B. E. SYLLABUS

MECHANICAL ENGINEERING

VII & VIII SEMESTER

With
Scheme of Teaching
& Examination
## DEPARTMENT: MECHANICAL ENGINEERING

<table>
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<tr>
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<th>Name</th>
<th>Position</th>
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<tr>
<td>1</td>
<td>Dr. Shrinivasa Rao B.R.</td>
<td>Prof./Vice Principal / COE</td>
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<td>2</td>
<td>Vinaya B R</td>
<td>Asso. Prof/1st year co-ordinator</td>
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<tr>
<td>3</td>
<td>Dr. Subrahmanya Bhat</td>
<td>Prof./HOD</td>
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<td>Dr. Sudesh Bekal</td>
<td>Professor, Dean(R&amp;D)</td>
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<tr>
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<td>Dr. Shashikanth Karinka</td>
<td>Professor, P G Coordinator</td>
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<td>Dr. Srinivas Pai P</td>
<td>Prof./DCOE</td>
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<td>7</td>
<td>Dr. Narasimha Marakala</td>
<td>Professor</td>
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<td>Dr. Muralidhar</td>
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<td>Manjunath Shenoy</td>
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<td>Dr. Mallikappa</td>
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<td>T.R. Venugopal</td>
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<td>Ravishankar Bhat</td>
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<td>Narasimha Bailkeri</td>
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<td>P. Venkatesh Murthy</td>
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<td>Gururaj Upadhyaya</td>
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<td>16</td>
<td>Ravindra</td>
<td>Asst. Prof, Gd III</td>
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<td>Ananthakrishna Swamayaji</td>
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<td>Suressh Shetty</td>
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<td>Udaya</td>
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<td>Austin Dinesh D’Souza</td>
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<td>Dilip Kumar K</td>
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<td>Ravikiran Kamath B</td>
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<td>Srinivas Prabhu</td>
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<td>Goutham Hebbar</td>
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<tr>
<td>40</td>
<td>Nithin Kumar</td>
<td>Asst. Prof, Gd I</td>
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Department of Mechanical Engineering, NMAMIT, Nitte

Vision:
To produce Mechanical engineers of the highest quality who are professionally competent and highly qualified to suit the needs of industries and organizations by promoting excellence in teaching, learning and research.

Mission:
The Dept. of Mechanical Engineering is committed to –

- Provide high quality education to the students, to fulfill the requirements of a ‘Global Engineer’.
- Constantly strive to improve the teaching-learning methods, in order to deliver good academic programs.
- To respond to the fast evolving scientific and technological challenges in a highly competitive world.
- To inculcate ethics, integrity, honesty, credibility, social and environmental consciousness.

Programme Educational Objectives (PEO’s):

To satisfy the mission of the mechanical engineering program, the graduates will:
1. Be able to research, design, develop, test, evaluate, and implement engineering solutions to problems that are of a complexity encountered in professional practice.
2. Be able to communicate and perform as an effective engineering professional in both individual and team-based project environments.
3. Consider the ethical implications and societal impacts of engineering solutions.
Programme Outcomes (PO’s):

- An ability to apply knowledge of mathematics, science, and applied sciences.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to formulate or design a system, process or program to meet desired needs.
- An ability to function on multi-disciplinary teams.
- An ability to identify, formulate, and solve imaging/printing problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of solutions in a global, and social context
## DEPARTMENT OF MECHANICAL ENGINEERING
### SCHEME OF TEACHING

**VII Semester**

<table>
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<tr>
<th>Sl. No.</th>
<th>Sub. Code</th>
<th>Subject</th>
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**Total** 21 2 7 27 450 350 800 30

*30 Hours/week*
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<td>Refrigeration and Air-conditioning</td>
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<td>ME714</td>
<td>Design of pressure vessel &amp; piping</td>
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<td>5</td>
<td>ME715</td>
<td>Modeling, Simulation of Engg. Systems</td>
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<td>ME716</td>
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<td>ME722</td>
<td>Maintenance &amp; Reliability Engineering</td>
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<td>Computer Integrated Manufacturing</td>
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<td>Design For Assembly</td>
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<td>ME726</td>
<td>Product Design and Development</td>
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<td>ME727</td>
<td>Design of Aircraft structures</td>
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DEPARTMENT OF MECHANICAL ENGINEERING
SCHEME OF TEACHING

VIII Semester

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Electives:

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<td>ME812</td>
<td>Tool Engineering and Design</td>
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<td>ME813</td>
<td>Non-destructive Testing</td>
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<td>Composite Materials Technology</td>
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<td>Fluid Power Systems</td>
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<td>Micro –Electro Mechanical Systems</td>
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POWER PLANT ENGINEERING

Subject Code : ME 701  
Credits : 04  
Hrs / Week : 4  
Total Hours : 52

UNIT - 1

Chapter-1: Steam Power Plant
DiffAerent types of fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace, Coal and ash handling.

UNIT - 2

Chapter-1 Contd: Generation of steam using forced circulation, high and super critical pressures, A brief account of Benson, Velox, L’mont steam generators

Chimneys: Natural, forced, induced and balanced draft, Calculationsinvolving height of Chimney to produce a given draft.

Cooling towers and Ponds.
Accessories for the steam generators: Super heaters, De-super heater, Economizers, air pre heaters and re heaters

UNIT - 3

Chapter-2: Diesel Engine Power Plant:
Applications of Diesel Engines in Power field, Method of starting diesel engines, cooling and lubrication system for the diesel engine. Intake and exhaust system, general layout, advantages and disadvantages over steam power plant.

Chapter-3: Hydro-Electric Plants
Storage and Pondage, flow duration and mass curves, hydrographs, low, medium and high head plants, pumped storage plants, Penstock, water hammer, surge tanks, power house general layout, advantages and disadvantages over thermal power plant.

UNIT-4

Chapter-4: Gas turbine Power Plant:
Advantages and disadvantages of gas turbine plant, open turbine plants with intercooling, reheating and regeneration. Closed gas turbine power plant.
Chapter-5: Nuclear Power Plant
Principles of release of nuclear energy, fusion and fission reactions, nuclear fuels used in the reactors, Multiplication and thermal utilization factors, Elements of the nuclear reactor, moderator, control rod, fuel rods, coolants, Brief description of reactors of the following types-Pressurized water reactor, boiling water reactor, sodium graphite reactor, fast breeder reactor and gas cooled reactor, radiation hazards, shielding, radioactive waste disposal 10 Hrs

UNIT - 5
Chapter-6: Power station estimation:
Choice of site for power station, load duration curve, load factor, capacity factor, use factor, diversity factor, demand factor, effect of variable load on power plant, selection of the number and size of units.

Chapter-7: Economics of power generation:
Cost of energy production, selection of plant and generating equipment and operating characteristics of power plants, tariffs for electrical energy 06 Hrs

TEXT BOOK:

REFERENCE BOOK:
1. Power Plant Engineering by RK.Rajput. Laxmi publication, New Delhi.

Scheme Examination:
Two questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.
MECHANICAL VIBRATIONS

Subject Code : ME 702  
Credits : 04  
Hrs /Week : 5  
Total Hours : 52

UNIT - I
Introduction:
Types of Vibrations, Simple Harmonic Motion, and Principle of superposition applied to simple harmonic motions, Beats and simple problems.

Undamped Free Vibrations:
Single Degree of Freedom systems, Natural frequency of undamped free vibrations, Parallel and series combination of springs-equivalent stiffness, effect of mass of spring on natural frequency, Problems on identification of natural frequency of different systems, Torsional vibrations. 10 Hrs

UNIT - II
Damped Free Vibrations:
Single degree of freedom systems, Different types of damping, Concept of critical damping and its importance, Study of response of viscous damped systems for cases of under-damping, critical-damping and over-damping, Logarithmic Decrement, Problems on rectilinear and rotary systems. 10 Hrs

UNIT - III
Forced Vibrations:
Single Degree of Freedom Systems, Forced Vibration of spring-mass-damper system, transient and steady state solution, Reciprocating and rotating unbalance, Force transmitted to the base due to harmonic excitation-Force Transmissibility, Vibrations due to support motion-Motion Transmissibility, vibration isolation. 12 Hrs

UNIT - IV
Analysis of two Degrees of Freedom Systems:
Introduction, principal modes of vibration, masses on tightly stretched strings, double pendulum, combined rectilinear and angular modes, system with damping, undamped forced vibrations with harmonic excitation, undamped dynamic vibration absorber, problems. Vibrometers and Accelerometers, Whirling of shafts with and without air damping, Discussion on speeds above and below critical speed of shaft, Numerical problems. 10 Hrs
UNIT - V

Numerical methods for multi degree freedom systems:
Introduction, Influence coefficients, Maxwell’s reciprocal theorem, Dunkerley’s equation, Orthogonality of Principal modes, Method of Matrix Iteration and orthogonality principle. Holzer’s Method, Stodola Method

Machine condition monitoring and Diagnosis 10 Hrs

TEXT BOOKS:

REFERENCE BOOKS:
INDUSTRIAL ROBOTICS

Subject Code : ME 703
Credits : 04
Hrs /week : 4
Total Hours : 52

UNIT – I
Introduction to robotics
Definition, anatomy of robot, classification configurations, robot links and joints, robot specifications, resolution accuracy and repeatability, simple numerical problems, robot drive systems, hydraulic, pneumatic and electric drive systems, wrist and its motions, end effectors, types of end effectors, mechanical grippers, methods of constraining parts in grippers, types of gripper mechanisms, simple numerical problems, vacuum cups, magnetic grippers, adhesive grippers, hooks, scoops and other gripper devices, tool as end effectors, examples. 10 Hrs

UNIT – II
Robot motion analysis
Direct kinematics and inverse kinematics, 3D homogeneous transformations, rotation, translation and displacement matrix, composite rotation matrix, rotation matrix about an arbitrary axis, links, joints and their parameters, Denavit-Hartenberg (D-H) representation, application of D-H matrices to different robot configurations. 12 Hrs

UNIT – III
Robot control and trajectory planning
Basic control systems and models, transfer function with examples, transfer function for spring-mass-damper system, transient response of a second order system, transfer function of a robot joint, different types of controllers, proportional (P) controller, integral (I) controller, derivative (D) controller, PID controller, simple numerical problems. Trajectory planning, definition, steps in trajectory planning, joint space techniques, use of a p-degree polynomial as interpolation function, cubic polynomial trajectories, linear function with parabolic blends, joint space verses Cartesian space trajectory planning, simple numerical problems on joint space trajectory planning. 10 Hrs

UNIT – IV
Robot sensors and Machine Vision
Classification of robot sensors and their functions, touch sensor, tactile sensor, binary sensor, analog sensor, proximity sensor, range sensor, force and torque sensor.
Machine vision, functions of machine vision system, sensing and digitizing, imaging devices, analog to digital signal conversion, quantization and encoding, simple numerical problems, image storage, image processing and analysis, image data reduction, segmentation, feature extraction, object recognition, robotic machine vision applications, inspection, identification, visual servoing and navigation

12 Hrs

UNIT – V

Robot Programming
Introduction to robot programming, robot cell layout, work cell control and interlocks, manual programming, lead through and walkthrough programming, off-line programming, VAL programming language, example, AML and VAL-II robot programming languages, examples, Programming with graphics, example.

8 Hrs

TEXT BOOKS:
2. Robot Technology Fundamentals, James G. Keramas, Cengage Learning, 1999

REFERENCE BOOKS:

Scheme Examination:
TWO questions to be set from each unit and students shall answer FIVE full questions choosing ONE question from each unit
MECHATRONICS

Subject Code : ME 704  
Credits : 04
Hrs /week : 4  
Total Hours : 52

UNIT - I
Introduction: Introduction to Mechatronic systems, Measurement systems, control systems, microprocessor based controllers, Mechatronics approach. Examples and discussions on typical mechatronic systems.
Review of Transducers and Sensors: Introduction to Transducers and sensors, their classification, light sensors, proximity sensors and Hall-effect sensor, encoders, selection of sensors. 10 Hrs

UNIT - II
Drives and controls: Mechanical system: Anti Friction guide ways, timer belt and pulley, high speed precession bearings Electrical Actuation Systems: Actuators and actuator system, classification, Mechanical switches, Solenoids, relays, solidstate switches, Motors- DC & AC motors, Stepper motors, servo motor. 12 Hrs

UNIT - III
Pneumatic Systems: Introduction, Basic structure of pneumatic systems, filter, lubricator, regulator, Valves – Classification, Pressure control valve, Flow control valve, Direction control valve. Types of cylinders, air motors, air compressors, Symbols of Pneumatic elements and application circuits. 10 Hrs

UNIT - IV
Signal Conditioning: Introduction to signal conditioning. Operational amplifier, Protection, Filtering, Wheatstone bridge, ADC and DAC, Multiplexers, Data acquisition system. Programmable logic controllers: Basic structures, input/output processing, programming, timers, relays and counters, data handling, selection of PLC. 10 Hrs

UNIT - V
Microprocessors: Digital number system, Binary & Decimal number systems, BCD, Boolean algebra, Logic Gates, flip flops. Introduction to microprocessor, microprocessor based digital control, basic elements of control system, 8085 A microprocessor architecture terminology such as CPU, memory and address, ALU, assembler data registers, Fetch cycle, write cycle, state, bus, interrupts.
Microcontrollers. Differences between microprocessor and microcontrollers. Classification of micro controllers.  

