



**JNT UNIVERSITY KAKINADA, KAKINADA**  
**MECHANICAL ENGINEERING - COURSE STRUCTURE - 2010 BATCH**

**IV YEAR**

**I SEMESTER**

S. No.	Subject	T	P	Credits
1	Refrigeration & Air Conditioning	4	-	4
2	CAD/CAM	4	-	4
3	Alternative Sources of Energy	4	-	4
4	Unconventional Machining Processes	4	-	4
5	<b>Open Elective</b>	4	-	4
6	<b>Departmental Elective – I</b>	4	-	4
7	Simulation Lab	-	3	2
8	Advanced Communication skills Lab	-	3	2
	<b>Total</b>			<b>28</b>

**IV YEAR**

**II SEMESTER**

S.NO	SUBJECT	T	P	CREDITS
1	Interactive computer Graphics	4	-	4
2	Departmental Elective - II	4	-	4
3	Departmental Elective - III	4	-	4
4	Departmental Elective - IV	4	-	4
5	Project Work			12
	Total			28

<p><b>Departmental Elective – I</b></p> <ol style="list-style-type: none"> <li>1. Automobile Engineering</li> <li>2. Computational Fluid Dynamics</li> <li>3. Condition Monitoring</li> <li>4. Rapid Prototyping</li> </ol>	<p><b>Departmental Elective – II</b></p> <ol style="list-style-type: none"> <li>1. Metal corrosion</li> <li>2. Nano Technology</li> <li>3. Automation in Manufacturing</li> <li>4. Industrial Hydraulics &amp; Pneumatics</li> </ol>
<p><b>Departmental Elective – III</b></p> <ol style="list-style-type: none"> <li>1. Non Destructive Evaluation</li> <li>2. DBMS</li> <li>3. Advance Materials</li> <li>4. power Plant Engineering</li> </ol>	<p><b>Departmental Elective – IV</b></p> <ol style="list-style-type: none"> <li>1. Production Planning and control</li> <li>2. Advance Optimization Techniques</li> <li>3. Gas Dynamics &amp; Jet Propulsion</li> <li>4. Quality and Reliability Engineering</li> </ol>
<p><b>OPEN ELECTIVE</b></p> <ol style="list-style-type: none"> <li>1. MEMS</li> <li>2. Industrial Robotics ( Except For Mechanical Students)</li> </ol>	



## JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. I-Sem.

### REFRIGERATION & AIR CONDITIONING

(Refrigeration and Psychrometric tables and charts allowed)

#### UNIT-1

**INTRODUCTION TO REFRIGERATION:** Necessity and applications – Unit of refrigeration and C.O.P. - Mechanical Refrigeration - Types of ideal cycles of refrigeration. Air Refrigeration: Bell Coleman cycle-open and dense air systems - refrigeration systems used in air crafts and problems.

#### UNIT-2

**VAPOUR COMPRESSION REFRIGERATION:** Working principle and essential components of the plant - simple vapour compression refrigeration cycle - COP - Representation of cycle on T-S and p-h charts - effect of sub cooling and super heating - cycle analysis - Actual cycle-Influence of various parameters on system performance - Use of p-h charts - numerical problems.

#### UNIT-3

**SYSTEM COMPONENTS:** Compressors - general classification - comparison - Advantages and Disadvantages. Condensers - classification, Working Principles, Evaporators - classification – Working Principles, Expansion devices - Types, Working Principles.

REFRIGERANTS - Desirable properties - classification refrigerants used Nomenclature - Ozone Depletion - Global warming.

#### UNIT-4

**VAPOR ABSORPTION SYSTEM:** Calculation of max COP – description and working of NH<sub>3</sub> - Water system and Li Br -water ( Two shell & Four shell) System. Principle of operation of Three Fluid absorption system, salient features.

#### UNIT-5

**STEAM JET REFRIGERATION SYSTEM:** Working Principle and Basic Components. Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube.

#### UNIT-6

**INTRODUCTION TO AIR CONDITIONING:** Psychrometric Properties & processes - Characterization of sensible and latent heat loads - Need for Ventilation, Consideration of Infiltration - Load concepts of RSHF, GSHF - Problems, Concept of ESHF and ADP temperature.

**UNIT-7**

Requirements of human comfort and concept of effective temperature- comfort chart -Comfort Air conditioning - Requirements of Industrial air conditioning, Air conditioning Load Calculations.

**UNIT-8**

**AIR CONDITIONING SYSTEMS:** Classification of equipment, cooling. heating, humidification and dehumidification, filters, grills and registers fans and blowers. Heat Pump - Heat sources - different heat pump circuits.

**TEXT BOOKS:**

1. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar/Dhanpatrai
2. Refrigeration and Air Conditioning / CP Arora / TMH.

**RIFERENCE BOOKS:**

1. Refrigeration and Air Conditioning/ Manohar Prasad / New Age.
2. Principles of Refrigeration - Dossat / Pearson Education.
3. Basic Refrigeration and Air - Conditioning -Ananthanarayanan / TMH

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## JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. I-Sem.

### CAD/CAM

#### UNIT-1

Computers in Industrial Manufacturing, Product cycle, CAD / CAM hardware. Basic structure, CPU, Memory types, input devices, display devices. hard copy devices, storage devices.

#### UNIT-2

**COMPUTER GRAPHICS:** Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry. 3D transformations, mathematics of projections, clipping, hidden surface removal.

#### UNIT-3

**GEOMETRIC MODELING:** Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

#### UNIT-4

**DRAFTING AND MODELING SYSTEMS:** Basic geometric commands, Layers, display control commands, editing, dimensioning, solid modeling.

#### UNIT-5

**PART PROGRAMMING FOR NC MACHINES:** NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming.

#### UNIT-6

**GROUP TECHNOLOGY:** Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

#### UNIT-7

**COMPUTER AIDED QUALITY CONTROL:** terminology in quality control, the computer in QC, Contact inspection methods, noncontact inspection methods-optical, noncontact inspection methods-nonoptical, computer aided testing, integration of C AQC with CAD/CAM.

#### UNIT-8

**INTEGRATED MANUFACTURING SYSTEMS:** Types of manufacturing systems, Machine tools and related equipment, material handling systems, computer control Systems, human labor in the manufacturing systems, CIMS benefits.

**TEXT BOOKS:**

1. CAD/ CAM A Zimmers & R.Groover/PE/PHI
2. Automation, Production systems & Computer integrated Manufacturing/ Groover/P.E

**REFERENCE BOOKS:**

1. CAD /CAM Theory and Practice/ Ibrahim Zeid / TMH
2. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
3. Computer Numerical Control Concepts and programming/ Warren S Seames / Thomson.

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## JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. I-Sem.

### ALTERNATIVE SOURCES OF ENERGY

#### UNIT-1

**SOLAR RADIATION:** Role and potential of new and renewable sources, the solar energy option. Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

#### UNIT-2

**SOLAR ENERGY COLLECTION:** Flat plate and concentrating collectors classification of concentrating collectors, orientation and thermal analysis advanced collectors.

#### UNIT-3

**SOLAR ENERGY STORAGE AND APPLICATIONS:** Different methods sensible, latent heat and stratified storage, solar ponds. Solar applications solar heating/cooling technique, solar distillation and drying, solar cookers central power tower concept and solar chimney.

