IV YEAR I SEMESTER   COURSE STRUCTURE

Code	Subject	L	T/P/D	C
57022	Operations Research	4	1	4
57023	Power Plant Engineering	3	1	3
57024	CAD/CAM	4	1	4
57025	Instrumentation and Control Systems	4	-	4
	ELECTIVE – I	3	1	3
57026	Robotics			
57027	Mechanical Vibrations			
57028	Mechatronics			
57029	Composite Materials			
	ELECTIVE – II	3	1	3
57030	Unconventional Machining Processes			
57031	CNC Technology			
57032	Automation in Manufacturing			
57033	Design for Manufacturing			
57605	Computer Aided Design & Manufacturing Lab	0	3	2
57606	Production Drawing Practice and Instrumentation Lab	0	3	2
	Total	21	11	25

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IV Year B.Tech. ME -I Sem	L	T/P/D	C
	4	1/-/-	4

(57022) OPERATIONS RESEARCH

UNIT – I

Introduction: Development – Definition– Characteristics and Phases – Types of operation Research models – applications. **Allocation :** Linear Programming - Problem Formulation – Graphical solution – Simplex method – Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

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 – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – dominance principle – m X 2 & 2 X n games -graphical method.

UNIT – V

Waiting Lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

UNIT – VI

Inventory: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete

variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost- Single period model.

UNIT – VII

Dynamic Programming: Introduction –Terminology- Bellman's Principle of optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

UNIT – VIII

Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages – Brief Introduction of Simulation Languages.

TEXT BOOKS:

1. Operations Research /J.K.Sharma 4e. /MacMilan
2. Operations Research / R.Pannerselvam 2e.,PHI Publications

REFERENCES :

1. Operations Research /A.M.Natarajan, P.Balasubramani, A. Tamilarasi/ Pearson Education.
2. Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence Friedman
3. Introduction to O.R /Taha 8e/PHI
4. Operations Research / Wagner/ PHI Publications.
5. Operations Research / S.D.Sharma-Kedarnath
6. O.R/Wayne L.Winston/Thomson Brooks/cole
7. Introduction to O.R/Hiller & Libermann·(TMH).

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	3	1/-/-	3

(57023) 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.

UNIT II

Steam Power Plant: 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 – III

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.

UNIT IV

Gas Turbine Plant: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparision.

UNIT – V

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 VI

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

Direct Energy Conversion: Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT – VII

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 – VIII

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 BOOK :

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/ Ramalingam/ Scietech Publishers
3. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
4. An Introduction to Power Plant Technology / G.D. Rai.
5. Power plant Engg - Elanchezhian- I.K. International Pub

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(57024) CAD / CAM

UNIT – I

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

UNIT – II

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 – III

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

UNIT – IV

Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling.

UNIT – V

Numerical control: NC, NC modes, NC elements, NC 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 – VI

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

UNIT – VII

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 CAQC with CAD/CAM.

UNIT – VIII

Computer 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 & P.Groover/PE/PHI
2. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH

REFERENCES :

1. Automation , Production systems & Computer integrated Manufacturing/ Groover/P.E
2. Computer Aided Design and Manufacturing –Lalit Narayan ,etal -PHI
3. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age
4. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
5. CAD/CAM: Concepts and Applications/Alavala/ PHI
6. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson.

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	L	T/P/D	C
	4	-/-/-	4

(57025) 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..

UNIT – III : 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 – IV : 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) .

UNIT – V : 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 – VI : 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.

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

Pre-Requisite:

Objective: This subject provides insight into the different mechanical measurement systems and working and testing procedures

TEXT BOOKS:

1. Measurement Systems: Applications & Design by D.S Kumar, Anuradha Agencies

2. Instrumentation, measurement & analysis by B.C.Nakra & K.K.Choudhary, TMH

REFERENCE BOOKS:

1. Instrumentation and Control systems/ S.Bhaskar/ Anuradha Agencies

2. Experimental Methods for Engineers / Holman

3. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.

4. Mechanical Measurements/Sirohi and Radhakrishna / New Age

5. Instrumentation &mech. Measurements by A.K. Tayal ,Galgotia Publications.

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(57026) 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.

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – IV

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

UNIT VI

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

UNIT VII

Robot actuators and Feed back components: Actuators: Pneumatic and Hydraulic actuators. **Electric Actuators:** DC servo motors - stepper motors **Feedback components:** position sensors – potentiometers, resolvers and encoders – Velocity sensors – Tactile sensors.

UNIT VIII

Robot Application in Manufacturing: Material handling - Assembly and Inspection.

TEXT BOOKS :

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

REFERENCES :

1. Robotics / Fu K S/ McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, 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) Pte Ltd.
5. Robotics and Control / Mittal R K & Nagrath I J / TMH

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(57027) MECHANICAL VIBRATIONS (ELECTIVE – I)

Unit I : Single degree of Freedom systems - I: Undamped and damped free vibrations; forced vibrations coulomb damping; Response to excitation; rotating unbalance and support excitation; vibration isolation and transmissibility.

Unit II : Single degree of Freedom systems - II: 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 III : Vibration measuring instruments: Vibrometers, velocity meters & accelerometers

Unit IV : Two degree freedom systems: Principal modes- undamped and damped free and forced vibrations; undamped vibration absorbers.

Unit V : 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.

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

Unit VII : Continuous system: Free vibration of strings – longitudinal oscillations of bars- traverse vibrations of beams- Torsional vibrations of shafts.

Unit VIII : Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

TEXT BOOKS:

1. Elements of Vibration Analysis by Meirovitch, TMH, 2001
2. Mechanical Vibrations by G.K.Groover.

REFERENCES:

1. Mechanical Vibrations by SS Rao, Pearson, 2009, Ed 4,
2. Mechanical Vibration – Rao V.Dukkipati & J Srinivas, PHI, 2010.
3. Mechanical Vibrations – V. Ram Murthy.
4. Vibration problems in Engineering by S.P. Timoshenko.
5. Mechanical Vibrations- S Graham Kellyk, Schaum's Outilines, TMH

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(57028) MECHATRONICS
(ELECTIVE – I)

UNIT – I Introduction: Definition – Trends - Control Methods: Stand alone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

UNIT – II Signal Conditioning: Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , sped channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps – Software - Digital Signal Processing – Low pass , high pass , notch filtering

UNIT – III Precision Mechanical Systems: Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection.

UNIT – IV Electronic Interface Sub systems: TTL, CMOS interfacing - Sensor interfacing - Actuator interfacing – solenoids , motors Isolation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers , over current sensing , reset able fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets

UNIT – V Electromechanical Drives : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors 4-quadrant servo drives, PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

UNIT – VI Microcontrollers Overview: 8051 Microcontroller , micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly. C (LED Blinking , Voltage measurement using ADC).

UNIT – VII Programmable Logic Controllers: Basic Structure - Programming : Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog

input / output - PLC Selection - Application.

Unit – VIII Programmable Motion Controllers : Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors , Inductive , Capacitive , Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal - S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear , Circular - Core functionalities - Home , Record position , Go to Position - Applications : SPM, Robotics.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton, Pearson Education Press, 3rd edition, 2005.

2. Mechatronics/M.D.Singh/J.G.Joshi/PHI.

REFERENCES:

1. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.

2. Mechatronics – N. Shanmugam / Anuradha Agencies Publisers.

3. Mechatronics System Design / Devdas shetty/Richard/Thomson.

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(57029) 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: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide. fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

Unit-III Manufacturing methods: Autoclave, tape production, moulding methods, filament winding, man lay up, pultrusion, RTM.

Unit-IV Macromechanical 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, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

Unit-V Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina. Invariant Form of Stiffness and Compliance Matrices for an Angle Lamina Strength Failure. Envelopes, Maximum Strain Failure Theory ,Tsai–Hill Failure Theory, Tsai–Wu Failure Theory Comparison of Experimental Results with Failure Theories. Hygrothermal Stresses and Strains in a Lamina: Hygrothermal Stress–Strain Relationships for a Unidirectional Lamina, Hygrothermal Stress–Strain Relationships for an Angle Lamina

Unit-VI Micromechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi Empirical Models ,Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion

UNIT-VII Macromechanical Analysis of Laminates: Introduction,

Laminate Code, Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate, Hygrothermal Effects in a Laminate, Warpage of Laminates

UNIT-VIII Failure Analysis and Design of Laminates: Introduction , Special Cases of Laminates, Failure Criterion for a Laminate, Design of a Laminated Composite, Other Mechanical Design Issues

TEXT BOOKS:

1. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.

2. R. M. Jones, Mechanics of Composite Materials, McGraw Hill Company, New York, 1975.

REFERENCES:

1. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley- Interscience, New York, 1980.

2. Mechanics of Composite Materials, Second Edition (Mechanical Engineering), By Autar K. Kaw, Publisher: CRC

3. Ever J. Barbero, Finite Element Analysis of Composite Materials, CRC Press, 2007.

4. 3.L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York, 1969.

5. Madhujit Mukhopadhyay, Mechanics of Composite Materials and Structures, University Press, 2009.

6. Krishan K. Chawla, Composite Materials Science and Engineering, Springer, 2009, Ed. 6. Robert M. Jones, Mechanics of Composite Materials, 1999, Ed. 2.

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(57030) UNCONVENTIONAL MACHINING PROCESSES
(ELECTIVE – II)

UNIT – I

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

UNIT II

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

UNIT – III

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

UNIT - IV

Electro–Chemical Processes: 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 - V

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, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

UNIT – VI

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-VII

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.

UNIT – VIII

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

TEXT BOOKS:

1. Advanced machining processes/ VK Jain/ Allied publishers.
2. Manufacturing Engineering and Technology, Serope Kalpakjian and Steven R. Schmid, Ed. 4, Pearson Publications, 2001

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

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(57031) CNC TECHNOLOGIES
(ELECTIVE – II)

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 N/C Machine Tools, design consideration of NC machine tool, methods of improving machine accuracy.

UNIT II:

CNC Machines Elements: Machine Structure- Guide ways - feed drives- spindles - spindle bearings - measuring systems-Tool monitoring systems.

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.

UNIT V:

Compute-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 VI:

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.

UNIT VII:

Micro Controllers: Introduction, Hardware components, I/O pins, ports, external memory, counters, timers and serial data I/O interrupts. Selection

of Micro Controllers, Embedded Controllers, Applications and Programming of Micro Controllers.

UNIT VIII:

Programming Logic Controllers (PLC's): Introduction, Hardware components of PLC, System, basic structure, principle of operations, Programming mnemonics timers, Internal relays and counters, Applications of PLC's in CNC Machines.

TEXT BOOKS:

1. Computer Control of Manufacturing Systems / Yoram Koren / Mc Graw Hill Int. 1983.

2. CAD/CAM – Michel P.Groover, TMH

REFERENCES:

1. Machining Tools Hand Book Vol 3, (Automation & Control)/ Manfred Weck / John Wiley and Sons, 1984.

2. Mechatronics – HMT, TMH.

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IV Year B.Tech. ME -I Sem

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(57032) 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.

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

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

UNIT -VI : Automated storage systems, Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

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

UNIT – VIII : Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE, concurrent Engineering, Techniques of Rapid Proto typing.

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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(57033) DESIGN FOR MANUFACTURING
(Elective - II)

UNIT I:

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

UNIT II:

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

UNIT III:

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 IV:

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.**

UNIT V:

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 VI:

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

UNIT VII:

Extrusion, Sheet Metal Work & Plastics: Design guidelines for Extruded sections - Design principles for Punching, Blanking, Bending, Deep

Drawing – Keeler Goodman Forming Limit Diagram – Component Design for Blanking.

UNIT VIII:

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 BOOKS:

1.　Product design for Manufacture and Assembly/ Geoffrey Boothroyd/ Marcel Dekker Inc. NY, 2006.

2.　Product Design/ Kevin Otto and Kristin Wood/ Pearson Education, 2004.

REFERENCE BOOK:

1.　Product design and Manufacturing / A.K Chitale and R.C Gupta / Prentice – Hall of India, New Delhi, 2003.

JAWAHAR LAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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

                                   0   -/3/-   2

(57605) 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 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 CNC part program for turnig components and milling components.

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.

Any Six Software Packages from the following: Use of 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. ME -I Sem   L   T/P/D   C

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(57606) 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.

UNIT – II

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

UNIT – III

Form and Positional Tolerances: Introduction and indication of the tolerances of from and position on drawings, deformation of runout and total runout and their indication.

UNIT – IV

Surface roughness and its indication: Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

UNIT – V

Heat treatment and surface treatment symbols used on drawings.

UNIT – VI

Detailed and Part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

UNIT – VII

Part drawing 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 roto meter 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.