**TEXT BOOKS:**

**REFERENCE BOOKS:**
2. Pneumatics Basic level TP101, Peter Croser and Frank Ebel,Festo Didactic Publications.

**Scheme Examination:**
TWO questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.

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**PROJECT PART - I**

**Subject Code : ME 705**

**Credits :** 03

**Hrs /week :** 3

**Preparing a project - brief proposal including**

- Problem Identification
- A statement of system / process specifications proposed to be developed (Block Diagram / Concept tree)
- List of possible solutions including alternatives and constraints
- Cost benefit analysis
Time Line of activities
- Identification of a real life problem in thrust areas
- Developing a mathematical model for solving the above problem
- Finalization of system requirements and specification
- Proposing different solutions for the problem based on literature survey
- Future trends in providing alternate solutions
- Detailed design and development plans
- Preparation of part drawings for manufacturing.
- Consolidated report preparation of the above

Or similar relevant academic activities suited for a particular project as approved by the guide.

SEMINAR

Subject Code : ME 706  
Credits : 01  
Hrs /week : 2

DYNAMICS LAB

Subject Code : ME 707  
Credits : 01  
Hrs /week : 2

Part - A
1. Determination of a Pressure distribution in Journal bearing.
2. Determination of Principal Stresses and strains in a member subjected to combined loading using Strain rosettes.
3. Determination of Fringe constant of Photoelastic material using a) Circular disc subjected to diametral compression, b) Pure bending specimen (Four point bending).
4. Determination of stress concentration using Photoelasticity for simple components like plate with a hole under tension or bending, circular disk with circular hole under compression, 2D Crane hook.
Part - B
5. Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in a single degree of freedom vibrating systems. (Longitudinal and torsional)
7. Determination of critical speed of a rotating shaft.
8. Experiments on Gyroscope (Demonstration only).
9. Determination of equilibrium speed, sensitiveness, power and effort of porter/propel Governor.

Scheme of Examination:
One Question from Part A : 20 marks
One Question from Part B : 20 marks
Viva Voce : 10 marks

FOUNDRY TECHNOLOGY

Subject Code : ME 711
Credits : 03
Hrs/week : 3
Total Hours : 39

UNIT – I
FOUNDRY METALLURGY: Oxidation of liquid metals, gas dissolution in liquid metals, methods of degassing, fluidity, factors affecting fluidity, fluidity tests, hot tearing, shrinkage of liquid metals.
CASTING DESIGN: Introduction to casting design, redesign considerations, design for minimum casting stresses, design for directional solidification, design for metal flow, safety factors, design for low pattern cost.

UNIT – II
SOLIDIFICATION OF CASTINGS: Crystallization and development of cast structure – nucleation, growth and dendritic growth. Coring and segregation. Concept of progressive and directional solidification, solidification time and Chvorinov’s rule. Structure of castings - refinement and modification of cast structure
MELTING FURNACES: Introduction to various types of furnaces. Developments in cupola melting – hot blast cupula, water cooled cupola, balanced blast cupola, cokeless cupola, cupola charge calculations.
UNIT - III
RISERING AND GATING: Need for risering, general considerations of risering, riser types, riser size and location. Requirements of a riser. Sand, insulating, and exothermic materials used for risers. Riser feeding distance and theory of risering. Riser efficiency, methods to improve riser efficiency. Gating system – Classification, theoretical consideration of gating, laws of fluid flow, turbulence in gating system, need for tapered sprue, gating ratio (simple problems). SPECIAL MOULDING TECHNIQUES: Principles, materials used, process details and application of no-bake sand systems, vacuum moulding, flaskless moulding, and high pressure moulding. 7 Hrs

UNIT - IV
FERROUS FOUNDRY: Melting procedures, casting characteristics, production, specification, and properties of some typical steels, grey cast iron, malleable iron, and spheroidal graphite cast iron castings. NON-FERROUS FOUNDRY: Melting procedures, casting characteristics, production, specification, and properties of some typical aluminum, copper, and magnesium based alloy castings. 7 Hrs

UNIT – V
MODERNIZATION AND MECHANIZATION OF FOUNDRY: Need for modernization, and mechanization, moulding and core making, melting, pouring, shake out equipment and fettling, dust and fume control, material handling equipments for sand moulds and cores, molten metal and castings, reclamation of sands. Pollution control. 7 Hrs.

TEXT BOOKS:
1. Principles of metal casting, Heine Loper & Rosenthal TMH - 2005

REFERENCE BOOKS:
2. Foundry Technology, P. N. Rao
ME 712– CONTROL ENGINEERING (3-0-0)

Subject Code : ME 712          Credits : 03
Hrs /week : 3                   Total Hours : 39

UNIT - I
Introduction: Control system , open and closed loop control systems, concept of feedback.          2 Hrs
Mathematical Model: Transfer functions models, Models of mechanical systems, electrical systems, hydraulic systems and thermal systems.  5 Hrs

UNIT - II
Block diagram and signal flow graph: Block representation of system elements, example of the use of block diagrams, Block diagram Reduction, Signal flow graph, Mason’s gain formula.  8 Hrs

UNIT - III
System Responses: Types of input signals, First order and second order system response to step input, steady-state error, system types, System stability criteria, Routh criteria.  8 Hrs

UNIT - IV
Frequency Response: Polar and rectangular plots for the frequency response, Nyquist stability criterion, stability analysis. Phase and gain margin.  5 Hrs
System Analysis using logarithmic plots: Bode diagrams: Stability analysis using Bode diagrams, simplified Bode diagrams.  5 Hrs

UNIT - V
System Analysis using Root locus Plots: General rules for construction of Root Locus plots, analysis using root locus plot
Control action: Basic concept of Proportional control, integral control, derivative control, proportional plus derivation control, PID control.  5 Hrs

TEXT BOOKS:
REFERENCE BOOKS:
2. Gopal M (2005) ” Modern Control Systems”, New Age International Publisher

REFRIGERATION AND AIR-CONDITIONING(3-0-0)

Subject Code : ME 713  
Credits : 03  
Hrs /week : 3  
Total Hours : 39

UNIT - I
8 Hrs

UNIT - II
VAPOUR COMPRESSION SYSTEM: Thermodynamic analysis, performance of system under varying operating conditions, cascade refrigeration, multistage refrigeration working principles.  
5 Hrs

VAPOUR ABSORPTION AND OTHER SYSTEMS: Ammonia - water system, Lithium Bromide – water system. Use of enthalpy – concentration charts, steam jet refrigeration and solar refrigeration systems.  
3 Hrs

UNIT - III
4 Hrs
COOLING LOAD: Effective temperature, comfort conditions, sensible heat factor ratio, number of air changes, cooling/heating load calculations. 3 Hrs

UNIT - IV
DUCT DESIGN AND AIR DISTRIBUTION: Considerations, methods of duct design air distribution systems, fans and air conditioning systems control. 8 Hrs

UNIT - V
BALANCING OF COMPONENTS: Condensers, air cooled, water cooled and evaporative condensers, selection, evaporates – flooded, dry expansion , shell and tube and double pipe, compressors – reciprocating, rotary and centrifugal types. Expansion devices, cooling towers.

TEXT BOOK:

REFERENCES:

DESIGN OF PRESSURE VESSEL & PIPING
(3-0-0)

Subject Code : ME 714 Credits : 03
Hrs /week : 3 Total Hours : 39

UNIT - I
INTRODUCTION
Methods for determining stresses - Terminology and Ligament Efficiency - Applications. 8 Hrs
UNIT - II
STRESSES IN PRESSURE VESSELS
Introduction - Stresses in a circular ring, cylinder - Membrane stress
Analysis of Vessel Shell components - Cylindrical shells, spherical
sheels, torispherical heads, conical head - Thermal stresses -
Discontinuity stresses in pressure vessels. 8 Hrs

UNIT - III
DESIGN OF VESSELS
Design of tall cylindrical self supporting process columns - supports
for short vertical vessels – stress concentration - at a variable thickness
transition section in a cylindrical vessel, about a circular hole,
elliptical openings. Theory of reinforcement - pressure vessel design
7 Hrs

UNIT - IV
BUCKLING AND FRACTURE ANALYSIS IN VESSELS
Buckling phenomenon - Elastic Buckling of circular ring and
cylinders under external pressure - collapse of thick walled cylinders
or tubes under external pressure - effect of supports on Elastic
Buckling of cylinders - Buckling under combined External pressure
and axial loading - Control and significance of Fracture Mechanics in
Vessels - FEM application. 8 Hrs

UNIT - V
PIPING  Introduction - Flow diagram - Piping layout and piping
stress Analysis. 8 Hrs

TEXT BOOK:

REFERENCES:
2. Stanley, M. Wales, " Chemical Process Equipment, Selection and
MODELING & SIMULATION OF ENGINEERING SYSTEMS (3-0-0)

Subject Code : ME 715  
Credits : 03  
Hrs /week : 3  
Total Hours : 39

UNIT - I
Fundamental Concepts in Mathematical Modeling: Abstraction - linearity and superposition - balance and conservation laws and the system - boundary approach  
7 Hrs

UNIT - II
8 Hrs

UNIT - III
8 Hrs

UNIT - IV
Frequency response of Linear, Time invariant systems - frequency response of first-order and second-order systems - state space formulations of systems, problems relating frequency response to pole location - transient response-poles and frequency response. Feedback systems:  
8 Hrs

UNIT - V
Systems with feedback - block diagrams - properties of feedback systems - relative stability-phase and gain margins.  
8 Hrs

TEXT BOOK:

REFERENCES:
ME716–TOTAL PRODUCTIVE MAINTENANCE (3-0-0)

Hrs/ week : 3  SEE Marks : 50
CIE Marks : 50  Credits : 3
Examination Hrs : 03  Total Marks : 100

UNIT - 1
Types of Maintenance – Preventive Maintenance, Predictive Maintenance, Reliability Centered Maintenance, Concept of Reliability, Availability and Maintainability
History and Impact of TPM, Maintenance to Productive maintenance, Definition, Features and Working of TPM, Benefits of TPM.  8 Hrs

UNIT - 2
Terotechnology – introduction, main functions, elements of Life-cycle cost and trade-off, essence of terotechnology

设备 six big losses - breakdown loss, setup loss, Idling and Minor stoppages, design speed loss, start-up loss, defect and rework losses.  8 Hrs

UNIT - 3
Total Productive Maintenance - Zero breakdowns, Zero Defects and TPM, maximizing equipment effectiveness, eight pillars of TPM, TPM small group activities, TPM organization, management decision, educational campaign, creation of organizations, establishment of basic policies and goals, formation of master plan. TPM implementation.  8 Hrs

UNIT - 4
Eliminating six big losses, autonomous maintenance and maintenance skills training, measuring maintenance effectiveness.  8 Hrs

UNIT - 5
Implementation of TPM – Discussion of real life case studies, TPM- Bajaj Way – 10 pillar approach, pitfalls of TPM and lessons on TPM  7 Hrs

TEXT BOOKS:
REFERENCE BOOKS:
1. Training Material – M/s Baja Auto Ltd., Pune
Other resources from the internet

Scheme Examination:
Two questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.

ADVANCED MANUFACTURING PROCESSES

Subject Code : ME 717  Credits : 03
Hrs /week : 3       Total Hours : 39

UNIT – I
Tool-based Micro machining – Conventional machining
Introduction, micro cutting, micro milling, micro tool geometry, effect of feed rate on cutting force for different tool geometry, micro turning, turning of microstructure array, Turning of brittle materials, micro grooving and micro threading, micro drilling, burr formation in micro drilling, effect of induced low frequency vibration on micro drilling, fabrication of micro drills by Wire electro discharge grinding (WEDG), Fly- cutting, burr formation mechanism, cutting mode in micromachining, burr minimization, micro shaping, micro grinding.
7 Hrs

UNIT – II
Tool-based Micro Machining – Nonconventional machining
7 Hrs
UNIT – III
High speed machining (HSM), definition of basic features of HSM, physical aspects of HSM, HSM technology and appliances, HSM spindle with tool clamping system, basic application of HSM Technology, machining of thin-walled parts using HSM.

Dry and Semi-dry machining, Dry machine tools and equipment, dry machining operations, introduction to near-dry machining, minimal quantity lubrication (MQL) media and mixture spraying systems, near-dry machine tools and machining operations.

Hard part machining (HM), definition of basic features of HM, physical aspects of HM, applications of HM Technology, surface finish produced by hard part machining.

High performance and high efficiency machining, high-performance cutting (HPC), machine tools and tooling for high performance cutting, simplified machining operations in HPC, multitasking and one-pass machining, multitasking machines and tooling.

