering , Tata McGraw-Hill, New Delhi
2. Arora and Domkundwar, A course in Power plant engineering, Tata McGraw-Hill, New Delhi

PROJECT MANAGEMENT

(ELECTIVE - II)

Course Code: AME1139

L	T	P	C
4	0	0	4

AIM AND OBJECTIVES:

This subject is a specialized area in Management. In the changing scenario every job, big or small, has to be considered as a separate entity or project for better control and timely completion of the total work. This course of project management introduces all aspects of project management like definition and characteristics of a project, project manager's role, project selection, stages in a project, work breakdown structure, planning, procurement, execution, project closure, project finance and other important topics like environment which bear on projects.

UNIT-I

Introduction, characteristics of a project, types of projects, Project Management Body of Knowledge (PMBOK), role of project manager, his qualities, project organization and benefits, idea generation, needs of society, import substitution, project life cycle, project charter, project sponsor

UNIT-II

Project planning, customer needs, stakeholder concept, Project scope, feasibility study and report, base line plan, SWOT analysis, project organization structure and hierarchy, project teams, formation, attitude and aptitude, work breakdown structure, project selection methods, break even analysis, DCF methods

UNIT-III

Project implementation, estimation, cost, price, value, scheduling, bar charts, network diagrams, PERT and CPM, schedule crashing, simple

introduction to risk management, probability in project management, decision trees

UNIT-IV

Procurement, vendor selection methods, JIT, supply chains, quality, quality circles, quality control and quality assurance, cause and effect analysis, ISO and concepts of total quality management and six sigma, resource planning and allocation, availability and constraints of resources, resource leveling and crashing

UNIT-V

Project control, project scope, project change request, control of schedule, resources, cost and quality, project communications, channels, means, meetings, project reports, project audits

UNIT-VI

Project evaluation, project close-out reports, guidelines, audit reports, maintenance and shutdown projects, plant turn-around and brief introduction to replacement analysis

UNIT-VII

Engineering projects, contour maps, site maps, plant layout, suitability of project site, preparation of site, selection and leasing of construction equipment

UNIT-VIII

Special considerations in selection and location of projects, safety, health, human and environmental factors, project finance, international projects, joint ventures, collaborations, impact of culture, implementation, and handing over of projects

TEXT BOOKS:

1. Essentials of Project Management by Kamaraju Ramakrishna, PHI Learning, New Delhi
2. Project Management by Maylor Harvey, Pearson Education, Harlow (UK)

REFERENCES:

1. Projects – Planning, analysis, selection, implementation and review by, Prasanna Chandra, Tata McGraw-Hill, New Delhi
2. Construction Project Management by Chitkara, Tata McGraw-Hill, New Delhi
3. Project Management by Harold Kerzner, Wiley, New York

INTRODUCTION TO AIRCRAFT SYSTEMS

(ELECTIVE - II)

Course Code: AME1149

L	T	P	C
4	0	0	4

AIM & OBJECTIVE:

The aim and objective of the present course is to provide the basic knowledge of aircraft systems

UNIT-I

AIRCRAFT INDUSTRY OVERVIEW : Evolution and History of Flight, Types Of Aerospace Industry, Key Players in Aerospace Industry, Aerospace Industry Trends, Advances in Engineering/CAD/CAM/CAE Tools and Materials technology, Global and Indian Aircraft Scenario

UNIT-II

INTRODUCTION TO AIRCRAFTS : Basic components of an Aircraft, Structural members, Aircraft Axis System, Aircraft Motions, Control surfaces and High lift Devices.

UNIT-III

TYPES OF AIRCRAFTS - Lighter than Air/Heavier than Air Aircrafts Conventional Design Configurations based on Power Plant Location, Wing vertical location, intake location, Tail Unit Arrangements, Landing Gear Arrangements.

UNIT-IV

BASIC PRINCIPLES OF FLIGHT: Significance of speed of Sound, Air speed and Ground Speed, Properties of Atmosphere, Bernoulli's Equation, Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift.

UNIT-V

DRAG, PITCHING MOMENTS: Types of Drag, Lift curve, Drag Curve, Lift/Drag Ratio Curve, Factors affecting Lift and Drag,

AEROFOIL NOMENCLATURE: Types of Aerofoil, Wing Section-Aerodynamic Center, Aspect Ratio, Effects of lift, Drag, speed, Air density on drag. Mach Waves, Mach Angles,

UNIT-VI

AIRCRAFT PERFORMANCE: Taking-off, climbing, cruise, Landing, Power Curves,

MANOEUVRES: Pull out dives, load Factor, Loads during a Turn, Correct and Incorrect Angles of Bank, Control and steep Banks, Inverted Maneuvers, Maneuverability.

UNIT-VII

STABILITY AND CONTROL: Meaning of Stabillity and Control, Degree of Stability- Lateral, Longitudinal and Directional Stability, Dihedral and Anhedral Angles, Control of an Aeroplane", Mechanical Systems, Electrical and Electronic Systems.