#### UNIT-4

**WIND ENERGY:** Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria, types of winds, wind data measurement.

#### UNIT-5

**BIO-MASS:** Principles of Bio-Conversion, Anaerobic/aerobic digestion types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C.Engine operation and economic aspects.

#### UNIT-6

**GEOHERMAL ENERGY:** Resources, types of wells, methods of harnessing the energy, potential in India.

#### UNIT-7

**OCEAN ENERGY:** OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

**UNIT-8**

**DIRECT ENERGY CONVERSION** : Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, See-beck, Peltier and joul thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects, Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions, photo voltaic energy conversion -types of PV cells, I-V characteristics.

**TEXT BOOKS:**

1. Sukhatme S.R and J.K.Nayak, Solar Energy- Principles of thermal Collection and Storage, TMH
2. Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2006

**REFERENCE BOOKS:**

1. Solar Power Engineering/ B.S Magal Frank Kreith & J .F Kreith.
2. Principles of Solar Energy/ Frank Krieth & John F Kreider.
3. Non- Conventional Energy /Ashok V Desai /Wiley Eastern.
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa.



## JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. I-Sem.

### UN CONVENTIONAL MACHINING PROCESSES

#### UNIT-1

**INTRODUCTION:** Need for non-traditional machining methods- Classification of modern machining processes - considerations in process selection, applications.

#### UNIT-2

Ultrasonic machining -- Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

#### UNIT-3

Abrasive jet machining, Water jet machining and abrasive water jet machining: Basic principles, equipments, process variables, mechanics of material removal, MRR, application and limitations.

#### UNIT-4

**ELECTRO - CHEMICAL MACHINING:** Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM -- Simple problems for estimation of metal removal rate. Fundamentals of chemical, machining, advantages and applications.

#### UNIT-5

**THERMAL METAL REMOVAL PROCESSES:** General principle and applications of Electric Discharge Machining, Electric Discharge Grinding and wire EDM - Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and -machining accuracy, characteristics of spark eroded surface.

#### UNIT-6

EBM, LBM, basic principle and theory, process parameters, efficiency & accuracy, applications

#### UNIT-7

Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

#### UNIT-8

Magnetic abrasive finishing, Abrasive flow finishing, Electro stream drilling shaped tube electrolytic machining.



**TEXT BOOK:**

1. Advanced machining processes/ VK Jain/ Allied publishers.

**REFERENCE BOOKS:**

2. Modern Machining Process/ Pandey P.C. and Shah H.S./ TMH.

2. New Technology / Bhattacharya A/ The Institution of Engineers, India 1984.

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## JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. I-Sem.

### AUTOMOBILE ENGINEERING

#### (DEPARTMENTALELECTIVE-I)

#### UNIT-1

**INTRODUCTION :** Components of four Wheeler automobile - chassis and body - power unit - power transmission - rear wheel drive, front wheel drive, 4 wheel drive - types of automobile engines, engine construction, turbo charging and super charging - engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft.

#### UNIT-2

**TRANSMISSION SYSTEM:** Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel - gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box , over drive torque converter. propeller shaft - Hotch - Kiss drive, Torque tube drive, universal joint, differential rear axles - types - wheels and tyres.

#### UNIT-3

**STEERING SYSTEM:** Steering geometry - camber, castor, king pin rake combined angle toein, center point steering. types of steering mechanism - Ackerman steering mechanism, Davis steering mechanism, steering gears - types, steering linkages.

#### UNIT-4

**SUSPENSION SYSTEM:** Objects of suspension systems - rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

**BRAKING SYSTEM:** Mechanical brake system, hydraulic brake system, master cylinder, wheel cylinder tandem master cylinder requirement of brake fluid, pneumatic and vacuum brakes.

#### UNIT-5

**ELECTRICAL SYSTEM:** Charging circuit, generator, current –voltage regulator - starting system, bendix drive mechanism solenoid switch, lighting systems, horn, Wiper, fuel gauge - oil pressure gauge, engine temperature

#### UNIT-6

**ENGINE SPECIFICATION AND SAFETY SYSTEMS:** Introduction- engine specifications with regard to power, speed, torque, no. of cylinders and arrangement, lubrication and cooling etc.

**safety:** Introduction, safety systems - seat belt, air bags, bumper, anti lock brake system (ABS), Wind shield, suspension sensors, traction control, mirrors, central locking and electric Windows, speed control.

**UNIT-7**

**ENGINE EMISSION CONTROL:** Introduction - types of pollutants, mechanism of formation, concentration measurement, methods of controlling- engine modification, exhaust gas treatment- thermal and catalytic converters- use of alternative fuels for emission control - National and International pollution standards

**UNIT-8**

**ENGINE SERVICE:** Introduction, service details of engine cylinder head valves and valve mechanism, piston-connecting rod assembly, cylinder block, crank shaft and main bearings, engine reassembly- precautions.

**TEXT BOOKS:**

1. Automotive Mechanics - Vol. I & Vol. 2 / Kripal Sing, standard publishers
2. Automobile Engineering/ William Crouse, TMH Distributors
3. Automobile Engineering- RS Gill, S.K. Kataria & Sons, New Delhi.

**REFERANCE BOOKS:**

1. Automotive Engines Theory and Servicing, James D. Halderman and Chase D. Mitchell Jr., Pearson education inc.
2. Automotive Engineering / Newton Steeds & Garrett Automotive Mechanics/ Heitner



**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**IV Year B.Tech. Mech. Engg. I-Sem.**

**COMPUTATIONAL FLUID DYNAMICS**

**(DEPARTMENTAL ELECTIVE - I)**

**UNIT-1**

**ELEMENTARY DETAILS IN NUMERICAL TECHNIQUES:** Number system and errors, Representation of integers, Fractions, Floating point Arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, Convergence of Sequences.

**UNIT-2**

**APPLIED NUMERICAL METHODS:** Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices.

**UNIT-3**

**REVIEW OF EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER:** Introduction, conservation of mass, Newton's second law of motion, expanded forms of Navier -Stokes equations, conservation of energy principle, special forms of the Navier -stokes equations.

**UNIT-4**

Steady flow, dimensionless form of Momentum and Energy equations, Stokes equation, conservative body force fields, stream function – Vorticity formulation.

**UNIT-5**

Finite Difference Applications in Heat conduction and Convection – Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite, difference application in convective heat transfer, closure

**UNIT-6**

Finite Differences, discretization, consistency, stability, and Fundamentals of fluid flow modeling: Introduction, elementary finite difference quotients implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

**UNIT-7**

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme.

**Unit-8**

**FINITE VOLUME METHOD:** Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and Quadratic interpolation.

**TEXT BOOKS:**

1. Numerical heat transfer and fluid flow / Suhas V. Patankar- Butter-worth Publishers
2. Computational fluid dynamics - Basics with applications - John. D, Anderson /Mc Graw Hill.

**REFERANCE BOOKS:**

1. Computational Fluid Flow and Heat Transfer/ Niyogi, Pearson Publications
2. Fundamentals of Computational Fluid Dynamics -- Tapan K. Sengupta / Universities Press.

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## JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. I-Sem.

### CONDITION MONITORING

(DEPARTMENT A/ELECTIVE-I)

#### UNIT-1

**BASICS OF VIBRATION:** Basic motion: amplitudes, period, frequency, Basic Parameters: displacement, velocity, acceleration, Units (including dB scales) and conversions, Mass, spring and damper concept, Introduction to SDOP and MDOF systems, Natural frequencies and resonance, Forced response.