7 Hrs

UNIT – IV
Hybrid thermal machining and thermally assisted machining processes
Hybrid thermal machining processes: Electro erosion dissolution machining, electro-discharge grinding, abrasive electro-discharge machining, EDM with ultrasonic assistance, electrochemical discharge grinding, brush-erosion dissolution mechanical machining
Laser Assisted Machining (LAM), definition of basic features of LAM, schematic diagram of LAM, Plasma Assisted Machining (PAM), definition of basic features of LAM, effect of surface temperature on cutting force.

8 Hrs

UNIT – V
Sensor assisted Machining
Sensors and System Architecture: Sensing objective during machining, multiple-sensor drive machining process control system, monitoring methods in manufacturing, sensor application verses level of precision and error-control parameters, sensors used for monitoring metal cutting and grinding operations, construction of direct spindle integrated with measuring ring and force sensors, tool monitoring systems, intelligent monitoring system.

Practical Examples of Monitoring Systems for Metal Cutting Applications: Monitoring systems on turning centres, drilling process
monitoring using sensors for torque and force measurements within the tool holder and current sensor, Tool-condition monitoring systems, the tool-breakage and tool-wear detection system, the collision-monitoring system, Typical applications of the acoustic emission principle for tool-condition monitoring, Method of dimensional error compensation in precision hard turning, Fundamental structure of the sensor-based intelligent manufacturing system, Hardware structure of the intelligent machining centre, Sensor-assisted intelligent machining system.

**Touch-trigger Probing and Laser Measuring Systems:** Examples of on-machine probing for tool and part measurements, 3D touch probes for machine tools, Radio transmission (a) and inductive transmission systems, Trigger signal transmission for touch probes using optical transmission, tool setting probing systems for CNC lathes, high precision pull-down arm (HPPA) and high precision removable arm (HPRA), Laser system for monitoring of tool breakage, high speed scanning probe and its use in measurements of cylinder bores, in-line inspection using vision sensors.

**TEXT BOOKS:**

**REFERENCE BOOKS:**
INTERNAL COMBUSTION ENGINES (3-0-0)

Subject Code : ME 721  
Credits : 03  
Hrs /week : 3  
Total Hours : 39

UNIT – I
SPARK IGNITION ENGINES:
8 Hrs

UNIT – II
COMPRESSION IGNITION ENGINES
8 Hrs

UNIT – III
POLLUTANT FORMATION CONTROL:
8 Hrs

UNIT – IV
ALTERNATIVE FUELS
Alcohol, Hydrogen, Natural Gas and Liquefied Petroleum Gas - Properties, Suitability, Engine Modifications, Merits and Demerits as fuels  
8 Hrs

UNIT – V
RECENT TRENDS
Learn Burn Engines - Stratified charge Engines - Gasoline Direct Injection Engine - Homogeneous charge Compression Ignition - Measurement techniques: Bosch Smoke meter, Measurement of Brake Power by dynamometers  
7 Hrs

TEXT BOOK:
REFERENCES:
1. R.B.Mathur and R.P.Sharmal, "Internal Combustion Engines".

MAINTENANCE & RELIABILITY ENGINEERING

Subject Code : ME 722
Credits : 03
Hrs /week : 3
Total Hours : 39

UNIT - I
Introduction:
Need for maintenance, objectives, functions and importance of maintenance systems, Type of maintenance systems – planned, breakdown, preventive, predictive, design-out, corrective, opportunistic, Total Productive Maintenance
Condition based maintenance – condition monitoring
Computers in maintenance – introduction, features and benefits

UNIT - II
Maintenance planning and Scheduling: Planning of maintenance, manpower allocation, long range planning, short range planning, planning techniques and procedures, estimation of maintenance work, maintenance control, scheduling, repair order control, manpower requirement, maintenance job analysis, spare parts control

UNIT - III
Economics in Maintenance: Maintenance costs, repair, replacement, repair complexity, finding out most optimal Preventive Maintenance frequency, Numerical problems are required Diagnostic maintenance – wear monitoring, temperature monitoring, vibration monitoring, lubricant analysis

UNIT - IV
UNIT - V

TEXT BOOKS:

REFERENCE BOOKS:

COMPUTER INTEGRATED MANUFACTURING

Subject Code : ME 723 Credits : 03
Hrs /week : 3 Total Hours : 39

UNIT – I
Computer Process Monitoring: Process control methods, direct digital control, supervisory computer control, steady state optimal control, on line search strategies, adaptive control. 8 Hrs
UNIT – II
Computer Aided Quality Control: The computer in Q.C, automated inspection principles and methods, Contact inspection methods, non-contact inspection methods, machine vision system, optical inspection method, sensors, coordinate, measuring machine, Computer-Aided testing, Integration of CAQL with CAD/CAM. 8 Hrs

UNIT – III

UNIT – IV
Analysis of Automated Flow Lines: Analysis of transfer lines without storage with storage buffer single stage, Double stage, Multistage with problems, Automated assembly systems, Design for automated assembly, parts feeding devices, analysis of Multi station assembly machine, Analysis of Single stage assembly machine. 8 Hrs

UNIT – V
Automated Material Handling Storage: Material functions, types of material handling equipment, analysis of material handling systems, design of system, conveyor system, automated guided vehicle systems, automated storage/retrieval systems, caroused storage systems work in process storage, interfacing handling & storage with manufacturing 8 Hrs

TEXT BOOKS:

REFERENCE BOOKS:

TEXT BOOKS:

REFERENCE BOOKS:

Scheme Examination:
TWO questions to be set from each unit and students shall answer FIVE full questions choosing ONE question from each unit

DESIGN FOR MANUFACTURE AND ASSEMBLY

Subject Code : ME 724  
Credits : 03
Hrs /week : 3  
Total Hours : 39

UNIT – I
Selection of materials and processes: Phases of design - General requirements, material and process selection, effect of material properties and manufacturing process on design-- The material selection process- DFM approach, DFM guidelines.  

UNIT – II
Product design for manual assembly, automatic assembly and robotic assembly, Computer aided DFMA. Process capability, mean, variance, skewness, kurtosis, process capability metrics, Cp, Cpk, Cost aspects, feature, tolerances.  

UNIT – III
Geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law, Selective assembly. Datum systems-Feature location, Comparison between co-ordinate and convention method of feature location, tolerancing and true position tolerancing, virtual size concept, floating and fixed fasteners, projected tolerance zone, assembly with gasket, zero true position tolerance, functional gauges, paper layout gauging, compound assembly, examples.
Redesign of castings based on parting line considerations, minimizing core requirements, redesigning cast members using weldments, use of welding symbols. Operation sequence for typical shaft type of components, preparation of process drawings for of different operations.  

UNIT – V
Tolerance worksheets and centrality analysis, examples. Design features to facilitate machining, datum features - functional and manufacturing, component design machining considerations, redesign for manufacture, examples.

TEXT BOOK:

REFERENCE BOOKS:
UNIT – III

UNIT – IV
Purchasing: Purchasing principles, procedures and systems, Functions of purchasing, Make-or-buy decision, Vendor development and vendor rating. Factors affecting purchase decisions, Legal aspects of purchasing, Documentation and procedure for import. 7 Hrs

UNIT – V
Storage: Functions and importance of store keeping, types of stores, store accounting and store verification, Legal aspects of store keeping, Management of surplus, scrap and obsolete items. Importance of material handling in store keeping, handling equipment. 7 Hrs

TEXT BOOK:
1. Materials Management by M.M Verma, S. Chand and Sons

REFERENCE BOOKS:
2. Purchasing and materials management by Dobbler and Burt; Tata McGraw Hill
3. Inventory control by Starr and Miller
PRODUCT DESIGN AND DEVELOPMENT

Subject Code : ME 726  
Credits : 03
Hrs /week : 3  
Total Hours : 39

UNIT - I
VISUAL DESIGN:
Basic elements and concept of visual design: line color, Balance proportion, Size shape mass, unity and variety, Special relationships and composition in two and three dimensions.  

8 Hrs

UNIT - II
FORM & COLOR Elementary forms their characteristics and significance in design. Form transition, Form in relation to ergonomics, material and manufacturing process, color as an element of design, color clarification dynamics, interrelation of colors, colors and traditions; Psychological use of color form and material.  

8 Hrs

UNIT - III
PRODUCT GRAPHICS: Meaning and objectives of product graphics. Basic principles of graphic design, Visual communication aspects of product graphics, Graphics of displays and control panels,  

7 Hrs

UNIT - IV
PRODUCT DETALING: Standard fastening and joining details in different materials; Temporary and permanent joints: Detailing for plastic products, Detailing for fabricated products in sheet metal.  

8 Hrs

UNIT - V
PRODUCTS DEVELOPMENT: Definition and objective, Role of designer in product development. Manufacturing and economic aspects of product development, Product promotions, product developments,  

8 Hrs

TEXT BOOK:

REFERENCE BOOKS:
2. Industrial Design-Mayall
4. Engineering Design-Matousek
DESIGN OF AIRCRAFT STRUCTURE

Subject Code : ME 727
Credits : 03
Hrs /week : 3
Total Hours : 39

UNIT - I

Chapter-1-Overview of the Aircraft Design Process
Airworthiness- Definition, Airworthiness Regulations, Regulatory Bodies, US FAR and Subparts of FAR Part 25, Type certification, General Requirements, Requirements Related to Aircraft Design - Performance and Stability Requirements, Airframe (strength) Requirements, Landing Requirements, Fatigue and Damage tolerance requirements, Emergency Provisions, Emergency Landing requirements. 4 Hrs

Chapter-2 -Aircraft Loads
Aerodynamic Loads, Inertial Loads, Loads due to engine, Actuator Loads, Maneuver Loads, V-n diagrams, Gust Loads, Ground Loads, Ground conditions, Miscellaneous Loads. Simple numerical examples. 2 Hrs

Chapter 3- Aircraft Structures Description
Types of Structural members of Fuselage and wing section and empennage, Splices, Types of structural joints, splices and fuselage floor structure. 1 Hrs

UNIT - II

Chapter 4-Aircraft Materials and properties
3 Hrs

Chapter 5- Static and Fatigue Failures
Principal stresses, principal strains, Mohr’s circle for stress and strain, Fatigue Failures, Fatigue theory, Introduction to Low cycle Fatigue, Stress Life and Strain Life Techniques, Mean stress effects, Multi-axial Effects, Introduction to high cycle fatigue. 4 Hrs

UNIT - III

Chapter 6-Theroy of bars ,Beams, Shafts and Columns
Axially loaded structures, Methods of analysis-Method of joints and Method of sections, Space truss.
Beam theory, Section properties, Deflection of beams, Symmetric and Unsymmetric bending, Plastic bending, Shear stress in beams, Shear center, Torsion of Solid Sections, Torsion of Thin walled-open and closed sections, Columns Theory-Euler equation, Effective column length, Plasticity effects, Thin walled columns-Crippling, Beam columns.  

8 Hrs

UNIT - IV

Chapter 7- Box Beams
Box Beams- Introduction, Shear flow due to shear, Shear flow due to torsion-Bredt Baths, Single and Multicell Boxes.  

4 Hrs

Chapter -8 Buckling of Thin Sheets
Buckling of thin sheets, Buckling of flat plate in compression and shear, Buckling of curved plates in compression and shear, buckling of stiffened panels-post buckling, effective width, Concept of diagonal tension, buckling under combined loads.  

8 Hrs

UNIT - V

Chapter 9- Aircraft Structural Joints
Introduction, Fasteners, Splices, and Eccentric joints-Bolt Group Analysis, Lug Analysis(Lugs loaded axially only), Tension Fitting and clips, Welded joints, Bonded joints  

3 Hrs

Chapter10- Advanced materials, Vibrations and Flutter
Introduction to Comp Materials, Matrices, Fibers, Forms, Characteristics of composite materials, Brief overview of static and dynamic aero elasticity (definition and importance only)  

2 Hrs

TEXT BOOKS:
6. An Introduction to Aircraft Certification; A Guide to Understanding Jaa, Easa and FAA by Filippo De Florio, Butterworth-Heinemann
HEAT TRANSFER

Subject Code : ME 801  
Credits : 03+01
Hrs /week : 3+1  
Total Hours : 52

UNIT - I
INTRODUCTORY CONCEPTS AND DEFINITIONS:
Modes of heat transfer; Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; Radiation heat transfer coefficient; combined heat transfer mechanism.

CONDUCTION-BASIC EQUATIONS:
General form of three dimensional heat conduction equation in rectangular, coordinate. Discussion (no derivation) on three dimensional conduction in cylindrical and spherical coordinate systems. Boundary conditions of first, second and third kinds.

ONE-DIMENSIONAL STEADY STATE CONDUCTION:
Steady state conduction in a slab, in a cylinder and in a sphere without heat generation. Overall heat transfer coefficient for a composite medium; thermal contact resistance; critical thickness of insulation; Steady state conduction in fins of uniform cross section long fin, fin with insulated tip and fin with convection at the tip; fin efficiency; conduction in solids with variable thermal conductivity.  