UNIT-VIII

MECHANICAL SYSTEMS: Environmental control systems (ECS), Pneumatic systems, Hydraulic systems, Fuel systems, Landing gear systems, Engine Control Systems, Air Conditioning Systems, Steering and Brakes Systems.

TEXT BOOKS:

1. Flight without Formulae by A.C Kermode, Pearson Education, 10th Edition
2. Mechanics of Flight by A.C Kermode, Pearson Education, 5th Edition
3. Fundamentals Of Flight, Shevell, Pearson Education, 2nd Edition
4. Introduction to Flight by Dave Anderson
5. Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration by Ian moir, Allan Seabridge

WEB RESOURCES:

1. http://www.aero.org/
2. http://www.rl.af.mil/rrs/resources/griffiss_aeroclub/aircraft.html

3. http://en.wikipedia.org/wiki/Tesla_turbine
4. http://ameslib.arc.nasa.gov/randt/1999/aero/aero.html
5. http://www.ctas.arc.nasa.gov/project_description/pas.html
6. http://www.moog.com/noq/_acoverview__c463/
7. http://www.dcmt.cranfield.ac.uk/aeroxtra/e339.htm

MECHATRONICS LAB & INSTRUMENTATION LAB

Course Code: AME1140

L	T	P	C
0	0	3	2

AIMS AND OBJECTIVES:

1. Become familiar with simple mechatronics equipment and principles of circuit design.
2. To enable students to practically apply the principles of measurement to engineering applications.

Note: Any five from Mechatronics Lab and any five from Instrumentation Lab

MECHATRONICS LAB

1. PTP control and linear interpolation of a linear conveyor using PMC.
2. PTP control and circular interpolation of a rotary table using PMC.
3. Simulation of basic hydraulic circuits for automating systems
4. Simulation of basic pneumatic circuits for automating systems.
5. Simulation of basic electro-hydraulic circuits for automating systems
6. 3-D Robot simulation for operation of Pick-place robot.
7. PLC programming in ladder logic and functional block diagram Software Packages from the following: P-Simulator, H-Simulator, Control-X, Robo-X, PLC Simulator

INSTRUMENTATION LAB

1. Calibration of pressure gauges
2. Calibration of thermistor for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.

4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotameter for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and measurement of vibration of stretched string.
12. Study and calibration of Mcleod gauge for low pressure.

REFERENCE :

George, Metallography Laboratory Practice, KEHL.

CAD/CAM LAB

Course Code: AME1141

L	T	P	C
0	0	3	2

Aim and Objectives:

The lab is composed of three sections. During the lab session, the students will be able:

1. To draw machine components with various manufacturing drawing symbols such as surface roughness, limits & fits, form tolerances.
2. To understand and know how to use the softwares for modeling and analysis.
3. To perform machining operations and generate NC code.

CAD / CAM LAB:

MANUFACTURING DRAWING

Introduction to representation of form tolerances, surface roughness, limits and fits

1. Details of protected flange coupling
2. Details of eccentric

PART MODELING & ASSEMBLY

Introduction to software commands

3. Part modeling & views
4. Assembly of screw jack
5. Assembly and simulation of 2-stroke petrol engine

FINITE ELEMENT ANALYSIS

Introduction to software commands

6. Static analysis of beam
7. Static analysis of plate with hole

SIMULATION OF MANUFACTURING OPERATION & NC CODE GENERATION

Introduction to software commands

8. Generation of NC code for drilling operation
9. Generation of NC code for milling operation
10. Generation of NC code for turning operation

TEXT BOOKS:

1. K.L. Narayana , P. Kannaiah & K. Venkata Reddy, Production Drawing, 3rd Edition, New Age Int. Publisher, 2011.

REFERENCES:

1. P.N. Reddy, J.A.J. Reddy&C.Srinivasa Rao, Production Drawing Practice, 2nd Edition, Hi-tech Pub, Hyd., 2002.
2. R.K. Jain, Engineering Metrology, 4th Edition, Khanna Publications, 2000.

SOFTWARE PACKAGES:

AutoCAD, CATIA, MasterCAM, UG-NX, Pro-E, ANSYS etc.

COURSE STRUCTURE & SYLLABI FOR VIII SEMESTER

VIII SEMESTER

COURSE CODE	THEORY/LAB	L	T	P	C
AME1142	Advanced Machining Process	4	0	0	4
	Elective-III	4	0	0	4
AME1143	Material Handling Equipment				
AME1144	Automobile Engineering				
AME1148	Value Engineering				
AME1150	Fluid Power Systems				
	Elective-IV	4	0	0	4
AME1145	Automation in Manufacturing				
AME1146	Computational Fluid Dynamics				
AME1147	Advanced Mechanics of Solids				
AME1151	Introduction to Aircraft Structures				
AME11SM	Seminar	0	0	3	2
AME11CV	Comprehensive Viva	-	-	-	4
AME11PW	Project work	0	0	9	12
	Total	**12**	**0**	**12**	**30**

ADVANCED MACHINING PROCESSES

Course Code: AME1142

L	T	P	C
4	0	0	4

AIM AND OBJECTIVE:

To create awareness and provide a Comprehensive reference for non-traditional machining processes and their applications.

