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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

(Established by Andhra Pradesh Act No.30 of 2008)

Kukatpally, Hyderabad – 500 085, Andhra Pradesh (India)

B.TECH. MECHANICAL ENGINEERING

IV YEAR I SEMESTER

Code	Subject	L	T/P/D	C
	Operations Research	4	-	4
	Power Plant Engineering	4	-	4
	CAD/CAM	4	-	4
	Instrumentation and Control Systems	4	-	4
	ELECTIVE – I Robotics Mechanical Vibrations Mechatronics Composite Materials Industrial Management	4	-	4
	ELECTIVE – II Unconventional Machining Processes CNC Technology Automation in Manufacturing Design for Manufacturing Nanotechnology	4	-	4
	Computer Aided Design & Manufacturing Lab	-	3	2
	Production Drawing Practice and Instrumentation Lab	-	3	2
	Total	**24**	**6**	**28**

Note: All End Examinations (Theory and Practical) are of three hours duration.

T-Tutorial L – Theory P – Practical/Drawing C – Credits

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IV Year B.Tech. ME-I Sem	L	T/P/D	C
	4	-/-/-	4

(A70352) OPERATIONS RESEARCH

UNIT – I

Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.

Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method.

UNIT – II

Transportation Problem – Formulation – Optimal solution, unbalanced transportation problem – Degeneracy.

Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem- Traveling Salesman problem.

UNIT – III

Sequencing – Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines

Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

UNIT – IV

Theory of Games: Introduction –Terminology– Solution of games with saddle points and without saddle points- 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

Inventory: Introduction – Single item, Deterministic models – Purchase inventory models with one price break and multiple price breaks –Stochastic models – demand may be discrete variable or continuous variable – Single Period model and no setup cost.

UNIT – V

Waiting Lines: Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

Dynamic Programming:

Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

Simulation: Introduction, Definition, types of simulation models, Steps involved in the simulation process- Advantages and disadvantages- applications of simulation to queuing and inventory.

TEXT BOOKS :

1. Operations Research /J.K.Sharma 4e. /MacMilan.
2. Introduction to O.R/Hillier & Libermann/TMH.

REFERENCE BOOKS :

1. Introduction to O.R /Taha/PHI.
2. Operations Research/ NVS Raju/ SMS Education/3rd Revised Edition.
3. Operations Research /A.M.Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education.
4. Operations Research / Wagner/ PHI Publications.
5. Operations Research/M.V. Durga Prasad, K, Vijaya Kumar Reddy, J. Suresh Kumar/ Cengage Learning.

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(A70353) POWER PLANT ENGINEERING

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India. **Steam Power Plant :** Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

Combustion Process: 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 – II

Internal Combustion Engine Plant:

DIESEL POWER PLANT: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging. **Gas Turbine Plant:** Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison. **Direct Energy Conversion:** Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT – III

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. **Power From Non-Conventional Sources:** Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

UNIT – IV

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 – V

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. Power Plant Engineering/ P.C.Sharma / S.K.Kataria Pub.
2. A Course in Power Plant Engineering: / Arora and S. Domkundwar.

REFERENCES :

1. A Text Book of Power Plant Engineering / Rajput / Laxmi Publications.
2. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
3. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers.
4. Power plant Engg / Elanchezhian/ I.K. International Pub.
5. Power plant Engineering/ Ramalingam/ Scietech Publishers.

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(A70328) CAD / CAM

UNIT – I

Fundamentals of CAD/CAM, Automation , design process, Application of computers for design, Benefits of CAD, Computer configuration for CAD applications, Computer peripherals for CAD ,Design workstation, Graphic terminal, CAD software- definition of system software and application software ,CAD database and structure.

Geometric Modeling: 3-D wire frame modeling, wire frame entities and their definitions, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, definitions of cubic spline, Bezier, and B-spline.

UNIT-II

Surface modeling: Algebraic and geometric form, Parametric space of surface, Blending functions,parametrization of surface patch, Subdividing, Cylindrical surface, Ruled surface, Surface of revolution Spherical surface, Composite surface, Bezier surface. B-spline surface, Regenerative surface and pathological conditions.

Solid Modelling: Definition of cell composition and spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.

UNIT – III

NC Control Production Systems : Numerical control, Elements of NC system, NC part programming : Methods of NC part programming, Manual part programming, Computer assisted part programming, Post Processor, Computerized part program, SPPL (A Simple Programming Language). CNC, DNC and Adaptive Control Systems.

UNIT – IV

Group Technology: Part families, Parts classification and coding. Production flow analysis, Machine cell design.

Computer aided process planning: Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.

Computer aided manufacturing resource planning: Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterprise resource planning, Capacity requirements planning.

UNIT – V

Flexible manufacturing system: F.M.S equipment, FMS layouts, Analysis methods for FMS benefits of FMS.

Computer aided quality control: Automated inspection- Off-line, On-line, contact, Non-contact; Coordinate measuring machines, Machine vision.

Computer Integrated Manufacturing: CIM system, Benefits of CIM, Benefits of CIM

TEXT BOOKS:

1. CAD/CAM /Groover M.P./ Pearson education.
2. CAD/CAM Concepts and Applications/ Alavala/ PHI.

REFERENCE BOOKS :

1. CAD/CAM Principles and Applications/P.N.Rao/ TMH.
2. CAD / CAM Theory and Practice/ Ibrahim Zeid/TMH.
3. CAD / CAM / CIM/Radhakrishnan and Subramanian/ New Age.
4. Principles of Computer Aided Design and Manufacturing/ Farid Amirouche/ Pearson.
5. Computer Numerical Control Concepts and programming/Warren S Seames/ Thomson.

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(A70343) INSTRUMENTATION AND CONTROL SYSTEMS

UNIT – I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, Classification and elimination of error.

UNIT – II

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

Measurement of Temperature: Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators..

Measurement of Pressure: Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

UNIT – III

Measurement of Level: Direct method – Indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – Bubbler level indicators.

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA) .

Measurement of Speed: Mechanical Tachometers – Electrical tachometers – Stroboscope, Non- contact type of tachometer.

Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle.

UNIT – IV

Stress Strain Measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge Rosettes.

Measurement of Humidity: Moisture content of gases, sling psychrometer, Absorption psychrometer, Dew point meter.

Measurement Of Force, Torque And Power: Elastic force meters, load cells, Torsion meters, Dynamometers.

UNIT – V

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems Servomechanisms – Examples with block diagrams – Temperature, speed and position control systems.

TEXT BOOKS:

1. Measurement Systems: Applications & Design / D.S Kumar/Anuradha Agencies.
2. Instrumentation, measurement & analysis /B.C.Nakra & K.K.Choudhary/ TMH.

REFERENCE BOOKS:

1. Principles of Industrial Instrumentation and Control Systems/ Chennakesava R Alavala/ Cengage Learning.
2. Instrumentation and Control systems/ S.Bhaskar/ Anuradha Agencies.
3. Experimental Methods for Engineers / Holman/McGraw Hill.
4. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
5. Mechanical Measurements / Sirohi and Radhakrishna / New Age.
6. Instrumentation & Mech. Measurements /A.K. Tayal /Galgotia Publications.

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(A70355) ROBOTICS

(Elective – I)

UNIT – I

Introduction, Automation and Robotics – An over view of Robotics – classification by coordinate system and control systems - **Components of the Industrial Robotics:** Degrees of freedom – End effectors: Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General consideration on gripper selection and design, Robot actuator and sensors.

UNIT – II

Motion Analysis: Basic rotation matrices – Composite rotation matrices – Euler Angles – Equivalent Angle and Axis – Homogeneous transformation – Problems.

Manipulator Kinematics: D-H notations - Joint coordinates and world coordinates - Forward and inverse kinematics – problems.

UNIT – III

Differential Kinematics: Differential Kinematics of planar and spherical manipulators - Jacobians – problems.

Robot Dynamics: Lagrange – Euler formulations – Newton-Euler formulations – Problems on planar two link manipulators.

UNIT IV

Trajectory Planning: Joint space scheme – cubic polynomial fit – Avoidance of obstacles – **Types of motion:** Slew motion - joint interpolated motion – straight line motion – problems.

Robot actuators and Feed back components: Actuators: Pneumatic.

UNIT V

Robot Application in Manufacturing: Material handling - Assembly and Inspection – Work cell design, work volume, Robot screan.

TEXT BOOKS :

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Introduction to Robotic Mechanics and Control / JJ Craig/ Pearson/ 3rd edition.

REFERENCES :

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klaftez/ Prentice Hall.
3. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.
4. Robot Dynamics & Control/Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pvt. Ltd.
5. Robotics and Control / Mittal R K & Nagrath I J / TMH.

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(A70346) MECHANICAL VIBRATIONS
(Elective-I)

UNIT- I:

Single Degree of Freedom Systems : Undamped and damped free vibrations; forced vibrations coulomb damping; Response to excitation; rotating unbalance and support excitation; vibration isolation and transmissibility- Response to Non Periodic Excitations: unit impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

UNIT- II:

Two Degree Freedom Systems: Principal modes- undamped and damped free and forced vibrations; undamped vibration absorbers;

UNIT-III:

Multi Degree Freedom Systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi- rotor systems and geared systems; Discrete- Time systems.

Vibration measuring instruments: Vibrometers, velocity meters & accelerometers

UNIT- IV:

Frequency Domain Vibration Analysis: Over view, machine-train monitoring parameters-Data base development-vibration data acquisition-trending analysis-failure- node analysis-signature analysis-root cause analysis.

UNIT V:

Numerical Methods: Raleigh's stodola's, Matrix iteration, Rayleigh- Ritz Method and Holzer's methods.

TEXT BOOKS:

1. Mechanical Vibrations/Groover/Nem Chand and Bros.
2. Elements of Vibration Analysis / Meirovitch/ TMH, 2001.

REFERENCE BOOKS:

1. Mechanical Vibrations/VP Singh/Danapathi Rai & Sons.
2. Mechanical Vibrations/ SS Rao/ Pearson, 2009/4th Edition.
3. Mechanical Vibrations/Debabrata Nag/Wiley.
4. Vibration problems in Engineering / S.P. Timoshenko.
5. Mechanical Vibrations and sound engineering/ A.G.Ambekar/ PHI.
6. Theory and Practice of Mechanical Vibrations/JS Rao & K. Gupta/ New Age Intl. Publishers/Revised 2nd Edition.

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(A70348) MECHATRONICS

(Elective-I)

UNIT-I

Mechatronics systems, elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion , force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT-II

Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering. Introduction to MEMS & typical applications.

UNIT-III

Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems.

UNIT-IV

Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT-V

System and interfacing and data acquisition, DAQS , SCADA, A to D and D to A conversions; Dynamic models and analogies, System response. Design of mechatronics systems & future trends.

TEXT BOOKS:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran & GK Vijaya Raghavan/WILEY India Edition/2008
2. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/ W Bolton/ Pearson Education Press/3rd edition, 2005.

REFERENCES:

1. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
3. Mechatronics System Design / Devdas shetty/Richard/Thomson.
4. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
5. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition, Pearson, 2012 W. Bolton
6. Mechatronics – Principles and Application Godfrey C. Onwubolu, WIsevier, 2006 Indian print.

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(A70347) MECHANICS OF COMPOSITE MATERIALS

(Elective-I)

UNIT-I

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-II

Reinforcements: Fibers- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibers. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT-III

Macro Mechanical Analysis of a Lamina: Introduction, Definitions Stress, Strain, Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

UNIT-IV

Macro Mechanical Analysis of Laminates: Introduction , Laminate Code , Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus.

UNIT-V

Failure Analysis of Laminates: Introduction, Special Cases of Laminates, Applications, Failure Criterion for a Laminate.

TEXT BOOKS:

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

REFERENCES:

1. Analysis and performance of fibre Composites/ B. D. Agarwal and L. J. Broutman/ Wiley- Inter science, New York, 1980.
2. Mechanics of Composite Materials/ Second Edition (Mechanical Engineering)/ Autar K. Kaw/Publisher: CRC.
3. Analysis of Laminated Composite Structures/ L. R. Calcote/ Van Nostrand Rainfold, New York, 1969.
4. Advanced Mechanics of Composite Materials/ Vasiliev &Morozov/ Elsevier/Second Edition.

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(A70332) INDUSTRIAL MANAGEMENT

(Elective-I)

UNIT I:

Introduction to Management: Entrepreneurship and organization - Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

UNIT II:

Designing Organizational Structures: Departmentation and Decentralization, Types of Organization structures - Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

UNIT III:

Operations Management: Objectives- product design process- Process selection-Types of production system(Job, batch and Mass Production),- Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts- Design of product layout- Line balancing(RPW method)

Value analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram

UNIT IV:

Work Study: Introduction – definition – objectives – steps in work study – Method study – definition – objectives – steps of method study. Work Measurement – purpose – types of study – stop watch methods – steps – key rating – allowances – standard time calculations – work sampling.

Statistical Quality Control: variables-attributes, Shewart control charts for variables- chart, R chart, - Attributes-Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

UNIT V:

Job Evaluation : methods of job evaluation – simple routing objective systems – classification method – factor comparison method – point method

– benefits of job evaluation and limitations.

Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

TEXT BOOKS:

1. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers.
2. Industrial Engineering and Management Science/T.R. Banga and S.C.Sarma/Khanna Publishers.

REFERENCE BOOKS:

1. Motion and Time Study by Ralph M Barnes/ John Willey & SonsWork Study by ILO.
2. Human factors in Engineering & Design/Ernest J McCormick / TMH.
3. Production & Operation Management /Paneer Selvam /PHI.
4. Industrial Engineering Management/NVS Raju/Cengage Learning.
5. Industrial Engineering Hand Book /Maynard.
6. Industrial Engineering Management / RaviShankar/ Galgotia.

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	4	-/-/-	4

(A70359) UNCONVENTIONAL MACHINING PROCESSES

(Elective – II)

Objectives:

1. To understand the need and importance of non traditional machining methods.
2. To know the basic principle, equipment, process variables and mechanics of metal removal in abrasive jet machining and water jet machining.
3. To study the fundamentals of tool design, surface finishing and metal removal rate of electro chemical grinding , electro chemical machining and electro chemical honing.
4. To understand principles of operation, types of electrodes and process parameters and machine tool selection in EDM and Electric discharge grinding and wire cut process.
5. To know the basics of Electron Beam Machining and comparison of thermal and non thermal processes.
6. To study the various process parameters and applications of Plasma in manufacturing industries.

UNIT – I

Introduction: Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials. Applications.

Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

UNIT – II

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

Electro – Chemical Processes : Fundamentals of electro-chemical machining, electro-chemical 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.

UNIT - III

Thermal Metal Removal Processes : General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM-principle and applications.

UNIT – IV

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes – General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

UNIT-V

Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining-principle- maskants – etchants- applications.

TEXT BOOK:

Advanced machining processes - VK Jain, Allied publishers.

REFERENCES :

1. Modern Machining Process - Pandey P.C. and Shah H.S., TMH.
2. New Technology - Bhattacharya A, The Institution of Engineers, India 1984.
3. Unconventional Machining Processes - C. Elanchezhian,, B. Vijaya Ramnath and M Vijayan, Anuradha Publications, 2005.
4. Unconventional Manufacturing Processes – M.K. Singh, New Age International Publishers.

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(A70337) CNC TECHNOLOGIES

(Elective – II)

Objectives:

1. Understand basic features of NC and CNC Machines and their Design Considerations.
2. To study various system devices hardware and software interpolations.
3. To know various tooling systems used in CNC Machines.
4. Understand both Manual and Computer Aided Programming for Generating Various Contours.
5. To study about the DNC systems and Adaptive Control used for various machining process.

UNIT I:

Features of NC Machines, Fundamentals of numerical control, advantage of NC systems, classification of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, Features of NC Machine Tools, design consideration of NC machine tool, methods of improving machine accuracy.

UNIT II:

CNC Machines Elements: Machine Structure- Guideways - feed drives-spindles - spindle bearings.

System Devices: Drives, feedback devices, counting devices.

Interpolators for manufacturing systems: DDA integrator, DDA hardware interpolators, CNC software interpolators.

UNIT III:

Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers.

UNIT IV:

NC Part Programming: Manual programming-Basic concepts, Point-to-Point contour programming, canned cycles, parametric programming.

Computer-Aided Programming: General information, APT programming, Examples APT programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors .Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT V:

DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining processes like turning, grinding.

TEXT BOOKS:

1. Computer Control of Manufacturing Systems - Yoram Koren ,Tata Mc Graw Hill, 2009.
2. Computer Aided Manufacturing - Elanchezhian, Sunder Selvan and Shanmuga Sunder, University Science Press, Second edition.

REFERENCE BOOKS:

1. Machining Tools Hand Book Vol 3, (Automation & Control)/ Manfred Weck / John Wiley and Sons, 1984.
2. Mechatronics – HMT, TMH.
3. Computer Numerical Control-Operations and Programming – Jon Stenerson and Kelly Curron Pul, 3rd Edition.

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(A70336) AUTOMATION IN MANUFACTURING

(Elective – II)

UNIT – I

Introduction: Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and too changing and machine tool control transfer the automaton.

UNIT – II

Automated flow lines : Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

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 – III

Assembly system and line balancing : Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT –I V

Automated material handling : Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.

Automated storage systems, Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT – V

Fundamentals of Industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in Manufacturing

Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE.

TEXT BOOK:

1. Automation, Production Systems and Computer Integrated Manufacturing : M.P. Groover 3e./PE/PHI, 2009.

REFERENCES:

1. Computer Aided Manufacturing, Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang, Pearson, 2009.
2. Automation by W. Buekinsham.

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(A70339) DESIGN FOR MANUFACTURING AND ASSEMBLY

(Elective - II)

Objectives:

- To understand various general design rules for manufacturability and criteria for material selection.
- To study various machining process and tolerance aspects in machining.
- To know the design considerations for casting and welding process.
- To understand the conceptual design factors to be considered in forging, extrusion and sheet metal work.
- To study the general design guidelines for manual assembly and development of DFA Methodology.

UNIT I:

Introduction: Design philosophy – Steps in Design process – General Design rules for Manufacturability – Basic principles of designing for economical production – Creativity in design.

Materials: Selection of Materials for design – Developments in Material Technology – Criteria for material selection – Material selection interrelationship with process selection – process selection charts.

UNIT II:

Machining Process: Overview of various machining processes – general design rules for machining - Dimensional tolerance and surface roughness – Design for Machining ease – Redesigning of components for machining ease with suitable examples, General design recommendations for machined parts

UNIT III:

Metal Casting: Appraisal of various casting processes, Selection of casting process, General design considerations for casting – casting tolerances – Use of Solidification Simulation in casting design – Product design rules for sand casting.

Metal Joining: Appraisal of various welding processes, Factors in design of weldments – General design guidelines – pre and post treatment of welds – Effects of thermal stresses in weld joints – Design of brazed joints.

UNIT IV:

Forging: Design factors for forging – Closed die forging design – parting lines of dies – Drop forging die design – General design recommendations

Extrusion, Sheet Metal Work: Design guidelines for Extruded sections - Design principles for Punching, Blanking, Bending, Deep Drawing – Keeler Goodman Forming Limit Diagram – Component Design for Blanking.

UNIT V:

Design for Assembly: General design guidelines for Manual Assembly- Development of Systematic DFA Methodology- Assembly Efficiency- Classification System for Manual handling- Classification System for Manual Insertion and Fastening- Effect of part symmetry on handling time-.

TEXT BOOK:

1. Product design for Manufacture and Assembly - Geoffrey Boothroyd, Peter Dewhurst and W.A. Knight, CRC Press.

REFERENCE BOOKS:

1. Product design and Manufacturing - A.K Chitale and R.C Gupta, Prentice – Hall of India, New Delhi, 2003.
2. Design and Manufacturing - Surender Kumar & Goutham Sutradhar, Oxford & IBH Publishing Co. Pvt .Ltd., New Delhi, 1998.
3. Product Design- Kevin Otto and Kristin Wood, Pearson Education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

IV Year B.Tech. ME-I Sem	L	T/P/D	C
	4	-/-/-	4

(A72909) NANO TECHNOLOGY

(Elective-II)

Objective:

Nano Technology is one of the core subjects of multidisciplinary nature. This has extensive applications in the field of energy, electronics, Biomedical Engg. Etc. Built to specifications by manufacturing matter on the atomic scale, the Nano products would exhibit an order of magnitude improvement in strength, toughness and efficiency. The objective here is impart the basic knowledge in Nano Science and Technology.

Unit-I:

Introduction: History and Scope, Can Small Things Make a Big Difference? Classification of Nanostructured Materials, Fascinating Nanostructures, Applications of Nanomaterials, Nature: The Best of Nanotechnologist, Challenges and Future Prospects.

Unit-II:

Unique Properties of Nanomaterials: Microstructure and Defects in Nanocrystalline Materials:Dislocations, Twins,stacking faults and voids, Grain

Boundaries, triple and disclinations, **Effect of Nano-dimensions on Materials Behavior:** Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, Enhanced solid solubility, **Magnetic Properties**: Soft magnetic nanocrystalline alloy, Permanent magnetic nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties and Mechanical Properties.

Unit-III:

Synthesis Routes: Bottom up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method ,Self assembly, **Top down approaches:** Mechanical alloying, Nano-lithography, **Consolidation of Nanopowders**: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

Unit-IV:

Tools to Characterize nanomaterials: X-Ray Diffraction (XRD), Small Angle X-ray scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nanoindentation.

Unit-V:

Applications of Nanomaterials: Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water- Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defence and Space Applications, Concerns and challenges of Nanotechnology.

TEXT BOOKS:

1. Text Book of Nano Science and Nano Technology – B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, University Press-IIM.
2. Introduction to Nanotechnology – Charles P. Poole, Jr., and Frank J. Owens, Wley India Edition, 2012.

REFERENCES BOOKS:

1. Nano: The Essentials by T.Pradeep, Mc Graw- Hill Education.
2. Nanomaterials, Nanotechnologies and Design by Michael F. Ashby, Paulo J. Ferreira and Daniel L.Schodek.
3. Transport in Nano structures- David Ferry, Cambridge University press 2000
4. Nanofabrication towards biomedical application: Techniques, tools, Application and impact – Ed. Challa S.,S. R. Kumar, J. H. Carola.
5. Carbon Nanotubes: Properties and Applications- Michael J. O'Connell.
6. Electron Transport in Mesoscopic systems - S. Dutta, Cambridge University press.

Outcome of the study:

The present syllabus of "Introduction to Nano Technology" will give insight into many aspects of Nanoscience, technology and their applications in the prospective of materials science.

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IV Year B.Tech. ME-I Sem	L	T/P/D	C
	-	-/3/-	2

(A70390) COMPUTER AIDED DESIGN AND MANUFACTURING LAB

1. Drafting: Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances.
2. Part Modeling: Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling and Assembly Modeling. Study of various standard Translators. Design of simple components.
3. Determination of deflection and stresses in 2D and 3D trusses and beams.
4. Determination of deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components.
5. Determination of stresses in 3D and shell structures (at least one example in each case)
6. Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
7. Study state heat transfer analysis of plane and axi-symmetric components.
8. Development of process sheets for various components based on Tooling and Machines.
9. Development of manufacturing defects and tool management systems.
10. Study of various post processors used in NC Machines.
11. Development of NC code for free form and sculptured surfaces using CAM software.
12. Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.
13. Quality Control and inspection.

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	-	-/3/-	2

(A70391) PRODUCTION DRAWING PRACTICE AND INSTRUMENTATION LAB

(A) PRODUCTION DRAWING PRACTICE

UNIT – I

CONVENTIONAL REPRESENTATION OF MATERIALS: conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

Limits, Fits and Tolerances: Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

UNIT – II

FORM AND POSITIONAL TOLERANCES: Introduction and indication of form and position tolerances on drawings, types of run out, total run out and their indication.

UNIT – III

SURFACE ROUGHNESS AND ITS INDICATION: Definition, types of surface roughness indication – Surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components. Heat treatment and surface treatment symbols used on drawings.

UNIT – IV

DETAILED AND PART DRAWINGS: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

UNIT – V

PRODUCTION DRAWING PRACTICE: Part drawings using computer aided drafting by CAD software

TEXT BOOKS:

1. Production and Drawing /K.L. Narayana & P. Kannaiah/ New Age
2. Machine Drawing with Auto CAD/ Pohit and Ghosh, PE

REFERENCES:

1. Geometric dimensioning and tolerancing/James D. Meadows/ B.S Publications
2. Engineering Metrology/ R.K. Jain/Khanna Publications

(B) INSTRUMENTATION LAB

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