14 Hrs
UNIT - II

ONE-DIMENSIONAL TRANSIENT CONDUCTION:
Conduction in solids with negligible internal temperature gradients (Lumped system analysis); Use of transient Temperature charts (Heisler’s Charts) for transient conduction in slab, long cylinder and sphere; use of transient temperature charts for transient conduction in semi infinite solids.

CONCEPTS AND BASIC RELATIONS IN BOUNDARY LAYERS:
Flow over a body-Velocity boundary layer; Critical Reynolds number; General expressions for drag coefficient and drag force; Thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number. Flow inside a duct-velocity boundary layer hydrodynamic entrance length and hydro dynamically developed flow; expressions for friction factor for hydro dynamically developed laminar flow through tubes. growth of thermal boundary layer for constant wall temperature and constant wall heat flux conditions; thermal entrance length and thermally developed flow.

UNIT - III

FORCED CONVECTION:
Application of dimensional analysis for forced convection problems. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydro-dynamically and thermally developed flows; use of correlations for flow over a flat plate, over a cylinder and across

FREE OR NATURAL CONVECTION:
Application of dimensional analysis for free convection- physical significance of Grashoff number; Use of correlations for free convection from or to vertical, horizontal and inclined flat plates, vertical and horizontal cylinders.

UNIT - IV

CONDENSATION AND BOILING:
Types of condensation; Nusselt's theory for laminar condensation on a vertical flat surface-expressions for film thickness and heat transfer coefficient; use of correlations for condensation on inclined flat surfaces, horizontal tube and horizontal tube banks; Reynolds number for condensate flow; Regimes of pool boiling-Pool boiling correlations.
HEAT EXCHANGERS:
Classification of heat exchangers; overall heat transfer coefficient, Fouling and fouling factor; LMTD and NTU methods of analysis of heat exchangers.  

UNIT - V
RADIATION HEAT TRANSFER:
Thermal radiation; Definitions of various terms used in radiation heat transfer; Stefan-Boltzman law, Kirchoff's law, Planck's Law and Wein's displacement law' Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces; Effect of radiation shield; Intensity of radiation and solid angle; Lambert's Law; Radiation heat exchange between two finite surfaces - configuration factor or view factor; properties of view factors; determination of view factors-view factor algebra; Hottel's cross string formula; Network method for radiationheatexchangeinanenclosure.  

TEXT BOOKS:
3. Heat Transfer by Domkundvar

REFERENCE BOOKS:

Scheme Examination:
TWO questions to be set from each unit and Students shall answer FIVE full questions choosing at least ONE question to be answered from each unit.
HEAT TRANSFER LAB

Subject Code : ME 802  
Credits : 03  
Hrs /week : 3

The students are required to carry out any 10 experiments from the following list.

1. Determination of Thermal conductivity of a Metal rod.
2. Determination of overall heat transfer coefficient of a Composite Wall.
3. Determination of Effectiveness on a metallic fin.
7. Determination of Stefan Boltzman constant.
12. Experiment on Transient conduction Heat Transfer.

Scheme of Examination:

Students are required to carry out Two experiments in Semester End Exam

Experiment 1: 20 marks
Experiment 2: 20 marks
  Viva Voce: 10 marks
  Total: 50 Marks
PROJECT – II

Subject Code : ME 803

Credits : 09

Hrs /week : 12

Total Hours: 39

The project work involves the following:

- A report highlighting the design finalization [based on functional requirements & standards (if any)]
- Fabrication, assembly, testing and performance analysis of the designed project
- A presentation including the following:
  - Implementation Phase (Hardware / Software / both)
  - Testing & Validation of the developed system
  - Learning in the Project
  - Consolidated report preparation

Objectives of the course on project work:

To expose engineering students to technology development at workplaces and appraise them regarding shop-floor problems “To provide practical experience in solving open ended problems in real work setting so as to cause transfer of college based knowledge and skills to solve practical problems and thereby develop confidence in the students in the analysis, synthesis and evaluation of practical problems leading to creative thinking Programme.

During this work bench involvement, students will be given 3-4 practical problems. The problems assigned should be of mutual interest to the students and the industry. The problem may belong to 3 or 4 different functional areas. To illustrate, following are some of the suggestions:

Design of a prototype” Programming of CNC machines” Calibration and testing of instruments “ Productivity Improvement Studies” Pollution control related problems” Capacity Planning and Capital Budgeting” Safety Management” Optimum utilization of resources” Conflict Management methodology. The industrial organizations where students are to be sent for problem solving project-oriented work bench involvement may be selected well in advance” The faculty of the department is expected to visit the selected industries and identify suitable problems to be handled by students.” It will be desirable that problems be matched with the interests of students.
It is recommended that a group of 5-6 students be guided by one faculty member during this period.

**SCHEME OF EVALUATION:** Project demonstration, Viva voce  
**Total marks:** 200 Marks

The distribution of marks shall be proportioned based on the type of the project and it is based on fulfilling the following requisites.

The evaluation of students is proposed to be done by internal faculty with active involvement of industrial personnel. The evaluation may be based on following criteria:

- Punctuality and Attendance
- Interpersonal relations
- Sense of Responsibility
- Clarity of concepts, principles and procedures
- Self expression/communication skills
- Report Writing Skills
- Creativity/conceiving new and unusual ideas
- Problem-solving skills

At the end of the project work course students are required to submit a working model of the equipment they have designed and developed or if it is a theoretical or experimental work, they are expected to study a detailed analysis and findings from their work.

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**INDUSTRIAL TRIBOLOGY**

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>ME 811</th>
<th>Credits</th>
<th>03</th>
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<td>Hrs /week</td>
<td>3</td>
<td>Total Hours</td>
<td>39</td>
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**UNIT - I**

Introduction: introduction to Tribology, industrial significance, introduction to micro/ nano tribology

Friction: introduction, laws of friction, types of friction – sliding, rolling, friction of metals, friction of ceramics, polymers, stick-slip, topography of engineering surfaces, contact between surfaces. **7 Hrs**

**UNIT - II**

Wear – introduction, types of wear mechanisms – adhesive, abrasive, fatigue, impact, corrosive wear, wear of materials – metals and alloys, ceramics, polymers, quantitative laws of wear, wear measurement. **8 Hrs**
UNIT - III
Lubrication and lubricants – types and properties of lubricants, viscosity, Newton’s Law of viscosity, Hagen-Poiseuille law
Fluid film lubrication – Hydrostatic, Hydrodynamic, Elastohydrodynamic, Mixed, Boundary, flow between parallel plates, viscosity measuring apparatus, effect of temperature and pressure on viscosity. 7 Hrs

UNIT - IV
Bearing materials – commonly used bearing materials, properties of typical bearing materials. 8 Hrs

UNIT - V
Hydrostatic lubrication – introduction, systems, step bearing – load carrying capacity, oil flow, design for max stiffness, numerical problems
Tribological components and applications – gears, cams, piston rings, cutting tools, industrial applications at least one.
Micro / nano tribology – introduction, AFM / FFM – description, measurements 8 Hrs

TEXT BOOKS:
1. Introduction to Tribology of Bearings – B.C.Majumdar, S. Chand & Company Ltd., New Delhi, 2008.

REFERENCE BOOKS:
TOOL ENGINEERING DESIGN

Subject Code : ME 812  
Credits : 03  
Hrs /week : 3  
Total Hours : 39

UNIT - I
Theory of Metal cutting – Mechanics of chip formation, nomenclature of single point tool, designation of cutting tools, orthogonal and oblique cutting, types of chips produced, tool wear and tool life  
Cutting tools – materials, properties, classification, selection, multipoint cutting tools – milling cutters, drills.  
8 Hrs

UNIT - II
Design of Single point tool – types of cutting tools, chip breakers, design of shank section for single point tool to account for strength and rigidity  
Design of multipoint tools – milling cutter, drill and reamer  
8 Hrs

UNIT - III
Design of Jigs and Fixtures – difference between a jig and a fixture, function of jigs and fixtures, design procedures for drill jig and fixtures, principles of location, different types of locators, principles of clamping, types of clamps, drill bushes and plates, types of drill bushes, bush materials.  
7 Hrs

UNIT - IV
Design of drill jigs – types of drill jigs, jig and machine relationship, jig body and jig feet  
Design of fixtures – milling fixture, turning fixture, grinding fixture and broaching fixture  
8 Hrs

UNIT - V
Design of Press tools – press operations, press tool components, press working terminology, types of dies, design of blanking die, design of drawing die, design of bending die  
8 Hrs

TEXT BOOKS:
3. ASTME – Fundamentals of Tool Design
REFERENCE BOOKS:
2. Jigs and Fixtures – Kempster, ELBS

NON DESTRUCTIVE TESTING
Subject Code : ME 813 Credits : 03
Hrs /week : 3 Total Hours : 39

UNIT - I
Introduction to Non Destructive Testing, Selection of ND methods, Visual Inspection, Leak testing – brief introduction, Liquid Penetrant Inspection – principle, advantages, limitations and applications, Magnetic Particle Inspection – methods of generating magnetic fields, types of magnetic particles, suspension liquids, steps in inspection, advantages, limitations and applications. 8 Hrs

UNIT - II
Eddy Current Inspection – principle, operation, operating variables, procedure, inspection coils, detectable discontinuities, advantages and limitations.
Industrial Computed Tomography – basic principles, capabilities and comparison with other NDT methods, applications
Thermal inspection – principles, equipment, inspection methods, applications 8 Hrs

UNIT - III
Ultrasonic Inspection – basic equipment, advantages, limitations, applications, characteristics of ultrasonic waves, major variables in ultrasonic inspection, basic inspection methods – pulse echo, transmission, transducer elements, couplants, search units, inspection standards 8 Hrs
UNIT - IV
Radiographic Inspection – principles, limitations, radiation sources – X rays, γ rays, recording media, film types and selection, interpretation of radiographs, image quality, penetrimeters
Electron radiography, Neutron radiography, Xero-radiography, application of radiographic inspection in industry 8 Hrs

UNIT - IV
Acoustic Emission Inspection – principle, comparison of AE with other inspection methods, applications, AE waves and propagation, AE sensors and preamplifiers, instrumentation principles, applications 7 Hrs

TEXT BOOKS:

COMPOSITE MATERIALS TECHNOLOGY
Subject Code : ME 814 Credits : 03
Hrs /week : 3 Total Hours : 39

UNIT - I
INTRODUCTION
Limitations of conventional materials - Definition of composite materials – Types of composites, properties and characteristics of different types of composites, Reinforcement of matrix materials, Applications of different types of composites 8 Hrs

UNIT - II
MATERIALS
Types of Fibres materials – Types of polymer matrix- Metal matrix and Ceramic matrix - Coupling agents, fillers and additives - Metal Matrix and Ceramic matrix materials, Coupling agents, Fillers and additives. Techniques used to manufacture Metal matrix and ceramic composites.
UNIT - III

MANUFACTURING
Fundamentals - bag moulding - compression moulding pultrusion-filament winding - other manufacturing process - quality inspection and non-destructive testing. 8 Hrs

UNIT - IV

DESIGN
Fabrication of Composites, cutting, machining, drilling, joint design, mechanical and adhesive bonding, joining, tooling, fabrication equipment. 7 Hrs

UNIT - V

MECHANICS AND PERFORMANCE
Introduction to micro-mechanics-unidirectional lamina - laminates - interlaminar stresses - static mechanical properties - fatigue properties - impact properties - enviromental effects - fracture mechanics and toughening mechanisms, damage prediction, failure modes. 8 Hrs

TEXT BOOKS:

REFERENCE BOOKS:
MARKETING MANAGEMENT

Subject Code : ME 815  
Credits : 03
Hrs /week : 3  
Total Hours : 39

UNIT – I

BASICS

UNIT – II

BUYING BEHAVIOUR & MARKET SEGMENTATION
Cultural, Demographic factors, Motives, types, Buying decisions, segmentation factors, Demographic, Psychographic & Geographic Segmentation, Process, Patterns. 7 Hrs

UNIT - III

PRODUCT PRICING & MARKETING RESEARCH
Objectives, pricing, Decisions and Pricing methods, Pricing Management. Introduction, Uses, process of Marketing Research. 8 Hrs

UNIT - IV

MARKETING PLANNING & STRATEGY FORMULATION
Components of a marketing plan, strategy formulations and the marketing process, implementation, Portfolio analysis, BCG, GEC grids. 8 Hrs

UNIT - V

ADVERTISING, SALES PROMOTION & DISTRIBUTION
Characteristics, Impact, goals, types, Sales promotion-Point of Purchase, Unique Selling proposition. Characteristics, Wholesaling, Retailing, channel design, logistics, Modern Trends in retailing. 8 Hrs

TEXT BOOK:

REFERENCES:


**ME816-CORROSION ENGINEERING**

<table>
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<th>Hours per week</th>
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<th>Total Marks</th>
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**UNIT - I**

**Introduction**
Definition; Significance; Costs of corrosion; Corrosion Science & Engg; Corrosion damage; Classification of corrosion; Electrochemical aspects of corrosion; Polarization and passivity; Environmental effects; Corrosion rate expressions; Electrode potentials; Potential – pH (Pourbaix diagrams).