The Student will be in a position to identify his machining needs for the job/work he takes up and apply the relevant modern/ non-traditional machining processes to produce finished products with a high degree of accuracy and surface quality.

UNIT–I

MATERIAL REMOVAL PROCESSES : Introduction, History of Machining, Traditional Machining processes, Nontraditional Machining processes, Hybrid machining processes. Need for non-traditional machining processes.

UNIT-II

MECHANICAL PROCESSES:ULTRASONIC MACHINING - Introduction, The machining system, Material removal process, Factors affecting material removal rate, Dimensional accuracy and surface quality, Applications.

WATER JET MACHINING - Introduction, The machining system, Process parameters, Applications, Advantages and disadvantages of WJM.

ABRASIVE JET MACHINING - Introduction, Machining system, Material removal rate, Applications, Advantages and limitations of AJM.

UNIT–III

CHEMICAL PROCESSES: CHEMICAL MILLING - Introduction, Tooling for CHM, Process parameters, Material removal rate, Accuracy and surface finish, Advantages, Limitations, Applications

PHOTOCHEMICAL MILLING - Introduction, Process description,

Applications, Advantages

Electro polishing - Introduction, Process parameters, Applications, Process limitations.

UNIT-IV

ELECTROCHEMICAL PROCESSES:Electro chemical machining - Introduction, Principles of electrolysis, Theory of ECM, ECM equipment, Basic working principles, Process characteristics, Process control, Applications

Basics of Electrochemical Drilling, Electro-Chemical Deburring, Electro stream drilling

UNIT-V

HYBRID ELECTROCHEMICAL PROCESSES: ELECTRO CHEMICAL GRINDING - Introduction, Material removal rate, Accuracy and surface quality, Applications, Advantages and disadvantages

ELECTROCHEMICAL HONING - Introduction, Process characteristics, Applications

ELECTROCHEMICAL SUPER FINISHING - Introduction, Material removal process, Process accuracy

ELECTROCHEMICAL BUFFING - Introduction, Material removal process

UNIT-VI

THERMAL PROCESSES I: General Principle and applications of Electric Discharge Machining **(EDM)**, 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, Process parameters, surface finish and machining accuracy, applications; **Micro EDM**.

UNIT-VII

THERMAL PROCESSES II: LASER BEAM MACHINING - Introduction, Material removal mechanism, Applications, Advantages and

limitations

ELECTRON BEAM MACHINING - Introduction, Basic equipment and removal mechanism, Applications, Advantages and disadvantages

PLASMA BEAM MACHINING - Introduction, Machining systems, Material removal rate, Accuracy and surface quality, Applications, Advantages and disadvantages

Ion Beam Machining - Introduction, Material removal rate, Accuracy and surface effects, Applications

UNIT – VIII

MATERIAL ADDITION PROCESSES: Introduction, classification.

LIQUID-BASED TECHNIQUES – Stereo-lithography, Holographic interference solidification, Beam interference solidification, Solid ground curing-Liquid thermal polymerization, Fused deposition modelling, Multi jet modelling, Ballistic particles manufacturing, Shape deposition manufacturing

POWDER-BASED PROCESSES- Selective laser sintering, Laser engineered net shaping, Three-dimensional printing

SOLID-BASED TECHNIQUES -Solid foil polymerization, Laminated object modelling

TEXT BOOK:

El-Hofy, Hassan Abdel-Gawad, "Advanced Machining Processes: Non traditional And Hybrid Machining Processes", McGraw-Hill, 2005

REFERENCES:

1. Pandey P.C. and Shah H.S., Modern Machining Processes, 1e, TMH, 2010
2. Bhattacharya A, New Technology, the Institution of Engineers, India 1984.
3. V. K. Jain, Advanced machining processes, 1e, Allied publishers, 2010.

MATERIALS HANDLING EQUIPMENT

(ELECTIVE-III)

Course Code: AME1143

L	T	P	C
4	0	0	4

AIM AND OBJECTIVES:

This subject is a highly specialized area in mechanical engineering. In almost all engineering industries, materials handling equipment are required for handling raw materials, semi-finished and finished goods. They are useful for bulk goods, piece goods and for automation. This course introduces the principles of operation of important materials handling equipment like belt, apron, flight, screw and overhead conveyors, cranes and stockyard equipment like, wagon tipplers and stackers and reclaimers, their description. The course includes some basic calculations also. Further studies in the subject will be greatly facilitated after completion of this course.