#### UNIT-2

**VIBRATION MEASUREMENTS AND ANALYSIS:** Transducers and mounting methods, Data acquisition using instrumentation recorders/data loggers, Time domain signal analysis, orbit analysis, Filters, Frequency domain analysis (Narrow band FFT analysis), Nyquist criteria, Sampling, aliasing, windowing and averaging.

#### UNIT-3

**VIBRATION MEASUREMENT AND ANALYSIS:** Use of phase; Bode, polar and water fall plots, Constant percentage band width analysis (1/3 and 1/1 Octave analysis), Envelope detection /Spike energy analysis, Cepstral analysis, Advances in analysis (PC based and portable instruments for vibration analysis).

#### UNIT-4

Fault Diagnosis, Interpreting vibration measurements for common machine faults, Imbalance, Misalignment, Mechanical looseness. Bearing and Gearing faults, Faults in Induction motors, Resonances, Some case studies, Static and Dynamic Balancing, International Standards for vibration condition monitoring.

#### UNIT-5

**THERMOGRAPHY:** The basics of infrared Thermography, Differences in equipment and specific wave length limitations, Application of IR to: Electrical inspection, Mechanical inspection, Energy conservation, How to take good thermal images, Hands-on demonstrations focusing on proper camera settings and image interpretation, Analysis of Thermal Images and Report Generation, Study of thermography applications

**UNIT-6**

**OIL AND WEAR DEBRIS ANALYSIS:** Basics of oil analysis, Monitoring condition of oil, Lubricant analysis, Physio - Chemical properties, Moisture, TAN TBN, Wear Debris analysis, Particle counting, Spectroscopy, uses & limitations, Ferrography Wear particle analysis, Concept of Ferrography, Principle particle classification, Size, Shape, Composition, Concentration, Analysis procedure, Sampling & Analytical Ferrography Equipments, Severity rating

**UNIT-7**

**CONDITION MONITORING OF ELECTRIC MACHINES AND MOTOR CURRENT SIGNATURE ANALYSIS:** Basics of Electric Motors, types of electric Motors and operation, Synchronous Motors, Induction Motors, constructional features of Squirrel Cage Induction Motors, Common faults In Induction Motors, Motor Current Signature. analysis, Electric Motor current Waveform and its characteristics, Motor current harmonics, Stator motor current wave pattern and reflection of rotor current harmonics, Rotor bar condition analysis, Estimation of rotor bar condition

**UNIT-8**

**ULTRASONIC MONITORING AND ANALYSIS:** Ultrasonic Monitoring (leak, Crack and Thickness) Basics of Ultrasonic Monitoring , Ultrasonic theory, Test taking philosophy, Ultrasonic theory, Mathematics of Ultrasound, equipment and transducers, Inspection parameters and calibration, Immersion theory, Equipment quality control, Flaw origins and inspection methods, UT Procedure familiarization, and Study recommendations, Application of ultrasound to: Air leaks, Steam trap testing, Bearing lubrication, Electrical inspection, case studies.

**TEXT BOOKS:**

1. The Vibration Analysis Handbook, J I Taylor (1994)
2. Machinery Vibration Condition Monitoring, Lynn, Butter worth( 1989)

**REFERENCE BOOKS:**

1. Machinery Vibration: Measurement and Analysis. Victor Wowk (1991)
2. Mechanical fault diagnosis and condition monitoring, RA Collacott (1977)
3. The Vibration Monitoring Handbook (Coxmoor's Machine & Systems Condition Monitoring) (1998)





## JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. I-Sem.

### RAPID PROTOTYPING

(DEPARTMENTAL- I)

#### UNIT-1

**INTRODUCTION:** Prototyping fundamentals, Historical Fundamentals of Rapid Prototyping, Advantages and Limitations of Prototyping, Commonly used Terms, Classification of RP process Prototyping Process Chain: Fundamental Automated Processes, Chain.

#### UNIT-2

**LIQUID-BASED RAPID PROTOTYPING SYSTEMS:** Stereo Apparatus (SLA): Models and specifications, Process, working principle, photo polymerization, Layering technology, laser and scanning. Applications, Advantages and Disadvantages, Case studies ground curing (SGC): Models and specifications, Process, Working Applications, Advantages and Disadvantages, Case studies.

#### UNIT-3

**SOLID-BASED RAPID PROTOTYPING SYSTEMS:** Laminated Object Manufacturing (LOM): Models and specifications. Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

#### UNIT-4

**POWDER BASED RAPID PROTOTYPING SYSTEMS:** Selective laser sintering (SLS): Models and specifications, Process, working principle Applications, Advantages and Disadvantages. Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

#### UNIT-5

**RAPID TOOLING:** Introduction to Rapid Tooling (RT), Convention Tooling Vs RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tool p Investment Casting, Spin Casting, Die casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool process. EOS Direct Tool Process and Direct Metal Tooling using 3DP.

#### UNIT-6

**RAPID PROTOTYPING DATAFORMATS:** STL Format, STI, File Problems, consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution; Other Translators, Newly Proposed Formats.



**UNIT-7**

**RAPID PROTOTYPING SOFTWARE'S:** Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

**UNIT-8**

**RP APPLICATIONS:** Application- Material Relationship, Application in design. Application in Engineering, Analysis and Planning, Aerospace industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic science and Anthropology, Visualization of Bimolecular.

**TEXT BOOK:**

1. Rapid prototyping: Principles and Applications - Chua C.K., Leong KP and LIM CS, World Scientific publications

**REFERENCEBOOKS:**

1. Rapid Manufacturing - D.T. Pham and S.S. Dimov, Springer
2. Wholers Report 2000 Terry Wohlers, Wohlers Associates
3. Rapid Prototyping & Manufacturing - Paul F. jacobs, ASME Press



## JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. I-Sem.

### SIMULATION LAB

**1. DRAFTING:** Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script, DXE and IGES files.

**2. PART MODELING:** Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and Assembly Modeling. Study of various standard Translators. Design simple components.

3.

- a). Determination of deflection and stresses in 2D and 3D trusses and beams.
- b). Determination of deflections component and principal and Von- mises stresses in plane stress, plane strain and Axisymmetric components.
- c). Determination of stresses in 3D and shell structures (at least one example in each case)
- d). Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
- e). Steady state heat transfer Analysis of plane and Axisymmetric components.

4.

- a). Development of process sheets for various components based on tooling Machines.
- b). Development of manufacturing and tool management systems.
- c). Study of various post processors used in NC Machines.
- d). Development of NC code for free form and sculptured surfaces using CAM packages.
- e). Machining of simple components on NC lathe and Mill by transferring NC Code/ from a CAM package. Through RS 232.
- f). Quality Control and inspection.

**Packages to be provided to cater to drafting, modeling & analysis from the following:**

Auto CAD, Micro station, CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM, Gibbs CAM, Master CAM etc.



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**IV Year B.Tech. Mech. Engg. I-Sem.**

**ADVANCE ENGLISH COMMUNICATIONS SKILLS LAB**

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## JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. I-Sem.