**UNIT - II**

**Forms of Corrosion**
Uniform corrosion and Atmospheric corrosion; Galvanic corrosion; Crevice corrosion; Filiform corrosion; Pitting corrosion; Inter granular corrosion; Selective leaching; Erosion-Corrosion Cavitation damage; Stress corrosion; Impingement Attack; Inlet tube corrosion; Corrosion fatigue; Hydrogen blistering; Hydrogen Embrittlement.

**UNIT - III**

a) **High Temperature Corrosion**
Mechanism and kinetics; High Temperature materials

b) **Corrosion in mineral acids;**
Corrosion of steel, stainless steels, Cu, Ni; Al.
UNIT - IV

Corrosion Prevention Methods
Materials Selection; Design; Alteration of the environment; Cathodic and Anodic protection; Protective coatings.

UNIT - V

Corrosion Testing
Planned Interval Tests, A few specific tests for corrosion rate measurement; Tafel extrapolation test; Linear polarization test; AC impedance.

Text Book / Reference Books:

WIND AND SOLAR POWER ENGINEERING

Subject Code : ME 821  Credits : 03
Hrs /week  : 3  Total Hours : 39

UNIT - I
PRINCIPLE OF SOLAR RADIATION

UNIT – II
SOLAR THERMAL ENERGY CONVERSION

UNIT - III
SOLAR PHOTO VOLTAICS
Introduction - Fundamentals of photo Voltaic Conversion - Solar Cells - PV Systems - PV Applications.  8 Hrs
UNIT – IV

WIND ENERGY

UNIT - V
Design of blade: Aerodynamic configuration of rotor and determination of blade structure. Orientation system and regulating devices. Description of vertical axis wind mills. Use of wind mill for water pumping. 8 Hrs

TEXT BOOKS:

REFERENCE BOOKS:
ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Subject Code : ME 822  
Credits : 03
Hrs /week : 3  
Total Hours : 39

UNIT – I
ARTIFICIAL INTELLIGENCE: Introduction, definition, underlying assumption, importance of AI, AI and related fields.

8 Hrs

UNIT – II
KNOWLEDGE REPRESENTATION ISSUES: Representations and Mappings, Types of knowledge – Procedural Vs Declarative, Logic programming. Forward Vs Backward reasoning, Matching.
USE OF PREDICATE LOGIC: Representing simple facts, Instance and isa relationships, Syntax and Semantics for Prepositional logic, FQPL and properties of Wffs, Conversion to Clausal form, Resolution, Natural deduction.

8 Hrs

UNIT – III
STATISTICAL AND PROBABILISTIC REASONING: Symbolic reasoning under uncertainty, Probability and Bayes’ theorem, Certainty factors and Rule based systems, Bayesian Networks, Shafer Theory, Fuzzy Logic.

8 Hrs

UNIT – IV

7 Hrs

UNIT – V
TYPICAL EXPERT SYSTEMS: MYCIN, Variants of MYCIN, PROSPECTOR, DENDRAL, PUFF, ETC.

8 Hrs
TEXT BOOKS:
1. Artificial Intelligence, Elaine Rich & Kevin Knight, M/H 1983.
2. Introduction to AI & ES, Dan W. Patterson, Prentice Hall of India, 1999.

REFERENCE BOOKS:

Scheme Examination:
TWO questions to be set from each unit and students shall answer FIVE full questions choosing ONE question from each unit

FLUID POWER SYSTEMS
Subject Code : ME 823 Credits : 03
Hrs /week : 3 Total Hours : 39

UNIT - I
FLUID POWER PRINCIPLES AND FUNDAMENTALS
UNIT - II
ACTUATORS: Linear & Rotary actuators, Hydraulic motors - Types, vane, gear, axial piston, & radial piston. Types of cylinder & its mountings, calculations of piston velocity, thrust under static applications. Design consideration for cylinders. 8 Hrs

UNIT - III
CONTROL OF FLUID POWER: Necessity of pressure control, directional control, flow control valves. Principle of pressure control valves, direct operated, pilot operated, relief valves pressure reducing valve, sequence valve. FLOW CONTROL VALVES: Principle of operation, pressure compensated, temperature compensated flow control valves, meter in & meter out flow control circuits, bleed off circuits. DIRECTION CONTROL VALVES: Check valves, types of D.C. Valves: Two way two position, four way three position, four way two position valves, open center, closed center, tandem center valves, method of actuation of valves, manually operated, solenoid operated, pilot operated etc. 8 Hrs

UNIT - IV
ACCUMULATORS & INTENSIFIERS: Types & functions of accumulators, intensifiers, applications,
DESIGN OF HYDRAULIC CIRCUITS: Meter in, meter out circuits, Pressure control for cylinders, Flow divider circuits. Circuit illustrating use of pressure reducing valves, sequencing valve, counter balance valves, unloading valves with the use of electrical controls, accumulators etc. 7 Hrs

UNIT - V
PNEUMATICS: Introduction to pneumatic power sources, Comparison of Pneumatics with Hydraulic power transmission. Air preparation units: Filter Regulators & Lubricators. Actuators, linear and rotary actuators, air motors, pressure regulating valves. Directional control valves: two way, three way & four way valves, solenoid operated, push button; & lever control valves. Flow control valves, Check valves, methods of actuation, mechanical, pneumatic & electrical etc. Pneumatic circuits for industrial applications & automation. Ex. Feeding, clamping, indexing, picking & placing etc. 8 Hrs
TEXT BOOKS:

REFERENCE BOOKS:
1. **Pneumatics Basic Level TP 101** - by Peter Croser & Frank Ebel, Festo Didactic publication - 1999.

Scheme Examination:
TWO questions to be set from each UNIT and Students shall answer FIVE full questions choosing at least ONE question from each UNIT.

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**ENERGY MANAGEMENT**

Subject Code : ME 824  
Credits : 03  
Hrs /week : 3  
Total Hours : 39

**UNIT – I**
Indian energy scenario: Introduction - Fossil fuels reserves in India, Energy consumption, current generation capacity, energy requirements in future.  
8 Hrs

**UNIT – II**
Pollution due to power plants, Green house effect, Global warming. Renewable energy sources. Energy audit Energy data - historic data, manufacturer specification, industry best specific energy consumption.  
7 Hrs
UNIT – III
8 Hrs

UNIT – IV
Heat recovery systems, etc. Energy storage systems. Advances in lighting technology - TS, CFL, LED, Electronic ballast for fluorescent lamps. Energy management:
8 Hrs

UNIT – V
8 Hrs

TEXT BOOK:
1. WR Murphy and G Mc Kay, 'Energy Management', Oxford University Press.

REFERENCES:

BIO MASS ENERGY SYSTEMS
Subject Code : ME 825 Credits : 03
Hrs /week : 3 Total Hours : 39

UNIT - I
5 Hrs

BIOMASS CONVERSION METHODS: Agrochemical, Thermochemical, Biochemical (flowchart) & Explanation.
3 Hrs
UNIT - II

PHYSICAL & AGROCHEMICAL CONVERSION: Briquetting, Pelletization, Agrochemical, fuel Extraction, Thermo chemical Conversion: Direct combustion for heat, Domestic cooking & heating.

4 Hrs

BIOMASS GASIFICATION: Chemical reaction in gasification, Producergas& the constituents, Types of gasifiers. Fixed bed gasifiers, Fluidized bed gasifiers. Liquefaction: Liquefaction through pyrolysis & Methanol synthesis, application of producer gas in I C Engines.

4 Hrs

UNIT - III

BIO METHANIZATION: Anaerobic digestion, Basic principles, factors influencing Biogas yield, classification of Biogas digester, floating gasholder & fixed dome type. (Working Principle with diagram), Calculations for sizing the Biogas plant.

4 Hrs

BIOGAS FOR POWER GENERATION: Ethanol as an automobile fuel, Ethanol production & its use in engines.

3 Hrs

UNIT - IV


8 Hrs

UNIT - V


8 Hrs

TEXT BOOKS:
REFERENCE BOOKS:

**MICRO-ELECTRO-MECHANICAL SYSTEMS**

Subject Code: ME 826  
Credits: 03
Hrs /week: 3  
Total Hours: 39

UNIT – I
Micro-Electro-Mechanical Systems, introduction and overview, Principles of MEMS, Silicon as a Mechanical Material, Benefits of MEMS, Scaling and performance, Cost reduction, complexity, Issues to consider, MEMS Markets, Overview of MEMS applications, 7 Hrs

UNIT – II
Micromachining Techniques – Overview, Capabilities and limitations of micromachining, Materials for micromachining, Substrates, Additive films and materials, Micromachining terms, General properties of common semiconductors, Mechanical properties, Native oxides of silicon, Typical silicon wafer types, Micromachining Techniques – Bulk Micromachining, Wet etching of silicon, Isotropic etching, Anisotropic etching, EDP, KOH, TMAH, Etch stop layers, Masking, Mask erosion around edges, bulk micromachining process flow, Electrochemical etching, Etch stop, Porous silicon, One-sided wafer etching, Vapor phase etching (XeF₂), Dry etching, SF₆, DRIE, Bosch process, Cryogenic dry etching, Sidewall roughness, Etch lag, Combined isotropic and anisotropic dry etching, SCREAM, ASIP. 8 Hrs

UNIT – III
Micromachining Techniques – Surface Micromachining, Thin film processes, Oxide (thermal, deposited LTO), Nitride (stoichiometric, low-stress), Poly (stress, stress-gradients), Metal, surface micromachining process flow, Release, Wet–Stiction, Dry - Critical point drying, Vapor HF, Microelectronic integration – prior, mixed and
post, Electro-deposition, Hybrid Micromachining Process, Wafer bonding, Anodic bonding, Fusion bonding, SOI wafers. 8 Hrs

UNIT – IV
Micro-Mechanics, Basic Mechanics, Axial stress & strain, Shear stress & strain, Poisson’s Ratio, Commonly used deflection equations, Static beam equations, Static torsion equations, Static plate equations, Cantilever beams, Clamped-clamped beams, Membranes, Springs – folded, torsional, Dynamics, Spring-mass-damper system, resonance, Test structures, Elastic properties, Bent Beam Method for determining Young’s modulus, Resonant beam structures - Cantilever beam, Comb drive resonator, Stress/Strain Gauges - Bent beam strain sensor, Cantilever beams, Buckling beam structures, Substrate analysis; Stoney Equation, Basic mechanisms and structures, In-plane rotary mechanisms, Out-of-plane mechanisms, Bistable mechanisms, Mechanical Sensors, Resistive and piezoresistive strain sensors, Semiconductor strain gauges, Capacitive sensing, Micromachined mechanical sensors, Accelerometers - Basic accelerometer concepts, Force-balanced accelerometer concepts, Strain guage accelerometers, Capacitive accelerometers, Gyrosopes, Pressure sensors, Piezoresistive pressure sensors, Capacitive pressure sensors. 8 Hrs

UNIT – V
Electrostatics, Actuation mechanisms, Electrostatic actuation, Parallel plate actuators, Torsional electrostatic actuators, Electrostatic comb drives, Electrostatic cantilever actuators, Electrostatic linear micromotors (scratch drive), Electrostatic rotary micro-motors.


Fluidic MEMS – Introduction, Basic fluid properties and equations, Types of flow, Bubbles and particles in microstructures, Capillary forces, Fluidic resistance, Fluidic capacitance, Fluidic inductance, Flow channels, Bulk micromachined channels, Surface micromachined channels, Valves – Passive valve, Active valves, Pumps, Bubble pumps, Membrane pumps, Diffuser pumps, Rotary pumps, Electrohydrodynamic pumps, Electrophoretic pumps, Droplet generators. 8 Hrs
TEXT BOOKS:

REFERENCE BOOKS:

Scheme Examination:
TWO questions to be set from each unit and students shall answer FIVE full questions choosing ONE question from each unit
Open Electives Offered in VIII Semester for the year 2014-15

MA8X 01  Graph Theory
MA8X 02  Linear Algebra
HU8X 03  Intellectual Property Rights
PH8X 04  Advanced Materials Technology for CV & ME
BT8X 05  Nano Technology
BT8X 06  Instrumental methods of Analysis for CV & ME
CV8X 07  Environmental Impact Assessment
ME8X 08  Industrial Pollution Control
ME8X 09  Management and Entrepreneurship
EE8X 10  Non-Conventional Energy Systems
EE8X 11  Linear Systems Theory
EC8X 12  Information and Electronic Communication Technology
EC8X 13  Robotics
CS8X 14  Object Oriented Prog. with C++
CS8X 15  Essentials of Information Technology
EC8X 18  Consumer Electronics
PH8X 19  Optoelectronic devices for EE, EC, CSE & ISE
HU8X 20  Value Education
CH8X 21  Natural Products Chemistry for Bio-Tech
CS8X 22  Essentials of IT Service Industry
MA8X 23  Statistical design and analysis of experiments
HU8X 24  Professional & Cognitive Communique
MA8X 25  Introduction to Topology
GRAPH THEORY

Subject code : MA8X01
Credits : 03
Hours/Week : 3
Total Hours : 39

UNIT - I
Introduction to graphs, digraphs, sub graphs-spanning and induced graphs, paths, cycles, connectivity, cutpoints, bridges, blocks.  8 Hrs.