UNIT- I

Introduction to materials handling, examples of materials equipment

Classification of materials handling equipment, continuous conveying, intermittent conveying, examples, lifting, hoisting, handling of bulk goods and piece goods, cranes and conveyors

Principles of calculation of conveying equipment, cycle time, bulk materials and bulk density, angle of repose

Example of calculation for a belt conveyor and a simple hoist

UNIT-II

Belt conveyors, constructional details, troughing angle, idlers, belt specifications, chutes, skirt boards, ploughs

Belt conveyor layouts, belt trippers, typical examples

UNIT-III

Roller conveyors, overhead conveyors, apron conveyors, component parts and operational details and applications with typical layouts

UNIT-IV

Bucket elevators, screw conveyors, flight conveyors, component parts, operational details and applications with typical layouts

UNIT-V

Hoists, EOT cranes, specifications, component parts, ropes, pulley layouts, hoisting drums, arrangement of drive

Wire rope specifications and selection, simple calculation of bridge girder, types of crane hooks

UNIT-VI

Jib cranes, like wall-mounted and travelling type, stability criteria, wheel loads, wheel trucks and bogeys, number of mechanisms in jib cranes, jib construction

UNIT-VII

Harbour cranes, luffing and level-luffing cranes, shipyard gantry cranes, portal frames and slewing rings and bearings

Typical stability calculations of portal cranes

UNIT-VIII

Special materials handling equipment, wagon tipplers, stackers, reclaimers, their constructional details, typical materials handling layouts and applications

TEXT BOOKS:

1. Material Handling Equipment by Rudenko, MIR Publishers
2. Conveying Equipment by Spivakowsky, MIR Publishers

REFERENCES:

1. Bulk material handling by conveyor belt I & II by R.O. Bailey, M.A. Alspaugh (Editor)
2. Bulk solids handling by Fruchtbaum

AUTOMOBILE ENGINEERING

(ELECTIVE-III)

Course Code: AME1144

L	T	P	C
4	0	0	4

AIM AND OBJECTIVES:

This is a first course in automobile engineering introducing the anatomy and the functioning of all major components of the modern automobile. With an introduction to the engine and its accessories, the course deals in detail with the description of automobile components like clutch, transmission, final drive, axles, wheels, suspension, steering, electrical systems among others. Concepts of modern automobile controls are also included.

UNIT-I

General introduction, types of automobiles, classification of automobiles, chassis and body, frames, frameless construction, sub-frames, defects in frames

Different systems in an automobile, brief introduction to important parts

Automobile engines, different parts and auxiliary systems, engine terminology, four-stroke and two-stroke operation, multi-cylinder engines, engine balance, power overlap

UNIT-II

Engine accessories, engine lubrication, points of lubrication, types of lubrication systems, wet sump and dry sump, lubrication schedule, properties of lubricants, oil pumps, oil filters, crankcase dilution and crankcase ventilation

Fuel induction in SI and CI engines, fuel pumps and air cleaners, problems in carburetors, direct injection of gasoline, MPFI and TBI, advantages and disadvantages, concepts of electronic injection, diesel injection systems, concepts of supercharging and turbo-charging, waste-gating principle

UNIT-III

Principle of ignition, ignition coil, condenser and distributor, ignition systems without storage battery, electronic ignition, ignition timing and ignition advance, spark plugs

Combustion in SI engines and CI engines, swirl and turbulence, types of combustion chambers in automobile engines

Engine cooling, heat balance, effects of improper cooling, air cooling, radiator details and functioning, thermostats, anti-freeze additives, heater core

UNIT-IV

Automobile emissions, their harmful effects, pollution control measures, catalytic converters, exhaust system layout, mufflers, resonators

Engine parameters, brief discussion of testing devices, engine service, engine tuning, engine re-boring, cyaniding, nitriding, de-carbonisation

UNIT-V

Manual transmission and types of gear box, sliding-mesh, constant-mesh and synchromesh gear boxes, types of dog clutches, gear shift mechanism, principles of automatic transmission, fluid coupling, planetary gear system and torque converter, overdrive, basic principle of electronic transmission control

Clutch operation and types, multi-plate and cone clutches, clutch construction and lining

Propeller shafts, universal joints, slip joint, Hotch-Kiss drive and torque tube drive, transaxle and transfer case, radius rods, four wheel drive arrangement

UNIT-VI

Braking systems, layouts for mechanical braking, hydraulic braking, pneumatic braking, master cylinder, wheel cylinder, tandem cylinder, shoe brakes, disc brakes, requirements of brake fluid, power brakes, concept of ABS and traction control, parking brakes

Steering system, principles and need of steering, components parts, steering gear, steering ratio, steering lock, turning radius, centre point

steering, wheel geometry, power steering principle and typical schemes,

UNIT-VII

Front axle scheme and end connections, rear axle, functions, types of rear axle, loads on rear axles, axle casing

Suspension system, functions of suspension, component parts, coil springs, leaf springs, air springs, shock absorbers, torsion bars, stabilizer bars, typical combinations of components in suspension systems, MacPherson strut suspension, its merits