### MICRO ELECTROMECHANICAL SYSTEMS (MEMS)

(OPENELECFIVE)

#### UNIT-1

**INTRODUCTION:** Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, Wafer bonding, LIGA.

#### UNIT-2

**MECHANICAL SENSORS AND ACTUATORS:** Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

#### UNIT-3

**THERMAL SENSORS AND ACTUATORS:** Thermal energy basics and heat transfer processes, thermistors, thermo devices, thermo couple, micro machined thermo couple probe, peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, :MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever.

#### UNIT-4

**MICRO-DPTO-ELECTRO MECHANICAL SYSTEMS:** Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.

#### UNIT-5

**MAGNETIC SENSORS AND ACTUATORS:** Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators, by directional micro actuator, feedback circuit integrated magnetic actuator, large force reluctance actuator, magnetic probe based storage device.

**UNIT-6**

**RADIO FREQUENCY (RF) MEMS:** RF-based communication systems, RF MEMS, MEMS inductors, varactors, tuner/filter, resonator, clarification of tuner, filter, resonator, MEMS switches, phase shifter.

**UNIT-7**

**MICRO FLUIDIC SYSTEMS:** Applications, considerations on micro scale fluid, fluid actuation methods, dielectrophoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting' (OEW), tuning using micro fluidics, typical micro fluidic channel, micro fluid dispenser, micro needle, molecular gate, micro pumps.

**UNIT-8**

**CHEMICAL AND BIO MEDICAL MICRO SYSTEMS:** Sensing mechanism & principle, membrane-transducer materials, chem.-lab-on-a-chip (CLOC) chemoresistors, chemocapacitors, chemotransistors, electronic nose (E-nose), mass sensitive chemosensors, fluorescence detection, calorimetric spectroscopy.

**TEXT BOOK:**

1. MEMS, Nitaigour Premchand Mahalik, TMH Publishing co.

**REFERENCE BOOKS:**

1. Foundation of MEMS, Chang Liu, Prentice Hall Ltd.
2. Bio-MEMS (Micro systems), Gerald Urban, Springer.
3. MEMS and Micro Systems: Design and Manufacture, Tai-Ran Hsu, TMH Publishers.



**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**IV Year B.Tech. Mech. Engg. I-Sem.**

**INDUSTRIAL ROBOTICS**

**(OPEN ELECTIVE)**

**UNIT-1**

Automation and Robots-Technology of Robots-Economics and social issues- (General characteristics of Robots-Basic components-Robot configuration- Robot selection.

**UNIT-II**

Robot classification-Arm Geometry-Degree of Freedom-Power Sources-Types of Motion-Path control-Intelligence Level. Robot System Analysis-Robot Operation-Hierarchical Control Structure-Line Tracking-Dynamic Properties of Robots-Modular Robot Components. Robot End Effectors-Types of End effectors- Mechanical Grippers-Gripper Force Analysis-Other Types of grippers.

**UNIT-3**

Sensors-Robot sensors-Sensor Classification-Micro switches-Solid-State Switches-Proximity Sensors-Photoelectric Sensors-Rotary Position Sensors- Usage and Selection of Sensors-Signal Processing. Vision-Visual Sensing- Machine Vision-Machine Vision Applications.

**UNIT-4**

Control Systems-Control System Correlation-Control System Requirements- Programmable Logic Controller-PLC Programming Terminals-Proportional Integral-Derivative-Computer Numerical Control-Microprocessor Unit-Work cell Control.

**UNIT-5**

Programming-Robot Programming-Programming Methods-Programming Languages-Levels of Robot Programming-Motion Interpolation-Sample Programs.

**UNIT-6**

Artificial Intelligence-Intelligent Systems-Elements of Artificial Intelligence- System Architecture-Applications of Advanced Robots-Fuzzy Logic controls- Advanced Concepts and Procedures-Future Developments.

**UNIT-7**

Safety-Robot Safety-Safety standards-System Reliability - Humana Factor Issues-Safety Sensors and Monitoring-Safeguarding-Training-Safety Guide lines-Definitions.

**UNIT-8**

Industrial Applications-Automation in Manufacturing-Robot Applications Material-Handling Applications-Processing Operations-Assembly Operations-Inspection Operations - Evaluating The Potential of a Robot Application-Future Applications-Innovations.

**TEXTBOOKS:**

1. Robot Technology Fundamentals by James G.Keramas, Cengage Learning.
2. Industrial Robotics by Mikell P.Groover, Weiss, Nagel, Odrey/ McGraWHill.

**REFERENCE BOOKS:**

1. Robotics, K.S Fu/McGrawHill
2. Introduction to Robotics, Mechanics & Control by John J .Craig/Pearson 3 edition.

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## JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. II-Sem.

### INTERACTIVE COMPUTER GRAPHICS

#### UNIT-1

**INTRODUCTION:** Application areas of Computer graphics, overview of graphic system, video-display devices, raster-scan systems, random scan systems, graphics monitors and Work stations, introduction to PHIGS &GKS and input devices, input device handling algorithms.

#### UNIT-2

**OUTPUT PRIMITIVES:** Points and lines, line drawing algorithms, mid-point circle algorithm, Filled area primitives: scan-line polygon fill algorithm, boundary-fill and flood-fill algorithm.

#### UNIT-3

**2-D VIEWING :** The viewing pipe-line, viewing coordinate reference frame, window to view-port coordinate transformations, viewing function, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland-Hodgeman polygon clipping algorithm, segments.

#### UNIT-4

**3-D OBJECT REPRESENTATION:** spline representation, Hermite curve, Bezier curve and B-spline curve, Polygon surfaces, quadric surfaces, Solid modeling Scalars - wire frame, CSG, B-rep. Bezier and B-spline surfaces.

#### UNIT-5

**Illumination:** Basic illumination models, Light sources, diffuse reflection- Lambert's cosine law and point source illumination, specular reflection, Transparency and shadows.

Shading algorithms: Constant intensity algorithm, Phong's shading algorithm, gourand shading algorithm, Comparison of shading algorithms.

#### UNIT-6

**Visible surface detection methods:** Classification, back-face detection, depth-buffer, scan-line, depth sorting.

#### UNIT-7

**COMPUTER ANIMATION:** Design of animation sequence, general computer animation functions, raster animation, computer animation language, key frame system, motion specification.



**UNIT-8****MULTIMEDIA**

**Introduction:** Multimedia-Systems, Technology, Architecture, Hardware trade-offs, contents, PC, Applications, Data compressions, Authoring System.

**MULTIMEDIA AUTHORIZING TOOLS**

Introduction, types of authoring tools, page based/In card authoring tools, icon-based authoring tools,

Time-based and presentation tools, Object-oriented -authoring tools, authorware professional for windows (APW).

**TEXT BOOKS:**

1. "Computer Graphics C version" Donald Hearn and M. Pauline Baker, Pearson/PHI
2. "Computer Graphics Principles & practice", second edition in C, Foley, VamDam, Feiner and Hughes, Pearson Education`

**REFERENCE BOOKS:**

1. "Computer graphics a practical approach", Er. Rajiv Chopra, S.chand Publications.
2. "Computer Graphics Second edition", Zhigand Xiang, Roy Plastock, Schaum's outlines, Tata Mc-GraW hill edition.
3. Procedural elements for Computer Graphics, David F Rogers, Tata McGraw hill, 2nd edition.



## JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. II-Sem.

### METALCORROSION

#### (DEPARTMENTALELECTIVE-II)

##### UNIT-1

Corrosion -Theoretical aspects. Electrolysis. Principles. Faraday 's laws and their application. Current efficiency. Energy efficiency. Ion conductivity. Equivalent and motor conductivities. Tonic mobilities and Transport Nos. Electrode potential, Equilibrium potentials - EMF series. Polarization, over voltage/over potential. `

##### UNIT-2

Activation, concentration, Ohmic polarization. Effect of polarization on electrode processes. Corrosion as an irreversible electrode process. Tafels equation. Tafels slopes. Effect of Temperature, composition and concentration of the corrosive media. Kinetics of electrode process (briefly). Passivity.

##### UNIT-3

Electronic processes. Cathodic Technical processes. Brief classification. Anodic technical process. Corrosion - Electrochemical aspects of Corrosion. Corrosion cells/Electro chemical cells, Concentration cells, Temperature cells. Determination of Electrode potential.

##### UNIT-4

Thermodynamic aspects-Nernst equation, Helmholtz equation. Galvanic series. Displacement equilibrium and its significance in corrosion processes. Potential- pH, Fe-H O diagram. E- I diagrams for prediction of corrosion currents. Polarization resistance, Linear polarization technique for evaluation of I<sub>corr</sub>.

##### UNIT-5

Corrosion - Practical aspects .Importance. Direct and indirect losses. Types and Forms of Corrosion. Uniform Corrosion, Pitting Corrosion, Galvanic Corrosion, and Integranular Corrosion, Stress Corrosion cracking. Cavitation Erosion, Erosion Corrosion. Corrosion Fatigue. Differential aeration corrosion. Corrosion rate expressions.

##### UNIT-6

Vesting methods. Effect of velocity, flow-rate, concentration, temperature and inhibitors on corrosion rates. Corrosion rate calculations.

**UNIT-7**

Corrosion prevention, 1) Design aspects 2) Alteration of Environment inhibitors 3) Alteration of the material, pure metals alloys, Non-metallic as structural materials ~ Reinforcement of the material for reducing, Corrosion rates. 4) Surface protection. Electroplating, Principles - Throwing power and its evaluation.

**UNIT-8**

Commercial plating of Cu, Ni, Cr, Cd, Zn, Ag, Au. Electro-deposition of alloys plating structure of Electro deposits and testing of deposits. 5) Anodic oxidation of Aluminium and its alloys. Commercial anodizing process. Faults in the anodic coating and the remedies. Treatment after anodizing. 6) Cathodic and Anodic protection.

**TEXT BOOKS:**

1. An introduction to Electrometallurgy, Sharan and Narain, Standard Publishers
2. Corrosion Engineering, MG Fountana, Mc-Graw Hill book company

**REFERENCEBOOK:**

1. Electro Beam Analysis of Materials, Loretto.

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**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**IV Year B.Tech. Mech. Engg. II-Sem.**

**NANO TECHNOLOGY**

**(DEPARTMENTALELECTIVE -II)**

**UNIT-1**

**GENERAL INTRODUCTION:** Basics of Quantum Mechanics, Harmonic oscillator, magnetic Phenomena, band structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, Anisotropy.

**UNIT-2**

**SILICON CARBIDE:** Application of Silicon carbide, nano materials preparation, Sintering of SiC, X-ray Diffraction data, electron microscopy sintering of nano particles,

**NANO PARTICLES OF ALUMINA AND ZIRCONIA:** Nano materials preparation, Characterization, Wear materials and nano composites,

**UNIT-3**

**MECHANICAL PROPERTIES:** Strength of nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties,

**UNIT-4**

**ELECTRICAL PROPERTIES:** Switching glasses with nanoparticles, Electronic conduction with nano particles

**OPTICAL PROPERTIES:** Optical properties, special properties and the coloured glasses

**UNIT-5**

Process of synthesis of nano powders, Electro deposition, Important Nano materials.

**UNIT-6**

**INVESTIGATING AND MANIPULATING MATERIALS IN THE NANOSCALE:** Electron microscopics, scanning probe microscopics, optical microscopics for nano science and technology, X-ray diffraction.

**UNIT-7**

**NANOBIولوجY:** Interaction between biomolecules and nanoparticle surface, Different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies, Application of nano in biology, nanoprobes for Analytical Applications-A new Methodology in medical diagnostics and Biotechnology, Current status of nano Biotechnology, Future perspectives of Nanobiology, Nano sensors.

**UNIT-8**

**NANOMEDICENS:** Developing of Nanomedicens Nano sytems in use, Protocols for nano drug Administration, Nanotechnology in Diagnostics applications, materials for used in Diagnostics and Therapeutic applications, Molecular Nano mechanics, Molecular devices, Nanotribology, studying tribology at nano scale, Nanotribology applications.

**TEXTBOOKS:**

1. Nano Materials- A.K.Bandyopadhyay/ New Age Publishers.
2. Nano Essentials- T.Pradeep/TMH

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**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**IV Year B.Tech. Mech. Engg. II-Sem.**

**AUTOMATION IN MANUFACTURING**

**(DEPARTMENTAL ELECTIVE - II)**

**UNIT-1**

**INTRODUCTION:** Types and strategies of automation, pneumatic and hydraulic components, circuits, Automation in machine tools, Mechanical feeding and tool changing and machine tool control.

**UNIT-2**

**AUTOMATED FLOW LINES:** Methods of part transport, transfer mechanism, buffer storage, control function, design and fabrication considerations,

**UNIT-3**

**ANALYSIS OF AUTOMATED FLOW LINES:** General terminology and analysis of transfer lines Without and with buffer storage, partial automation, implementation of automated flow lines.

**UNIT-4**

**ASSEMBLY SYSTEM AND LINE BALANCING:** Assembly process and systems, assembly line, line balancing methods, Ways of improving line balance, flexible assembly lines.

**UNIT-5**

**AUTOMATED MATERIAL HANDLING:** Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems.

**UNIT-6**

**AUTOMATED STORAGE SYSTEMS:** Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.\_

**UNIT-7**

**ADAPTIVE CONTROL SYSTEMS:** Introduction, adaptive control with optimization, Adaptive control with constraints, Application of A.C. in Machining operations. Use of various parameters such as cutting force, temperatures, vibration and acoustic emission.

**UNIT- 8**

**Automated inspection:** Fundamentals, types of inspection methods and equipment, CMM, machine vision.

**TEXTBOOK:**

1. Automation, Production Systems and Computer Integrated Manufacturing: MR Groover/ PE/PHI

**REFERENCEBOOKS:**

1. Computer Control of Manufacturing Systems by Yoram Coren.
2. CAD/ CAM/ CHVI by Radhakrishnan.
3. Automation by W Buekinsham.

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**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**IV Year B.Tech. Mech. Engg. II-Sem.**

**INDUSTRIAL HYDRAULICS & PNEUMATICS**

**(DEPARTMENTAL ELECTIVE – II)**

**UNIT-1**

Fundamentals of Fluid Power Systems-Introduction-types advantages, disadvantages & applications- fluid characteristics-terminologies used in fluid power-hydraulic symbols-hydraulic systems and components -sources- pumping theory-gear, vane & piston pumps.

**UNIT-2**

**Fluid Power Actuators:** Introduction-hydraulic actuators-hydraulic cylinders- types, construction, specifications and special types. Hydraulic motors- Working principle-selection criteria for various types-Hydraulic motors in circuits- Formulae-numerical problems

**UNIT-3**

Hydraulic elements in the design of circuits- Introduction-control elements- direction control valve-check valve-Pressure control valve-Relief valve- Throttle valve-Temperature & Pressure compensation-locations of flow control valve.

**UNIT-4**

Accumulators & Intensifiers-Types, size &function of accumulators- application & circuits of accumulators- Intensifiers-circuit & Applications.

**UNIT-5**

Design & drawing of hydraulic circuits-Introduction-case study & specifications-method of drawing a hydraulic circuit-hydraulic cylinder-quick return of a hydraulic cylinder

**UNIT-6**

Pneumatic systems - Introduction-symbols used-concepts & components- comparision-types & specifications of compressors-arrangement of a complete pneumatic system-compressed air behaviour- understanding pneumatic circuits-direction control valves

**UNIT-7**

Electro pneumatics- Introduction-Pilot operated solenoid valve-electrical connections to solenoids- electro pneumatic circuit switches – relays – solenoids – P. E converter – concept of latching



**UNIT-8**

Applications-Servo systems-Introduction-closed loop, hydro-mechanical and electro hydraulic – conventional and proportional valves-characteristics of proportional and servo valves- PLC applications in fluid power – selected pneumatic / electro pneumatic circuit problems- failure and trouble shooting in fluid power systems.

**TEXT BOOKS:**

1. Introduction to Hydraulics and Pneumatics by S. ilango and V Soundararaj an, PHI, New Delhi
2. Applied hydraulics and pneumatics-T. Sunder Selwyn & R. Jayendiran, Anuradha Publications. »

**REFERENCEBOOKS:**

1. Oil Hydraulic Systems, S.R .Majumdar, McGrawHill Companies
2. Pneumatic Systems: Principles and Maintenance, Majumdar, McGraWHill

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**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**IV Year B.Tech. Mech. Engg. II-Sem.**

**NON - DESTRUCTIVE EVALUATION**

**(DEPARTMENTAL ELECTIVE – III)**

**UNIT-1**

**ULTRA SONIC HARDNESS TESTING:** Flaw Detection Using Dye Penetrants. Magnetic Particle Inspection introduction to electrical impedance, Principles of Eddy Current testing, Flaw detection using eddy currents.

**UNIT-2**

**INTRODUCTION TO X-RAY RADIOGRAPHY:** The Radiographic process, X-Ray and Gamma-ray sources, Geometric Principles, Factors Governing Exposure, Radiographic screens, Scattered radiation, Arithmetic of exposure, Radiographic image quality and detail visibility, Industrial X-Ray films

**UNIT-3**

**X-RAY RADIOGRAPHY PROCESSES:** Fundamentals of processing techniques, Process control, The processing Room, Special Processing techniques, Paper Radiography, Sensitometric characteristics of x-ray films, Film graininess signal to noise ratio in radiographs, The photographic latent image, Radiation Protection

**UNIT-4**

**INTRODUCTION TO ULTRASONIC TESTING:** Generation of ultrasonic waves, Horizontal and shear Waves, Near field and far field acoustic Wave description, Ultrasonic probes~ straight beam, direct contact type, Angle beam, Transmission/reflection type, and delay line transducers, acoustic coupling and media

**UNIT-V**

**ULTRASONIC TESTS:** Transmission and pulse echo methods, A-scan, B-scan, C-scan, F-scan and P-scan modes, Flaw sizing in ultrasonic inspection: AVG, Amplitude, Transmission, TOFD, Satellite pulse, Multi-modal transducer, Zonal method using focused beam. Flaw location methods, Signal processing in Ultrasonic NDT; Mimics, spurious echos and noise. Ultrasonic flaw evaluation.

**UNIT-6**

**HOLOGRAPHY:** Principles and practices of Optical holography, acoustical, microwave, x-ray and electron beam holography techniques.

**UNIT-7**

**APPLICATIONS - I:** NDT in flaw analysis of Pressure vessels, piping

**UNIT- 8**

**APPLICATIONS - II:** NDT in Castings, Welded constructions, etc., Case studies.

**TEXT BOOKS:**

- I. Ultrasonic testing by Krautkramer and Krautkramer
2. Ultrasonic inspection 2 Training for NDT: E. A. Gingel, Prometheus Press,
3. ASTM Standards, Vol 3.01, Metals and alloys

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**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**IV Year B.Tech. Mech. Engg. II-Sem.**

**DATABASE MANAGEMENT SYSTEMS**

**(DEPARTMENTALELECI'IVE-III)**

**UNIT-1**

Data base System Applications, data base System VS file System - View of Data - Data Abstraction - Instances and Schemas - data Models - the ER Model - Relational Model - Other Models - Database Languages A DDL - DML - database Access for applications Programs - data base Users and Administrator - Transaction Management - data base System Structure -- Storage Manager -the Query Processor

**UNIT-2**

History of Data base Systems. Data base design and ER diagrams – Beyond ER Design Entities, Attributes and Entity sets - Relationships and Relationship sets - Additional features of ER Model - Concept Design with the ER Model - Conceptual Design for Large enterprises

**UNIT-III**

Introduction to the Relational Model - Integrity Constraint Over relations - Enforcing Integrity constraints - Querying relational data - Logical data base Design - Introduction to Views – Destroying /altering Tables and Views.

Relational Algebra - Selection and projection set operations - renaming - Joins - Division - Examples of Algebra overviews - Relational calculus - Tuple relational Calculus - Domain relational calculus - Expressive Power of Algebra and calculus.

**UNIT-4**

Form of Basic SQL Query - Examples of Basic SQL Queries - Introduction to Nested Queries - Correlated Nested Queries Set - Comparison Operators - Aggregative Operators - NULL values - Comparison using Null values - Logical com1ectivity's -AND, OR and NOT - Impact on SQL Constructs - Outer Joins - Disallowing NULL values V- Complex Integrity Constraints in SQL Triggers and Active Data bases.

**UNIT-5**

Schema refinement Problems Caused by redundancy - Decompositions -Problem related to decomposition- reasoning about FDS - FIRST, SECOND, THIRD Normal forms - BCNF Lossless join Decomposition – Dependency preserving Decomposition - Schema refinement in Data base Design – Multi valued Dependencies - FORTH Normal Form.

**UNIT-VI**

Transaction Concept- Transaction State- Implementation of Atomicity and Durability - Concurrent - Executions - Serializability- Recoverability - Implementation of Isolation - Testing for serializability- Lock – Based Protocols - Timestamp Based Protocols- Validation- Based Protocols -Multiple Granularity.

**UNIT-7**

Recovery and Atomicity - Log 4 Based Recovery - Recovery with Concurrent Transactions - Buffer Management - Failure with loss of nonvolatile storage- Advance Recovery systems- Remote Backup systems.

**UNIT-8**

Data on External Storage - File Organization and Indexing - Cluster Indexes, Primary and Secondary Indexes - Index data Structures - Hash Based Indexing - Tree base Indexing - Comparison of File Organizations – Indexes and Performance Tuning- Intuitions for tree Indexes - Indexed Sequential Access Methods (ISAM)- B+ Trees: A Dynamic Index Structure.

**TEXT BOOKS:**

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATAMcGrawHill 3rd Edition
2. Data base System Concepts, Silberschatz, Korth, McGraw hill, Vedition.

**REFERANCE BOOKS:**

1. Data base' Systems design, Implementation, and Management, Peter 'Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education
3. Introduction to Database Systems, C.J .Date Pearson Education



**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**IV Year B.Tech. Mech. Engg. II-Sem.**

**ADVANCED MATERIALS**

**(DEPARTMENTALELECTIVE-III)**

**UNIT-1**

**INTRODUCTION TO COMPOSITE MATERIALS:** Introduction, Classification Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon - Carbon Composites, Fiber- Reinforced Composites and nature-made composites, and applications.

**UNIT-2**

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

**UNIT-III**

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

**UNIT-4**

**MACROMECHANICAL ANALYSIS OF A LAMINA:** Introduction, Generalized Hooke's Law, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of an orthotropic Lamina, Laminate-Laminate code.

**UNIT-5**

**METALMATRIXAND CERAMIC MATRIX COMPOSITES:** Manufacturing of C.M.C & metal matrix composites and their applications, stress strain relations for MMC and CMC.

**UNIT-6**

**FUNCTIONALLY GRADED MATERIALS:** Types of Functionally graded materials-classification-different systems - Preparation - Properties and applications of Functionally graded materials.

**UNIT-7**

**SHAPE MEMORY ALLOYS:** Introduction-Shape memory effect - Classification of shape memory alloys-Composition-Properties and applications of shape memory alloys.

**UNIT-8**

**NANO MATERIALS:** Introduction-Properties at nano scales-advantages & disadvantages-applications in comparison with bulk materials (Nano - structure, wires, tubes, composites). State of art nano advanced-s topic delivered by student.

**TEXT BOOKS:**

1. Nano material by A.K. Bandyopadhyay, New age Publishers
2. Material science and Technology- Cahan
3. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press

**REFERENCE BOOKS:**

1. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, NewYork, 1975.
2. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold.
3. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980
4. Mechanics of Composite Materials, Second Edition (Mechanical Engineering), Autar K.KaW, Publisher: CRC



**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA****IV Year B.Tech. Mech. Engg. II-Sem.****POWER PLANT ENGINEERING****(DEPARTMENTALELECTIVE-III)****UNIT-1**

Introduction to the Sources of Energy - Resources and Development of Power in India.

**STEAM POWER PLANT:** Plant Layout, Working of different Circuits, Fuel handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

**UNIT-2**

**STEAM POWER PLANT:** Combustion: Properties of coal -- overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment. ,

**UNIT-3****INTERNAL COMBUSTION AND GAS TURBINE POWER PLANTS:**

**DIESEL POWER PLANT:** Plant layout with auxiliaries - fuel supply system, air starting equipment, super charging.

**GAS TURBINE PLANT:** Introduction - classification - construction-layout with auxiliaries, combined cycle power plants and comparison.

**UNIT-4**

**HYDRO ELECTRIC POWER PLANT:** Water power - Hydrological cycle - flow measurement - drainage area characteristics - Hydrographs – storage and pondage - classification of dams and spill ways.

**HYDRO PROJECTS AND PLANT:** Classification - typical layouts – plant auxiliaries - plant operation pumped storage plants.

**UNIT-V**

**NUCLEAR POWER STATION:** Nuclear fuel - breeding and fertile materials - Nuclear - reactor - reactor operation.

**TYPES OF REACTORS:** Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor, homogeneous reactor, gas cooled reactor, radiation hazards and shielding - radioactive waste disposal.



**UNIT- 6****COMBINED OPERATIONS OF DIFFERENT POWER PLANTS:**

Introduction, advantages of combined working, load division between power stations, storage type hydro-electric plant in combination with steam plant, run-of-river plant in combination with steam plant, pump storage plant in combination with steam or nuclear power plant, co-ordination of hydro- electric and gas turbine stations, co-ordination of hydro-electric and nuclear power stations, co-ordination of different types of power plants.

**UNIT-7**

**POWER PLANT INSTRUMENTATION AND CONTROL:** Importance of measurement and instrumentation in power plant, measurement of water purity, gas analysis,  $O_2$  and  $CO_2$  measurements, measurement of smoke and dust, measurement of moisture in carbon dioxide circuit, nuclear measurements.

**UNIT-8**

**POWER PLANT ECONOMICS AND ENVIRONMENTAL CONSIDERATIONS:** Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, load curves, load duration curve. Definitions of connected load, maximum demand, demand factor, average load, load factor, diversity factor - related exercises. Effluents from power plants and Impact on environment - pollutants and pollution standards - methods of pollution control.

**TEXT BOOKS:**

1. A course in Power Plant Engineering - Arora and Domkundwar Dhanpatrai & Co.
2. Power Plant Engineering - RC.Sharma / S.K.Kataria Pub P

**REFERENCE BOOKS:**

1. Power Plant Engineering: PK.N ag/ II Edition /TMH\_
2. Power station Engineering - ElWakil / McHill.
3. An Introduction to Power Plant Technology / G.D. Rai.



**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**IV Year B.Tech. Mech. Engg. II-Sem.**

**PRODUCTION PLANNING AND CONTROL**

**(DEPARTMENTAL ELECTIVE-IV)**

**UNIT-1**

Introduction: Definition - Objectives and functions of production planning and control - Elements of production control - Types of production - Organization of production planning and control department – Internal organization of department.

**UNIT-II**

Forecasting - Importance of forecasting - Types of forecasting, their uses - General principles of forecasting - Forecasting techniques – qualitative methods and quantitative methods.

**UNIT-3**

Inventory management- Functions of inventories - relevant inventory costs -ABC analysis - VED analysis - EOQ model - Inventory control systems - P-Systems and Q-Systems

**UNIT-4**

Introduction to MRP I, MRP II, ERR LOB (Line of Balance), JIT and KANBAN system.

**UNIT-5**

Routing - definition - routing procedure -route sheets - bill of material – factors affecting routing procedure, schedule -definition - difference with loading

**UNIT-6**

Scheduling policies - techniques, standard scheduling methods.

**UNIT-7**

Line Balancing, aggregate planning, chase planning, expediting, controlling aspects. Dispatching - Activities of dispatcher - dispatching procedure - follow up - definition- Reason for existence of functions - types of follow up, applications of computer in production planning and control.

**TEXT BOOKS:**

1. Elements of Production Planning and Control/ Samuel Eilon.
2. Manufacturing, Planning and Control, Partik Jonsson Stig-Arne Mattsson, TataMcGrawHill

**REFERENCEBOOKS:**

1. Inventory Control Theory and Practice/ Martin K. Starr and David W. Miller.
2. Production Planning and Control, Mukhopadyay, PHI.
3. Production Control A Quantitative Approach / John E. Biegel. 4. Production Control / Moore.

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JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA

IV Year B.Tech. Mech. Engg. II-Sem.

ADVANCED OPTIMIZATION TECHNIQUES

(DEPARTMENTALELECTIVE - IV)

UNIT-1

**INTRODUCTION TO OPTIMIZATION:** Engineering applications of optimization- Statement of an optimization problem- Classification of optimization problem- Optimization techniques.

UNIT-2

**CLASSICAL OPTIMIZATION TECHNIQUES:** Single variable optimization- Multivariable optimization with equality constraints- Multivariable optimization with inequality constraints.