UNIT - II
Trees, Eulerian graphs, characterizations, Hamiltonian graphs.  7 Hrs.

UNIT - III
Planar graphs, outer planar graphs, Euler’s polyhedron formula, Colorability: chromatic number, Five colour theorem, four colour conjecture, Chromatic polynomial.  8 Hrs.

UNIT - IV
Representations of graphs: The adjacency matrix and incidence matrix. Circuit matrix, cutest matrix, Shortest paths in weighted graphs, Dijkstra’s algorithm to find shortest paths.  8 Hrs.

UNIT - V
Spanning trees: Algorithms to find a spanning tree A minimal spanning tree – Kruskal’s & Prims algorithm. Connectivity test: Warshall’s algorithm, algorithm to locate an Euler Circuit from Incidence matrix. Algorithm to locate an Euler Circuit from the adjacency matrix for an undirected graph.  8 Hrs.

Text Book:
1. F. Harary, Graph theory, Narosa Publishing House, 1988
2. Narsing Deo, Graph Theory with applications to Engg. and Comp. Sciences- PHI

Reference Books:
2. D.B. West, Introduction to Graph Theory, PHI
LINEAR ALGEBRA

Subject code : MA8X02  
Credits : 3
Hours/Week : 3  
Total Hours : 39

UNIT - I
Linear equations: System of linear equations and its solution sets; elementar row operations and echelon forms; matrix operations; invertible matrices, LU-factorization. 7 Hrs

UNIT - II
Vector spaces: Vector spaces; subspaces; bases and dimension; coordinates; summary of row-equivalence; computations concerning subspaces. 7 Hrs

UNIT - III
Linear Transformations: Linear transformations; algebra of linear transformations; isomorphism; representation of transformations by matrices; linear functions; transpose of a linear transformation. Determinants and elementary properties. 10 Hrs

UNIT - IV
Canonical Forms: Characteristic values; similarity of matrices, Cayley Hamilton theorem, annihilating polynomials; invariant subspaces; direct –sum decompositions; invariant direct sums; diagonalization of symmetric matrices, iterative estimates of characteristic values. 8 Hrs

UNIT - V
Inner Product Spaces: Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization; least-squares problems; symmetric and unitary operators. 7 Hrs

Text Books:
INTELLECTUAL PROPERTY RIGHTS (IPR)

Subject Code: HU8X03  Credits : 03
Hours/week: 3 Hrs  Total hours : 39

UNIT - I
Introduction to Intellectual Property
Invention and Creativity - Intellectual Property (IP) – Importance, Jurisprudential definition and concept of property, rights, duties and their correlation; History and evaluation of IPR – like Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications 08 Hrs

UNIT - II
Agreements and Treaties

UNIT - III
Basics of Patents and Concept of Prior Art
Introduction to Patents; Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees, Invention in context of “prior art”; Patent databases; Searching International Databases; Country-wise patent searches (USPTO, EPO, WIPO, IPO, etc.) 08 Hrs

UNIT - IV
Patent filing procedures
National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Structure of Patent document, Precautions while patenting – disclosure/non-disclosure; Financial assistance for patenting – introduction to existing schemes, Patent licensing and Agreement, Patent infringement- meaning, scope, litigation. 08 Hrs
UNIT - V

Case Studies on Patents (Basumati rice, turmeric, Neem, etc.) non-biological cases may be included – Copyright and related rights – Trade Marks – Trade secrets - Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition Technology transfer and license agreements.

07 Hrs

References:
5. Intellectual Property Today : Volume 8, No. 5, May 2001,
    - Rachna Singh Puri
    - Arvind Vishwanathan
    I.K. International Publishing House Pvt. Ltd.,

Important Links:
http://www.w3.org/IPR/
http://www.wipo.int/portal/index.html.en
http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
www.patentoffice.nic.in
www.iprlawindia.org/ - 31k - Cached - Similar page
ADVANCED MATERIALS TECHNOLOGY

Subject Code : PH8X04  
Credits : 03  
Hrs/Week : 3  
Total Hours : 39

The objectives of the course:
1. To provide our students adequate education in materials technology to have a basis for a complete understanding of current and future scientific and technological developments.
2. To provide our students, adequate education regarding the material properties to handle the design problem involving materials, effectively.
3. To select a right material for a specified application from the thousands of available materials available.
4. To select a cost effective material to reduce the cost of finished product.

UNIT - I

Structures and Properties of Ceramics - Introduction, Ceramic structures: Crystal structures, Silicate Ceramics, Carbon, Imperfection in ceramics, ceramic phase diagram, Mechanical properties: Brittle Fracture of Ceramics, Stress-Strain Behavior, mechanisms of plastic deformation, Miscellaneous mechanical Considerations.
Types, processing and Applications of Ceramics - Glasses and Glass Ceramics, clay Products, Refractories, Abrasives, Cements, Advanced Ceramics, Fabrication and processing of Ceramics and applications, Fabrication and processing of Glasses and applications, Fabrication and processing of Clay Products, Powder Pressing, Tape casting. 08 Hrs

UNIT - II

Polymer Synthesis and Processing - Polymerization, polymer additives, Forming Techniques for Plastics, Fabrication of fibers and Films and applications. 08 Hrs

UNIT - III

UNIT IV
Shape memory alloys and Metallic glasses:
Introduction to shape memory alloys, Fundamental characteristics, shape memory effect (psuedoelasticity),Advantages and disadvantages of SMA, Methods of processing, Commercial shape memory alloys and applications.
Introduction to metallic glasses, principle, properties, processing, applications - bulk metallic glass in nanotechnology, metallic glasses for air craft structure. 07 Hrs

UNIT V
Introduction to Nano materials: Properties of individual nanoparticles, Semiconducting nanoparticles: optical properties, photofragmentation, coulombic explosion, Carbon clusters: small carbon clusters, \( \text{C}_{60} \) crystals, alkali doped \( \text{C}_{60} \), larger and smaller fullerenes, other bucky balls, nanostructured crystals: natural nanocrystals, photonic crystals, nanostructured ferromagnetism: Dynamics of nanomagnets, nanopore containment of magnetic particles, ferrofluids. 08 Hrs.

Text books
REFERENCE BOOKS:

1. Van Vlack L.H. “Elements of Material Science” Addison-Wesley Publishers

Scheme:

1) SEE to be conducted out of 100 marks and will be reduced to 50 marks
2) Two Questions are to be set from each unit, carrying 20 marks each.
3) Students have to answer any one full question from each Unit.

NANOTECHNOLOGY

Subject Code : BT8X05  Credits : 03
Hrs/Week : 3  Total Hours : 39

OBJECTIVE
The objectives of this course includes introduction to nanotechnology, detailed study of MEMS, applications of nanotechnology. Beneficiary Branches of Engineering: EC, Mechanical, Civil.

UNIT - I

INTRODUCTION

UNIT - II

NANOMATERIAL AND NANO TOOLS
Buckyballs (Fullerenes), Nanotubes, nanowire, Dendrimers, Nanoshells, magnetic nanoparticle, Quantum Dot (Nanocrystals), self
assembled monolayers, Scanning probe microscopy (Scanning tunneling microscopy, Atomic force microscopy).  

UNIT - III
NANOTECHNOLOGY FOR DRUG DISCOVERY & DRUG DELIVERY

UNIT - IV
MICROFLUIDICS
Microflows (Laminar flow), Hagen-Poiseuille equation, micromixing, microvalves & micropumps, Need for the microfluidics, Fabrication of Soft Materials, application of microfluidics.  

UNIT - V
MEMS & APPLICATIONS
Introduction and Overview, Design of MEMS, Sensors, Electromagnetic Transducers, Mechanical Transducers, Chemical Transducers, Optical Transducers - Applications of optical and chemical transducers. Recent Developments in MEMS and Nanochips. DNA based MEMS, application of MEMS.  

Text books:
2. Transducers and instrumentation, D.V.S. Murthy, Prentice Hall of India.  
5. Micro fluidics for biotechnology by Jean Berthier Pascal Silberzan
INSTRUMENTAL METHODS OF ANALYSIS

Subject Code : BT8X06  Credits : 03
Hours / Week : 3  Total Hours : 39

Beneficiary Branches of Engineering: Mechanical, Civil.

UNIT - I
INTRODUCTION
Types of analytical instrumental methods and their selection, role of computers in analytical methods, performance requirements of analytical instruments, and instrument calibration techniques. Principle of microscopy, light field microscopy, scanning electron microscopy, tunneling electron microscopy and applications 7 Hrs

UNIT - II
SPECTROSCOPIC TECHNIQUES
Basic principles and applications of UV-Visible spectrometry, infrared spectrometry, nuclear magnetic resonance spectrometry, molecular mass spectrometry. Surface spectroscopic techniques: electron spectroscopy and ion spectroscopy; atomic absorption spectroscopy. 9 Hrs

UNIT - III
CHROMATOGRAPHIC TECHNIQUES
Introduction to chromatographic separations. Basic principles and theory. Gas chromatography and HPLC: principle, instrumentation, column, detector, mobile phase, sample preparation. Application of chromatographic techniques. 9 Hrs

UNIT - IV
THERMAL AND ELECTROCHEMICAL TECHNIQUES
Principles and applications of thermo-gravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC). Electrochemical methods for analysis, electrochemical cells, types of electrodes, electrode potentials. 8 Hrs

UNIT - V
ENVIRONMENTAL APPLICATIONS
Types and concentration of various gas pollutants, instrumental techniques and measurement range for carbon dioxide, sulfur dioxide, nitrogen oxides, hydrocarbons and ozone. Types of water pollutants and detection techniques. 6 Hrs
Text Book:

Reference Books:
1. R. S. Khandpur, Handbook of analytical instruments, TMH.

ENVIRONMENTAL IMPACT ASSESSMENT

Sub Code : CV 8X07
Credits : 03
Hrs/ Week : 03
Total Hours : 39

Objective: To equip the students with the various key elements of EIA.
Pre-requisites of the course: CV 113

UNIT - I
Developmental activity and ecological factors; EIA, EIS, FONSI. Need for EIA studies, Baseline information, Procedure for conducting EIA, Limitation of EIA; Environmental Acts/policies.  
8 Hrs

UNIT - II
Frame work of impact assessment in developmental projects; Environmental setting, EIA- Objective, content, methodologies, techniques, Rapid and comprehensive EIA.  
9 Hrs

UNIT - III
7 Hrs.
UNIT - IV
Public participation in environment decision making, practical consideration in preparing EIA and EIS, salient features of the project activity, Environmental parameter–activity relationship matrices.  
8 Hrs

UNIT - V
EIA for construction project, power projects, mining projects.  
7 Hrs

TEXT BOOKS

REFERENCE BOOKS
1. Guidelines for EIA of developmental projects, Ministry of Environment and Forest, GOI

INDUSTRIAL POLLUTION CONTROL

Subject Code : ME 8X08  
Credits : 03  
Hrs/ Week : 03  
Total Hours : 39

UNIT - I
1. Introduction to Pollution
Man and the environment, environmental degradation due to energy generation, consequences of pollution, sustainable industrial growth, air water and soil pollution, carbon audit.Ill effects of pollutants, Photochemical Smog, permissible concentrations.  
8 Hrs

UNIT - II
2. Meteorology
Meteorology, Wind rose, plume dispersion studies & Numerical problems  
8 Hrs
UNIT - III

3. Separation techniques
Particulates and fly ash separation techniques. Sources of Particulates Matter, fly ash properties, theory of settling processes- (problems), Single & parallel plate ESP- (problems), Bag House, Cyclone separator, Spray Tower, Scrubbers & Venturi Scrubber, merits and demerits of each. 8 Hrs

UNIT - IV

4. Smoke and gaseous pollutants
Smoke and gaseous pollutants: formation, measurement and control techniques T.T.T.O principle-(Ringlemann Chart, Smokescope, Bosch smoke meter), Coal firing- Under feed and overfeed stocker, Domestic and Industrial Incinerators, Pollutant gaseous (So2, Co, UBHC & NOx) Their sources, measurement and control. So2-Colorimetric, scrubbing & lime stone injection method. CO- Colorimetric, IR CO analyzer & control by oxidation. UBHC- Gas chromatography, Control by after burning & floating tanks. NOx- Iso-kinetic sampling, colorimetric method, control methods in brief for Low peak combustion temperature. 7 Hrs

UNIT - V

Water, soil, noise, plastic and odor pollution, their control methods. Pollution control Acts, Legal aspects of pollution control. 8 Hrs

Reference Books:
2. "Air Pollution control", W. L. Faith, John Wiley
3. "Environmental Pollution Control Engineering, Wiley Eastern Ltd.,

Scheme Examination:
TWO questions to be set from each UNIT and Students shall answer FIVE full questions choosing at least ONE question from each UNIT.
MANAGEMENT & ENTREPRENEURSHIP

Subject Code : ME 8X09  Credits : 03
Hrs/ Week : 03  Total Hours : 39

UNIT - I

PLANNING: Nature, importance and purpose of planning process - Objectives - Types of plans (Meaning Only), Steps in planning & planning premises, Hierarchy of plans. 9 Hrs

UNIT - II

DIRECTING & CONTROLLING: Meaning and nature of directing - Leadership styles Classification and meaning only), Motivation Theories (Meaning of motivation and Classification of theories; content, process and contemporary), Communication - Meaning and importance. Coordination - meaning, importance and Techniques of Coordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief). 10 Hrs

UNIT - III
ENTREPRENEURSHIP: Concept of Entrepreneurship, Evolution of Entrepreneurship, Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship - its Barriers. Meaning of Entrepreneur; Functions of an Entrepreneur, Types of Entrepreneurs, Intrapreneur - an emerging Class.

Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study. 8 Hrs
UNIT - IV

SMALL SCALE INDUSTRIES: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI, Government policy towards SSI; Different Policies of SSI, Impact of Liberalization, Privatization, Globalization on SSI. Effect of WTO/GATT on SSI, Supporting Agencies of Government for SSI, Ancillary Industry and Tiny Industry (Definition Only)

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

UNIT - V

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Errors of Project Report; Project Appraisal, Network Analysis (Simple numerical problems to find early and late, start and finish times, critical path and total project duration).

TEXT BOOKS:
2. Dynamics of Entrepreneurial Development & Management - Vasant Desai - Himalaya Publishing House

REFERENCE BOOKS:
1. Management Fundamentals - Concepts, Application, Skill Development - Robers Lusier - Thomson -
NON CONVENTIONAL ENERGY SYSTEMS

Subject Code : EE8X10
Credits : 3
Hrs / Week : 3
Total Hours : 39

UNIT – I
Energy Sources: Introduction, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Classification of Energy Resources; Conventional Energy Resources - Availability and their limitations; Non-Conventional Energy Resources – Classification, Advantages, Limitations; Comparison of Conventional and Non-Conventional Energy Resources; World Energy Scenario; Indian Energy Scenario. 3 Hrs


Solar Thermal Systems: Principle of Conversion of Solar Radiation into Heat, Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, concentrating dish type, Solar driers, Solar Still, Soilr Furnces, Solar Green Houses. 4 Hrs


UNIT – II

Syllabus of VII & VIII Semester B.E./Mechanical Engg.

Output and Capacity Factor of WECS, Wind site selection consideration, Advantages and Disadvantages of WECS. **5 Hrs**

Biomass Energy: Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Biogas production from waste biomass, factors affecting biogas generation, types of biogas plants – KVIC and Janata model; Biomass program in India. **7 Hrs**

**UNIT – III**

Energy from Ocean: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant (TPP), Classification of Tidal Power Plants, Estimation of Energy – Single basin and Double basin type TPP (no derivations. Simple numerical problems), Advantages and Limitation of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Site-selection criteria, Biofouling, Advantages & Limitation of OTEC. **5 Hrs**


**TEXT BOOKS:**


**REFERENCE BOOKS:**


**LINEAR SYSTEMS THEORY**

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**UNIT - I**

State variable analysis & design: Introduction, concept of state, state variables & state model, state model of linear systems, linearization of state equations. **3 Hrs**
State space representation using physical variables, phase variables & canonical variables. 6 Hrs

Derivation of transfer function from state model, diagonalisation, eigen values, Eigen vectors, generalized Eigen vectors. 6 Hrs

UNIT - II
Solution of state equation, state transition matrix & its properties, computation using Laplace transformation, power series method, Cayley-Hamilton method, 8 Hrs

Concept of controllability & observability, methods of determining the same. 6 Hrs.

UNIT - III
Pole placement techniques: stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement. 5 Hrs

Liapunov stability criteria, Liapunov functions, direct method of Liapunov & the linear system, Hurwitz criterion & Liapunov’s direct method 5 Hrs

Text Books:

Reference Books:
INFORMATION AND ELECTRONIC COMMUNICATION TECHNOLOGY

Subject Code : EC 8X12  Credits : 03
Hrs/ Week : 03  Total Hours : 39

Common elective from Electronics and Communication department - for the students of Other branches

UNIT - I
Introduction: measure of information, information content, symbols, entropy, communication channel, noise and channel capacity, discrete channels, error control, codes.
Noise & signal processing, AM/FM/PM..., sampling, PAM, TDM, PCM,
Concept of spread spectrum, multiple access, cells, mobility, inter-cell handshake. 15 Hrs

UNIT - II
Microwaves: microwave devices, microwave systems and antennas, propagations, reflections and refractions terrestrial communications, ground and space components, SNR, FDMA, TDMA Etc, satellite systems and services.
Optical fiber: optical devices, transmission networks, multiplexing, WDM, OTDM, n/w management, lasers. 16Hrs

UNIT III
Computers communications: OSI, TCP/IP, languages, adhoc networks, security, multimedia, audio/video compression, 3G/4G N/Ws, latest trends. 8 Hrs

REFERENCE BOOKS:
R2. Kamilo Feher, "Wireless Communication &Application ", PHI.
R3. Faraouzan, "Data Communication", TMH.
R4. Gerd keiser, "Optical fiber Communication", MGH.
R5. Fred Halsall, "Multimedia Communication", Pearson Education.
ROBOTICS

Subject Code : EC 8X13  
Credits : 03  
Hrs/ Week : 03  
Total Hours : 39

Common elective from Electronics and Communication department - for Students from other branches

UNIT - I
Introduction: Historical developments, arm kinematics and dynamics, manipulated trajectory, planning and control, sensing, robot languages, machine intelligence.
Robot arm kinematics: Direct kinematics problem and inverse kinematics solution.
Robot arm dynamics: Lagrange-Euler formulation, Newton -Euler formulation equation of motion.
Planning trajectories: General considerations, joint interpolated trajectories, planning Cartesian path trajectories.  16 Hrs

UNIT - II
Sensing: Range, proximity, touch, force and torque sensing.
Low level vision: Image acquisition, illumination, geometry preprocessing.
High level vision: Segmentation, description, 3D structure recognition, interpretation.
Robot programming languages: Characteristics of robot languages, task languages.  16 Hrs

UNIT - III
Robot intelligence: State space search, predicate logic, means-ends analysis, robot learning, task planning expert systems.  7 Hrs

TEXT BOOK:
T1. Fu K S. etal, "Robotics-control, sensing, machine and intelligence", McGraw Hill

REFERENCE BOOKS:
R2.Groover MP etal., "Industrial robotics", TMH
OBJECT ORIENTED PROGRAMMING with C++

Subject Code : CS 8X14  
Credits : 03  
Hrs/ Week : 03  
Total Hours : 39

UNIT - I
Principles of object - oriented programming:
A look at Procedure Oriented Programming, object Oriented Programming Paradigm, Basic Concepts of OOP, Benefits of OOP, Object oriented languages ,Applications of OOP.

Beginning with c++:
What is c++, Applications of C++, Structure of C++ program, Basic Data types, derived data types, user defined data types, variables in c++, dynamic initialization of variables, reference variables, operators in c++, scope resolution operator, memory management operators, type cast operators,manipulators,namespace.  

UNIT - II
Functions in C++:
Function prototyping, Inline Functions, Default Arguments, Function Overloading

Classes and objects:
Introduction, C Structure Revisited, Specifying a Class, Defining Member Functions, Static Data Members, and Static Member Functions. Arrays of Objects, Objects as Functions Arguments, this pointer, Friend Functions, Returning Objects, Constant Member Functions.

UNIT - III
Constructors and Destructors
Introduction, Constructors, Parameterised Constructors, Multiple Constructors in a Class. Constructors with Default Arguments, Copy Constructors, Dynamic Constructors, Constant Objects, Destructors.

Operator Overloading and Type Conversions
Introduction, Defining Operator Overloading, Overloading the Various Operators, Overloading the Increment and the Decrement Operators (Prefix and Postfix), Overloading the Unary Minus and the Unary Plus Operator, Overloading the Arithmetic Operators, Overloading the Relational Operators, Overloading the Assignment
Operator, Overloading the Insertion and Extraction Operators, Rules for overloading operators. Type Conversions.  

**UNIT - IV**

**Inheritance**
Introduction, Defining Derived Classes, Single Inheritance, Protected Access Specifier, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructors in Derived Classes, Nesting of Classes.

**Pointers, Virtual Functions and Polymorphism**
Introduction, Pointers, Pointers to Objects, Pointers to Derived Classes, Virtual Functions, Pure Virtual Functions.  

**UNIT - V**

**Templates and Exception Handling**

**Working with files**
Classes for Files Stream Operations, Opening and Closing a File, Error Handling during File Operations.  

**Text Books:**
1. E. Balagurusamy: Object - Oriented Programming with C++, Third Edition, Tata McGraw Hill. (Chapters 1.3 to 1.8, 2.1, 2.2, 2.6, 3.5 to 3.7, 3.10 to 3.18, 4.3, 4.6 to 4.9, 5, 6, 7, 8, 9, 11, and 12).

**Reference:**
1. Robert Lapore: Object - Oriented Programming in Turbo C++
3. K.R. Venugopal: Mastering C++
ESSENTIALS OF INFORMATION TECHNOLOGY

Subject Code : CS 8X15  Credits : 03
Hrs / Week : 03  Total Hours : 39

Introduction to Computer Systems (Self-Study)
Introduction to Computer Systems - Basics of computer systems - Various hardware components - Data storage and various Memory units - Central Processing Unit - Execution cycle - Introduce to software and its classifications.

UNIT - I
Operating Systems
Introduction - Memory management - Process management - Interprocess Communication - Deadlocks - File management - Device management. 6 Hrs

UNIT - II
Problem Solving Techniques
Introduction to problem solving - Computational problem and it's classification - Logic and its types - Introduction to algorithms - Implementation of algorithms using flowchart - Flowcharts implementation through RAPTOR tool - Searching and sorting algorithms - Introduction and classification to Data Structures - Basic Data Structures - Advanced Data Structures. 7 Hrs

UNIT - III
Programming & Testing
- Structured Programming - Functions - Structures - File Handling - Introduction to Software Development Life Cycle - Industry Coding Standards and Best Practices - Testing and Debugging Code Review. 8 Hrs
UNIT - IV

**Object Oriented Concepts using JAVA:** Introduction of OOP - Object Oriented Concepts - Introduction to Object Oriented Analysis and Design - Java Architecture and Program Structure - Java language fundamentals - Classes and objects - Inheritance and polymorphism - Abstract classes - Introduction to Packages and Interfaces - Introduction to Eclipse IDE. 9Hrs

UNIT - V

**RDBMS**
- RDBMS- data processing - the database technology - data models
- ER modeling concept -notations - Extended ER features
- Logical database design - normalization
- SQL - DDL statements - DML statements - DCL statements
- Joins - Sub queries - Views
- Database design Issues 9 Hrs

**Integrated Project:**
Project based on C/C++/JAVA & RDBMS.

**References:**
4. Andrew Tanenbaum, Modern Operating Systems, Pearson Education
6. Charles Crowley, "Operating Systems: A Design-Oriented Approach"
7. Dromey, R.G., How to solve it by computers, Prentice Hall, 2005
14. Programming Pearls, by Jon Bentley, Pearson Education publication
16. Tharp Alan L, File Organization and Processing, John Willey and Sons.

Note:
1. Courseware for the subject (power point and the notes) is provided by the teacher. List of references is only for additional reading.
2. Project is a team work with 3 or 4 students in a team. Project need to be carried out offline (outside the lecture hours).
3. Project work includes implementation of some information system using the concepts of programming, testing and RDBMS. Following activities are involved in the project:
   - Preparation of High level design and Detailed design document.
   - Unit Test Plan and Integrated Test Plan.
   - Coding and Unit Testing, Integration Testing.
Students can use the following to implement the Project:
   - Programs using C/C++/JAVA Language
   - Embedded SQL can be used to connect the Front-End with the backend Database systems
   - Visual studio .NET 2005 (or Visual studio 6), RAPTOR tool and oracle 9i/10g to be used for the project.
4. CIE carries 50 Marks which includes Theory Assessment (40 Marks) and Project Work (10 marks). Theory Assessments will be conducted based on CAMP methodology. Project evaluation will be done using Rubrics methodology.
5. Number of hours listed for each unit are only for the class room teaching. Students are expected to give much more time to study each of the topics outside the class hours.