UNIT-VIII

Wheel and tyres, wheel assembly and parts, pressed wheels and cast wheels, wheel rim, tyres, aspect ratio, tyres with tubes and tubeless tyres, advantages, construction of a tyre, plies, radial plies, tyre treads and tyre specifications,

Electrical systems, generator circuit and need for cut-out, starting with solenoid and over-running clutch, lighting points in a passenger car, high beam and restricted high beam from head lights, circuits for flashers, horn, wind screen wiper, fuel level indicator, speedometer

Cabin heating and cooling, simple schemes

TEXT BOOKS:

1 Kamaraju Ramakrishna, Automobile Engineering, PHI Learning, New Delhi

2 Jain & Asthana, Automobile Engineering, Tata McGraw-Hill, New Delhi

REFERENCE BOOKS:

1 Newton, Steeds & Garret, Butterworth & Heinemann, The Motor Vehicle, Standard Publishers, Delhi

2 Crouse & Anglin, Automotive Mechanics, Tata McGraw-Hill, New Delhi.

VALUE ENGINEERING

(ELECTIVE-III)

Course Code: AME1148

L	T	P	C
4	0	0	4

AIM AND OBJECTIVES:

The concept of value engineering has gained importance in the Indian industrial scenario due to the globalization initiative of 1990s and is considered as one of the most effective cost reduction efforts available.

This course introduces the various terms, techniques and processes involved in value engineering so as to familiarize the student with this essential tool. At the end of this course he/she will have acquired improved problem-solving skills and appreciation of the difficulties involved in resolving their complexities.

UNIT-I

INTRODUCTION: Value Engineering concepts, Advantages, Applications, Problem recognition, and role in productivity, criteria for comparison, element of choice.

UNIT-II

ORGANISATION : Level of VE in the organization, Size and skill of VE staff, small plant, VE activity. Unique and quantitative evaluation of ideas.

UNIT-III

VE JOB PLAN : Introduction, orientation, information phase, speculation phase, analysis phase. Selection and Evaluation of VE Projects: Project selection, Methods selection, value standards, application of VE methodology.

UNIT -IV

ANALYSIS FUNCTION : Anatomy of the function, Use of esteem and exchange values, Basic vs secondary vs. unnecessary functions. Approach

of function, Evaluation of function, determining function, classifying function, evaluation of costs, evaluation of worth, determining worth, evaluation of value.

UNIT- V

VE TECHNIQUES : Selecting products and operation for VE action, VE programmes, determining and evaluating function(s) assigning rupee equivalents, developing alternate means to required functions, decision making for optimum alternative, Use of decision matrix, Queuing theory and Monte Carlo method make or buy, Measuring profits, Reporting results, Follow up, Use of advanced technique like FAST (Function Analysis System).

UNIT -VI

VERSATILITY OF VE : VE operation in maintenance and repair activities, value engineering in non hardware projects. Initiating a VE Programme Introduction, training plan, career development for VE specialities.

UNIT -VII

FAST DIAGRAMMING : Cost models, life cycle costs

UNIT -VIII

VE LEVEL OF EFFORT : VE team, Co-coordinator, designer, different services, definitions, construction management contracts, value engineering case studies.

TEXT BOOKS:

1. Anil Kumar Mukhopadhyaya, Value Engineering: Concepts Techniques and Applications, SAGE Publications 2010.
2. Anil Kumar Mukhopadhyaya, Value Engineering Mastermind: From concept to Value Engineering Certification, SAGE Publications, 2003

REFERENCES:

1. Alphonse Dell'Isola, Value Engineering: Practical Applications for Design, Construction, Maintenance & Operations, R S Means Co., 1997.

2. Richard Park, Value Engineering: A Plan for Invention, St. Lucie Press, 1999.
3. Del L. Younker, Value Engineering analysis and methodology, Marcel Dekker Inc, New York, 2004
4. Miles, L.D., Techniques of Value Analysis and Engineering, McGraw Hill second Edition, 1989.
5. Khanna, O.P., Industrial Engineering and Management, Dhanpat Rai & Sons, 1993.

FLUID POWER SYSTEMS

(ELECTIVE-III)

Course Code: AME1150

L	T	P	C
4	0	0	4

AIM& OBJECTIVE :

To Provide the student with an in – depth background in the field of fluid power. To Provide knowledge related to the operation, maintenance and application of fluid power systems.

UNIT-I

INTRODUCTION TO HYDRAULIC SYSTEMS AND ANCILLARY HYDRAULIC SYSTEMS: Introduction to Hydraulic Systems, Construction of Hydraulic Reservoir, Gravity type, Spring-loaded and Gas loaded type Accumulators

UNIT-II

HYDRAULIC PUMPS : Gear pumps, Vane pumps and Piston pumps, Selection of Hydraulic Pumps

UNIT-III

HYDRAULIC CONTROL VALVES : Direction Control Valves, Pressure Control Valves, Flow Control Valves, Servo Valves

UNIT-IV

HYDRAULIC CYLINDERS AND HYDRAULIC MOTORS : Hydraulic cylinder operation and cylinder mountings, Hydraulic cylinder and Cushions, Hydraulic Motors operation- Gear, Vane and Piston motors, Hydraulic Motor performance, Hydrostatic Transmissions

UNIT- V

HYDRAULIC CIRCUITS-I : Introduction, Control of a Single-Acting Hydraulic Cylinder, Control of a Double Acting Hydraulic Cylinder, Regenerative Circuit, Pump-Unloading Circuit, Double-Pump Hydraulic System, Pressure Intensifier Circuit, Counter balance Valve Application, Hydraulic Cylinder Sequencing Circuits.

UNIT- VI

HYDRAULIC CIRCUITS-II : Cylinder Synchronizing Circuits, Fail Safe Circuits, Speed control of a Hydraulic Cylinder, Speed control of a Hydraulic Motor, Hydraulic Motor Braking System, Hydrostatic Transmission System, Accumulators and Accumulator Circuits, Mechanical-Hydraulic Servo System.

UNIT-VII

PNEUMATIC CIRCUITS AND APPLICATIONS: Introduction to Pneumatics, Basic Pneumatic Circuits and applications.

UNIT-VIII

MAINTENANCE AND TROUBLE SHOOTING OF HYDRAULIC &PNEUMATIC CIRCUITS AND COMPONENTS: Oxidation and Corrosion of Hydraulic Fluids, Maintaining and Deposing of Fluids, Wear of moving parts due to solid particle contamination of the fluid, Problems caused by gases in Hydraulic Fluids, Troubleshooting of Hydraulic System, Common problems in Pneumatic Systems, Troubleshooting of Pneumatic Systems

TEXT BOOKS:

1. Anthony Esposito, Fluid Power with Applications, PHI, New Delhi, 1st Edition, 2005
2. Andrew Parr, Hydraulics and Pneumatics, Jaico Publishing house,9th Edition, 2005

REFERENCES:

1. S.R.Majumdar, Oil Hydraulic Systems , Tata McGraw Hill, 1st Edition ,2002
2. S.R.Majumdar, Pneumatic Systems , Tata McGraw Hill, 1st Edition, 2002
3. www.pneumatics.com
4. www.fluidpower.com.

AUTOMATION IN MANUFACTURING

(ELECTIVE-IV)

Course Code: AME1145

L	T	P	C
4	0	0	4

AIM:

To introduce and familiarize the student with the various Automated systems that are established and incorporated in various Production Industries.

OBJECTIVE:

The student should be able to identify and correlate the concepts of automation and be in a position to incorporate, modify and adopt the automation concepts when he is placed, after graduation, in an industry to its requirements.

UNIT-I

INTRODUCTION TO AUTOMATION : Production systems. Automation in Production systems, Types of Automation, Reasons for Automation, Automation Principles and Strategies, Basic elements of an automated system, Advanced Automation Functions, Levels of Automation.

UNIT-II

MATERIAL TRANSPORT SYSTEMS : Introduction, types of equipment in Material Handling systems, design considerations in Material Handling systems, Material transport equipment, Analysis of Material Transport Systems, Simple problems.

UNIT-III

MATERIAL STORAGE SYSTEMS : Introduction, types of Material stored in a factory, Conventional Methods of storage methods and equipment, Automated Storage and retrieval systems.

UNIT-IV

AUTOMATED PRODUCTION LINES I : Fundamentals of Automated Production Lines (automated Flow lines): Line type, Rotary type. Work Part Transfer- continuous transfer, Intermittent Transfer, Asynchronous transfer, walking beam transfer, chain drive conveyor system, Applications of Automated Production Lines.

UNIT-V

AUTOMATED PRODUCTION LINES II : Analysis of Transfer Lines – Starving, Blocking, analysis using upper bound approach, analysis using lower bound approach, Analysis of flow lines with storage simple problems on automated production lines.

UNIT-VI

FUNDAMENTALS OF ASSEMBLY LINES : Assembly workstations, work transport systems line pacing, coping with Product variety.

Line Balancing Problems and Line Balancing Algorithms: Largest candidate Rule, Kilbridge and wester Method, Ranked Positional weights Method. simple problems on line balancing using the mentioned algorithms.

UNIT-VII

AUTOMATED ASSEMBLY SYSTEMS: Fundamentals of Automated Assembly systems: System Configurations, parts delivery at work stations.

QUANTITATIVE ANALYSIS OF ASSEMBLY SYSTEMS : Parts delivery system at workstations, multi-station assembly machines, single station assembly machines, partial automation.

UNIT-VIII

CAD/CAM/CIM : Computer Aided Design, Computer Aided Manufacturing, Computer Integrated Manufacturing. Product Design and CAD, Application of Computers in design, Fundamentals of Computer Aided Process Planning, Concurrent Engineering and Design for Manufacturing.

TEXT BOOKS:

1. M.P. Groover, Automation, Production Systems and Computer Integrated Manufacturing, Pearson and PHI, 3rd Edition, 2009.
2. M S Ganesh Prasad and B S Raju, Computer Integrated Manufacturing, Lakshmi Publications (p) Ltd, 1st Edition, 2009

REFERENCES:

1. Yoram Coreom, Computer control of Manufacturing Systems, McGraw-Hill Education – Europe, International Ed ition, 1984
2. P. Radhakrishnan and S. Subramanyam, CAD/CAM/CIM, New Age International Pvt Ltd, 3rd Edition, 2009

COMPUTATIONAL FLUID DYNAMICS

(ELECTIVE-IV)

Course Code: AME1146

L	T	P	C
4	0	0	4

AIM AND OBJECTIVE:

To familiarize students with mathematical modeling of physical problems and teach some numerical solution methods.

UNIT-I

Equations governing fluid flow and heat transfer - Conservation of mass - Momentum and energy balance equations - Definitions of stream function and vorticity. Classification of second order partial differential equations as hyperbolic, parabolic and elliptic equations.

UNIT-II

Applied numerical methods for numerical integration - Trapezoidal and Simpson rules. Roots of a function - bisection method, method of false position, Newton-Raphson scheme.

UNIT-III

Solution of a system of linear algebraic equations: Iterative methods - Jacobi method - Gauss-Siedel method. Direct methods - Gaussian elimination and Gauss-Jordan method. Solution of a tri-diagonal matrix - Thomas algorithm.

UNIT-IV

Numerical solution of ordinary differential equations by fourth-order Runge-Kutta method: Solution of a first order differential equation - Solution of two simultaneous first order differential equations - Solution of a second order differential equation.

UNIT-V

Certain selected finite difference applications in heat conduction: Heat dissipation through a straight fin - Two dimensional heat conduction in

rectangular geometry - One-dimensional transient heat conduction in a rectangular slab.

UNIT-VI

Fundamentals of fluid flow modeling - Conservative property - Transportive property - Second upwind differencing or hybrid scheme.

A selected finite difference application in heat convection: One-dimensional steady state convection-diffusion equation.

UNIT-VII

Solution of Navier-Stokes equations for incompressible flows - Governing continuity and momentum balance equations in conservative form - Concept of staggered grid - SIMPLE formulation for one-dimensional convection-diffusion equation -

UNIT-VIII

Extension to two dimensional equations with pressure gradient - Discussion on various differencing schemes - central difference approximation - upwind scheme - hybrid scheme.

TEXT BOOK:

1. K. Muralidharan and T. Sundararajan, Computational Fluid Flow and Heat Transfer, Second Edition, Narosa Publishing House, New Delhi , 2003.

REFERENCE BOOKS:

1. Suhas V. Patankar, Numerical heat transfer and fluid flow, Taylor & Francis (1980)
2. John D. Anderson, Jr., Computational fluid dynamics - The basics with applications, McGraw-Hill (1995)
3. H.K. Versteeg and W. Malalasekera, An introduction to computational fluid dynamics
4. The finite volume method, Pearson Education Limited, England (1995)
5. S.S. Sastry, Numerical Analysis.

ADVANCED MECHANICS OF SOLIDS

(ELECTIVE-IV)

Course Code: AME1147

L	T	P	C
4	0	0	4

AIM AND OBJECTIVE:

This subject describes the concepts of Fixed beams and Continuous beams. It also gives the analysis of the bending of curved bars for different cross-sections like rectangular, circular and trapezoidal sections. It gives the insight to design the mechanical structures in the view point of both strength and deformation including the design by means of numerical simulation.

UNIT-I

THEORY OF ELASTICITY: Basic equations of elasticity, Stress at a point, Nature of Stress at a point, Stress Tensor, Stress Transformation, Principal Stresses and Planes, Strain at a point, Strain tensor analogy between stress and strain tensors, Constructive equations, Generalized Hook's law, Equations of equilibrium ,Strain displacement relations, Compatibility conditions.

UNIT-II

FIXED BEAMS: Fixing moments for a fixed beam of uniform and variable sections, Effect of Sinking support, slope and deflection, Portal frames.

UNIT-III

CONTINUOUS BEAMS : Analysis of Continuous beams, Reaction at the supports, Theorem of Three Moments, Effect of sinking of supports.

UNIT-IV

ENERGY METHODS : Castigliano's Theorems I&II and its Applications.

UNIT-V

STRESSES IN CURVED BARS: Stresses in bars of Circular, rectangular and trapezoidal sections, Introduction to Theory of Plates and Shells.

UNIT-VI

STRESSES DUE TO ROTATION: Wheel rim, disc of uniform thickness and disc of uniform strength.

UNIT-VII

TORSION OF NONCIRCULAR SHAFTS: Torsion of noncircular prismatic bars,Saint Venant's Theory,Solution for simple cases Pradtl membrane analogy,open and closed sections and shear flow. Introduction to Shear Centre.

UNIT-VIII

BEAMS ON ELASTIC FOUNDATION: Differential equation of the elastic line,Concentrated load on an infinite beam, Force and Couple on a beam, principle of superposition and Udl over part of beam.

TEXT BOOKS:

1. Beer, P.F and Johnson, E. R, Mechanics of Materials,2nd Edition, Mc Graw Hill Inc,1992.
2. Arthur P.Boresi and Ken P. Chang, Elasticity in Engineering Mechanics, 2nd Edition, Johnwiley &Sons, Inc., 2000.

REFERENCES:

1. Sadhu Singh, Strength of Materials, 7th Edition, 1999, Khanna Publishers, New Delhi.
2. Rajput, R. K, Strength of Materials, Revised Edition, 2006, S. Chand & Company Ltd, New Delhi.
3. Irving H. Shames and James M.Pitaressi, Introduction to Solid Mechanics, 3rd Edition, Prentice Hall, 2000, New Delhi.
4. Timoshenko S.P. and Goodier J N, Theory of Elasticity, MC Grawhill, New Delhi, 1970

INTRODUCTION TO AIRCRAFT STRUCTURES

(ELECTIVE-IV)

Course Code: AME1151

L	T	P	C
4	0	0	4

AIM & OBJECTIVE:

The present course is to provide the basic methodologies to design and analysis of aircraft structures

UNIT-I

AIRCRAFT DESIGN PROCESS : Introduction, Phases of Aircraft Design, Aircraft Conceptual Design Process, Conceptual Stage, Preliminary Design, Detailed Design, Design Methodologies

UNIT-II

INTRODUCTION TO AIRCRAFT STRUCTURES : Types of Structural members of Fuselage and wing section Ribs, Spars, Frames, Stringers, Longeron, Splices, Sectional Properties of structural members and their loads, Types of structural joints, Type of Loads on structural joints

UNIT-III

AIRCRAFT MATERIALS AND MANUFACTURING PROCESSES : Material selection criteria, Aluminum Alloys, Titanium Alloys, Steel Alloys, Magnesium Alloys, copper Alloys, Nimonic Alloys, Non Metallic Materials, Composite Materials,

UNIT-IV

STRUCTURAL ANALYSIS OF AIRCRAFT STRUCTURES: Plate deflection under different end conditions, Strain energy due to bending of circular, rectangular plates.

UNIT-V

PLATE BUCKLING: Compression buckling, shear buckling, Buckling due to in plane bending moments, Rectangular plate buckling, Sample Exercises.

UNIT-VI

THEORY OF BEAMS: Symmetric Beams in Pure Bending, Deflection of beams, Unsymmetrical Beams in Bending, Bending of Open Section Beams, Bending of Closed Section Beams. Sample Exercises.

UNIT-VII

THEORY OF TORSION: Shafts of Non-Circular Sections, Torsion in Closed Section Beams, Torsion in Open Section Beams, Sample Exercises.

UNIT-VIII

AIRWORTHINESS AND AIRCRAFT CERTIFICATION: Definition, Airworthiness Regulations, Regulatory Bodies, Type certification, General Requirements, Requirements Related to Aircraft Design Covers, Performance and Flight Requirements,

TEXT BOOKS

1. Aircraft Design-A Conceptual Approach by Daniel P. Raymer, AIAA education series, 6e, 2001
2. Airframe Structural Design by Michael Niu, Conmilit Press, 2e, 1988
3. Airframe Stress Analysis and Sizing by Michael Niu, Conmilit Press, 3e, 1999
4. The Elements of Aircraft Preliminary Design – Roger D. Schaufele, Aries Publications, 2000
5. Aircraft Structural Maintenance by Dale Hurst, Avotek publishers, 2e, 2006
6. Aircraft Maintenance & Repair by Frank Delp, Michael J. Kroes & William A. Watkins, Glencoe &McGraw-Hill,6e,1993
7. An Introduction to Aircraft Certification; A Guide to Understanding Jaa, Easa and FAA by Filippo De Florio, Butterworth-Heinemann

WEB RESOURCES

1. http://www.aero.org/
2. http://www.rl.af.mil/rrs/resources/griffiss_aeroclub/aircraft.html
3. http://en.wikipedia.org/wiki/Tesla_turbine
4. http://ameslib.arc.nasa.gov/randt/1999/aero/aero.html
5. http://www.ctas.arc.nasa.gov/project_description/pas.html
6. http://www.moog.com/noq/_acoverview__c463/
7. http://www.dcmt.cranfield.ac.uk/aeroxtra/e339.htm
8. http://www.aeromech.usyd.edu.au/structures/as/acs1-p4.htm
9. http://www.av8n.com/how/htm/xref.html
10. http://www.aviation-history.com/video.html