UNIT-III

**NONLINEAR PROGRAMMING:** One-Dimensional Minimization: Unimodal function- Elimination methods- Unrestricted search- Exhaustive search- Dichotomous search- Fibonacci method- Golden section method- Interpolation methods- Quadratic interpolation method- Cubic interpolation method- direct root method.

UNIT-4

**NONLINEAR PROGRAMMING:** Unconstrained Optimization Techniques: Direct search methods- Random search methods- Univariate method- Pattern search method- Rosenbrock's method of rotating coordinates- The simplex method- Descent methods- Gradient of function- Steepest descent method- Conjugate gradient method (Fletcher-Reeves method)- Quasi-Newton methods- Variable metric method (Davidon- Fletcher-Powell method).

UNIT-5

**NONLINEAR PROGRAMMING:** Constrained Optimization Techniques: Characteristics of a constrained problem- Direct method- The complex method- Cutting plane method- Methods of feasible directions- Indirect methods- Transformation techniques- Basic approach in the penalty function method- Interior penalty function method- Convex programming problem- Exterior penalty function method.

UNIT-6

**GEOMETRIC PROGRAMMING (G.P):** Solution of an unconstrained geometric programming, differential calculus method and arithmetic method. Primal dual relationship and sufficiency conditions. Solution of a constrained geometric programming problem (G.P.P). Complimentary geometric programming (C.G.P)

**UNIT-7**

**DYNAMIC PROGRAMMING (D.P):** Multistage decision processes. Concepts of sub optimization, computational procedure in dynamic programming calculus method and tabular methods. Linear programming as a case of D.P, Continuous D.R

**UNIT-8**

**INTEGER PROGRAMMING (I.P):** Graphical representation. Gomory's cutting plane method. Bala's algorithm for zero-one programming problem. Integer non linear programming. '

**TEXTBOOK:**

1. Optimization Theory and Applications, by S.S.Rao,. Wiley Eastern A Limited, NewDelhi. A

**REFERENCE BOOKS:**

1. Engineering Optimization By Kalyanmanai Deb, Prentice Hall of India, NewDelhi.
2. Optimization Techniques,C.Mohan, Kusum Deep.
3. Operations Research by S.D.Sharma

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**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA****IV Year B.Tech. Mech. Engg. II-Sem.****GAS DYNAMICS AND JET PROPULSION****(DEPARTMENTALELECTIVE - IV)****UNIT-1**

**Introduction to gas dynamics:** control volume and system approaches acoustic waves and sonic velocity - Mach number - classification of fluid flow based on Mach number - Mach cone-compressibility factor – General features of one dimensional flow of a compressible fluid - continuity and momentum equations for a control volume.

**UNIT-II**

**Isentropic flow of an ideal gas:** basic equation - stagnation enthalpy, temperature, pressure and density - stagnation, acoustic speed - critical speed of sound- dimensionless velocity-governing equations for isentropic flow of a perfect gas - critical flow area - stream thrust and impulse function.

**UNIT-3**

Steady one dimensional isentropic flow with area change-effect of area change on flow parameters-choking- convergent nozzle - performance of a nozzle under decreasing back pressure -De level nozzle - optimum area ratio effect of back pressure - nozzle discharge coefficients - nozzle efficiencies.

**UNIT- 4**

**Simple frictional flow:** adiabatic flow with friction in a constant area duct- governing equations - fanno line limiting conditions - effect of wall friction on flow properties in an Isothermal flow with friction in a constant area duct - governing equations - limiting conditions.

**UNIT-5**

Steady one dimensional flow with heat transfer in constant area ducts - governing equations - Rayleigh line entropy change caused by heat transfer - conditions of maximum enthalpy and entropy.

**UNIT-6**

Effect of heat transfer on flow parameters: Intersection of Fanno and Rayleigh lines. Shock waves in perfect gas- properties of flow across a normal shock - governing equations - Rankine Hugoniat equations - Prandtl's velocity relationship - converging diverging nozzle flow with shock thickness - strength.

**UNIT- 7**

**Propulsion:** Air craft propulsion: -types of jet engines - energy flow through jet engines, thrust, thrust power and propulsive efficiency turbojet components-diffuser, compressor, combustion chamber, turbines, exhaust systems.

**UNIT-8**

Performance of turbo propeller engines, ramjet and pulsejet, scramjet engines. Rocket propulsion - rocket engines, Basic theory of equations - thrust; equation - effective jet velocity - specific impulse - rocket engine performance - solid and liquid propellant rockets - comparison of various propulsion systems.

**TEXTBOOKS:**

1. Compressible fluid flow - A. H. Shapiro
2. Fundamentals of compressible flow with aircraft and rocket propulsion- S. M. Yahya

**REFERENCEBOOKS:**

1. Elements of gas dynamics - Liepman & Roshko
2. Aircraft & Missile propulsion - Zucrow
3. Gas dynamics - M.J. Zucrow & Joe D.Holfman

JNTUK FAST UPDATES



**JAWAHARLALNEHRU TECHNOLOGICAL UNIVERSITY KAKINADA**

**IV Year B.Tech. Mech. Engg. II-Sem.**

**QUALITY AND RELIABILITY ENGINEERING**

**(DEPARTMENTAL ELECTIVE-IV)**

**UNIT-1**

Quality value and engineering - quality systems - quality engineering in product design and production process - system design - parameter design- tolerance design, quality costs - quality improvement.

**UNIT-2**

Statistical P process control X, R, p, c charts, other types of control charts, process capability, process capability analysis, process capability index. (SQC tables can be used in the examination).

**UNIT-III**

Acceptance sampling by variables and attributes, design of sampling plans, single, double, sequential and continuous sampling plans, design of various sampling plan.

**UNIT-4**

Loss function, tolerance design - N type, L type, S type; determination of tolerance for these types. online quality control - variable characteristics, attribute characteristics, parameter design.

**UNIT-5**

Quality function deployment- house of quality, QFD matrix, total quality management concepts. quality information systems, quality circles, introduction to ISO 9000 standards.

**UNIT-6**

Reliability - Evaluation of design by tests - Hazard Models, Linear, Releigh, Weibull. Failure Data Analysis, reliability prediction based on weibull distribution, Reliability improvement. \_

**UNIT-7**

Complex system, reliability, reliability of series, parallel & standby systems & complex systems & reliability prediction and system effectiveness.

**UNIT-8**

Maintainability, availability, economics of reliability engineering, replace of items, maintenance costing and budgeting, reliability testing.



**TEXTBOOKS:**

1. Eugene Grant, Richard Leavenworth, "Statistical Process Control", McGraw Hill.
2. G Taguchi, 'Quality Engineering in Production Systems', - McGrawHill, 1989.
3. W.A. Taylor, 'Optimization & Variation Reduction in Quality', Tata McGraw Hill, 1991, 1st Edition.

**REFERENCEBOOKS:**

1. Frank.M.Gryna Jr. "Jurans Quality planning &Analysis", McGraw Hill.
2. Philippos, 'Taguchi Techniques for Quality Engineering', McGraw Hill, 1996, 2nd Edition. '
3. LS Srinath, 'Reliability Engineering', Affiliated East West Pvt. Ltd., 1991, 3rd Edition.
4. E.Bala Guruswamy, 'Reliability Engineering', Tata McGraw Hill, 1994.