CONSUMER ELECTRONICS

Subject Code : EC 8X18  
Credits : 03
Hrs/ Week : 3  
Total Hours : 39

Common elective from Electronics and Communication department - for the students
Of other branches

UNIT - I
FUNDAMENTALS: Electricity, Particle and Wave Motions, Conduction and Radiations, dielectrics, inductors, Vac. tubes, S.S. devices, IC's further advances, Power supply, Circuit functions.
SOUND: Transducers (Micro Phone, Loud Speakers), enclosures, Recordings - disc, Magnetic, Optical, mono-stereo, Amplifiers, Multiplexers, mixers, Synthesizers, Theatre Sound, Studios, Editing.  
15 Hrs

UNIT - II
VISION: B/W TV, CTV, Video tapes/discs, recording/ play back, Standards, Broad-casting, Video systems, Studios, editing, B/W, Displays, Filters, Cameras, Color displays.
15 Hrs

UNIT - III
UTILITIES: - Fax, Xerox, Calculators, Microwave ovens, Washing Machines, A/C & refrigeration, Dishwashers, ATMS, Set -Top boxes, Auto Electronics, Industrial Electronics, Robotics, Electronics in health / Medicine, nano-technologies.  
9 Hrs

TEXT BOOK:
REFERENCES:
R2. Kamilo Feher, "Wireless Communication & Application", PHI

OPTO ELECTRONIC DEVICES

Subject Code : PH 8X19 Credits : 03
Hrs/ Week : 3 Total Hours : 39

The objectives of the course:
* To know the basics of solid state Physics and understand the
  nature and characteristics of light
* To understand different methods of luminescence, display
  devices and laser types and applications
* To learn the principle of optical detection, mechanisms in
  different detection devices
* To understand different light modulation techniques and the
  concepts and applications of optical switching
* To study the integration process and application of optoelectronic
  integrated circuits in transmitters and receivers.

PART-A
UNIT – I
Display Devices
Introduction- Fluorescence, Phosphorescence, Photo Luminescence,
Cathode Luminescence, Electro Luminescence, LED, plasma
displays, Liquid Crystal displays, Numeric displays. 7 Hrs

UNIT – II
Lasers & Fibre Optics
Laser Emission and Absorption of Radiation, Population Inversion,
Optical Feedback, Threshold conditions-laser losses, Laser modes-
axial & transverse, He-Ne and Liquid dye laser-construction &
working.
Optical fibre - Principle construction & working, Propagation of light,
signal distortion and Attenuation. 8 Hrs
PART-B
UNIT - III

Optical Detectors
Photo detector- thermal detectors, thermoelectric detectors-types, Photon Devices-types, Photoconductive detectors, Junction detectors-Photo diodes (PIN and APD), Photo Transistors, Detector Performance – characteristics, frequency response, noise aspect and sensitivity  8 Hrs

UNIT - IV

Optoelectronic Modulators
Introduction, Polarization, Birefringence, Optical activity, Electro-optic effect, Kerrmodulators, scanning & switching, Magneto-optic devices, Acousto-optic effect  8 Hrs

UNIT - V

Optoelectronic Waveguides
Hybrid and Monolithic Integration, Applications of Optoelectronic wave guide devices, Construction and working of integrated transmitters and receivers-Front end photo receiver, PIN-HBT Photo receiver & OEIC transmitters  8 Hrs

TEXT BOOK:

References:
Bhattacharya “Semiconductor Optoelectronic Devices” Prentice Hall of India Pvt.,Ltd., New Delhi
Ghatak and Thyagarajan, “Introduction to Opto Electronics” New Age International Publishers

Scheme:
1) SEE to be conducted out of 100 marks and will be reduced to 50 marks
2) Two questions carrying 20 marks each will be set from each unit and students have to answer any one.
VALUE EDUCATION

Subject Code : HU 8X20  
Credits : 03  
Hrs/ Week : 3  
Total Hours : 39

The Objectives of the course:
1. To make the students realize the significance of values in self-development.
2. To train the students in techniques of mind control, time management and stress management.
3. To make students use the fundamentals learnt in the course in solving
   a) The problems in their own lives like intoxication, gambling, extra marital relations, generation gap, ragging, peer pressure, addiction to social networking sites.
   b) The problems pertaining to the society in general like corruption, irresponsible media, distractions among youth, gender discrimination, westernization, child abuse & animal cruelty.
4. To make students understand value of sustainable civilization, simple living and high thinking.

UNIT - I
Three components of human personality (IQ, EQ and SQ), separating men from animals, real problems of life, how to acquire knowledge. Why sense gratification is opium of the masses, three kind of people and their symptoms, ethical degradation of the society today, how mind gets out of control, anger management, different levels of consciousness (bodily platform, sensual platform, mental and intellectual), regulative principles of freedom, difference between moderation and abstinence.

UNIT - II
Intoxication, harmful effect of alcohol on liver, central nervous system, blood, gastro intestinal tract, muscles, etc. myths and facts regarding alcohol. Harmful effect of smoking on respiratory health, strokes and heart diseases, cognitive dysfunction, passive smoking myths and facts about smoking, Drug addiction, common neurological effects of drug addiction, physical effects. Negative impacts of gambling, gambling vs. substance abuse, Forms of illicit sex, forms of animals cruelty, alternatives for animal experimentation. Knowledge, attitudes and skills needed to achieve a sustainable value based global culture.
UNIT - III
Generation gap, ragging, peer pressure, addiction to social networking sites, corruption, irresponsible media, distractions among youth, gender discrimination, westernization, child abuse, euthanasia, capital punishment, female feticide, terrorism. 9Hrs

Scheme:
1) SEE to be conducted out of 100 marks and will be reduced to 50 marks.
2) Three questions from units 1&2 each and two questions from unit 3 shall be set, carrying 20 marks each.
3) Students have to answer 5 full questions, selecting at least two questions from units 1&2 each and one from unit 3.
4) Break Up of CIE (50 marks) :
   - First Mid Semester Exam - 10 marks
   - Second Mid Semester Exam - 10 marks
   - Class Quiz - 05 marks
   - Students' solution of problems discussed in the form of video skits - 25 marks

NATURAL PRODUCTS CHEMISTRY

Subject Code : CH8X21  Credits : 03
Hrs/Week : 03  Total Hours : 39

UNIT - I
Terpenoids: Introduction and classification, isoprene rules, general methods of determination of structure of terpenoids. Structure elucidation, synthesis and biosynthesis of the following terpenoids; Monoterprenoids-Geraniol, α-pinine, and camphene. Sesquiterpenods-Farnesol, and α-santonine, Diterpenoids- gibberillic acid. Triterpenoids-Squaline, Cyclisation of squaline into α-lanosterol and friedelene. 8 Hrs

UNIT - II
Sex hormones: Chemistry of estrogen, progesterone, androsterone and testosterone. Structure and synthesis of cortisone and aldosterone. 8 Hrs.

UNIT - III
Prostaglandins: Introduction, nomenclature, classification and biological role of prostaglandins. Structure elucidation and stereochemistry of PGE1, PGE2 and PGE3. Total synthesis of PGE1 (Corey’s method) 7 Hrs

UNIT - IV
Chemistry of Porphyrins: Introduction to porphyrins, structure and degradation products of haemoglobin and chlorophyll. 8 Hrs.

UNIT - V
Alkaloids: Definition, Classification and isolation of alkaloids. General methods of structural determination of alkaloids. Detailed study of structure elucidation, rearrangement, synthesis and biogenesis of the following alkaloids- papaverine, cinchonine, and morphine. 8 Hrs

References:
ESSENTIALS OF IT SERVICE INDUSTRY
(SPAN TECHNOLOGIES)

Subject Code : CS8X22
Credits : 03
Hrs/week : 3
Total Hours : 39

UNIT - I
Fundamentals of Software Industry 3 Hrs
Introduction to SDLC Process; Life cycle models; Requirement
Gathering Techniques; Functional, Non Functional, Statutory and
Regulatory Requirements; Configuration Mgmt; Workshop on
Requirement Analysis.

UNIT - II
Relational Database 6 Hrs
Fundamentals of Relational Databases; Primary key, Unique Key,
Foreign keys and Indexes; Logical & Physical Databases; Simple
Queries.

UNIT - III
Basics of DOTNET & coding techniques 9 Hrs
Introduction to .NET framework 3.5 with additional features of .NET
4.0; Language construct C#; Visual Studio Developer environment
IDE; Coding Standards and General Coding guidelines.

UNIT - IV
ASP.NET 12 Hrs
Page life cycle; Web.config; types of apps, control structure; HTML
controls; Server controls; Custom controls; User controls; Form
validation; Master Pages, Themes, Skins, CSS, Passing data between
forms, Session object, view state, Request / Response; ADO.Net.

UNIT - V
Code Enable 9 Hrs
Error/Exception handling; XML – Overview; Creating XML; XML
validation; XPATH; XML schema, attributes, XML in SQL; Usage of
Code Analysis Tools – Face, Style Cop; Jquery;IIS.

Note:
1. Courseware for the subject (Power Point Presentation) will be
   provided by the teacher. List of references is only for
   additional reading.
2. Assignment will be provided for each theory sessions. These assignments need to be carried out by each student (outside the lecture hours) independently and must be submitted within the timeframe specified by the instructor.

3. Tests will be conducted on each topics separately and test assignment score will be used for final evaluation.

4. Test score will carry a weightage of 20%, assignment 30% and rest 50% weightage would be given to the final examination.

STATISTICAL DESIGN AND ANALYSIS OF EXPERIMENTS

Sub code: MA8X23  
Credits : 0 3  
Hrs/Week : 3  
Total Hours : 39

UNIT – I

Curve fitting and Regression: Least square principle, curve fitting of linear, quadratic and exponential. Correlation and properties, correlation coefficients, regression analysis.  
8 Hrs

UNIT – II

Probability Theory: Review of pdf’s, expectation, variance, moment generating function and properties, Moment generating functions and their properties, random samples, sampling distributions, central limit theorem and applications.  
10 Hrs

UNIT - III

Estimation and Testing of hypothesis: Consistency and unbiased statistics, point and interval estimation, mean and variance, tests of hypothesis concerning mean and variances.  
8 Hrs
UNIT - IV
Functions of random variables, t, F and chi-square distributions 7 Hrs

UNIT - V
Analysis of variance of one-way, two-way classified data, experimental designs: CRD,RBD,LSD, factorialexperiments 6 Hrs

Text Books:
1. Irwin Miller, John E. Frund, “Probability and Statistics for Engineers” 3rd edition

Reference books:

PROFESSIONAL & COGNITIVE COMMUNIQUÉ

Subject Code : HU8X24 CIE Marks : 50
Hrs/Week : 3 Total Hours : 39

UNIT - I
Common sense: Understand the term ‘common sense’ & commonsensical consensus, unsettling commonsensical consensus. (Role of language in the growth of an individual)
Emotional Intelligence: Nature, function and types of intelligence; emotion, intelligence and creativity; Growth and development of emotional intelligence. 8 Hrs
UNIT - II
Manners and Etiquettes - work place etiquettes, Significance of Cross Cultural understanding; Cultural Sensitivity, Impact of social Media  Self-Presentation Skills.
Workplace: Physical and Psychological working conditions; Workplace Readiness Skills.  8 Hrs

UNIT - III
Writing: Creative Writing, Formal writings/Informal writing, Plagiarism.
Reading and Interpretation: Styles of reading, scanning, skimming, detailed reading.  8 Hrs

UNIT - IV
Presentation Skills: Event planners coordinate and manage conferences meetings and parties.  8 Hrs

UNIT - V
Diaspora: exile, migration, old and new diasporas, the heterogeneity of diasporas, groups, especially by gender, class, sexuality, caste, religion, the role of language and other cultural practices in migratory experiences; Films and Indian Diaspora.  7 Hrs

References:
Ray French : Cross Culture Management, Universities Press
Urmila Rai : Business Communication, Himalaya Publishing House
Neil Fiore; The Now Habit at Work: Perform Optimally, Maintain Focus, and Ignite Motivation in Yourself and Others ,Publisher: Wiley ISBN: 9780470593462
V. Geetha; Gender
http://writingexercises.co.uk/index.php
http://www.studyskills.soton.ac.uk/studytips/reading_skills.htm
http://pages.minot.k12.nd.us/votech/File/workplace.htm
INTRODUCTION TO TOPOLOGY

Subject code: MA8X25 Credits: 03
Hrs/Week: 03 Total Hours: 39

UNIT – I
Basics of set theory and logic: Functions, relations, arbitrary cartesian products, principle of recursive definition, countable and uncountable sets, infinite sets and axiom of choice, well ordered set and maximum principle 8 Hrs.

UNIT - II
Topological spaces, basis for a topology, order topology, product topology on $X \times Y$, The subspace topology, closed sets and limit points, continuous functions. 8 Hrs.

UNIT - III
Product topology, Metric topology, Examples. 8 Hrs.

UNIT - IV
Connectedness and compactness: Connected spaces, connected sets in the real line, compact spaces, compact sets in the real line. 8 Hrs.

UNIT - V
Countability and separation axioms. $T_1,T_2,T_3,T_4$ Spaces. 7 Hrs.

Reference books: