M.Tech(Mechanical Engineering)

1st Sem

Theory:

CODE	Paper	Contacts periods Per week			Total	Credits
MM(ME)101	Advanced Engg. Math	3	1	0	4	4
MMT 101	Operational Management	4	0	0	4	4
MMT 102	Principles of Machining Process	4	0	0	4	4
MMT 103	Computer Graphics & CAE	4	0	0	4	4
MMT 104A 104B 104C	Elect I Hydraulics & Pneumatics Ergonomics & Work System Design Statistical Process Control	4	0	0	4	4
	Total Of Theory				20	20

Practical:

CODE	Paper	Contacts periods Per week			Total	Credits
MMT 191	Machining Technology Lab	0	0	4	4	2
MMT 192	CAD/CAM Lab	0	0	4	4	2
Sessional MMT 181	Seminar I	0	2	0	2	1
	Total OF Practical				10	5
Total:					30	25

M.Tech(Mechanical Engineering)

2nd Sem

Theory:

CODE	Paper	Contacts periods Per week			Total	Credits
MMT 201	Numerical Control of Machine Tools	4	0	0	4	4
MMT 202	Non-traditional & Modern Machining	4		0	4	4
MMT 203	Robotics	4		0	4	4
MMT 204A 204B 204C	Elect II Reverse Engineering And Rapid Prototyping Mechatronics Holonic Manufacturing Systems	4	0	0	4	4
MMT 205A 205B 205C	Elect III Reliability Quality Function Deployment Business Process Reengineering	4	0	0	4	4
	Total of Theory				20	20

Practical:

CODE	Paper	Contacts periods Per week			Total	Credits
MMT 291	Robotics & Mechatronics Lab	0	0	4	4	2
Sessional						
MMT 281	Seminar II	0	2	0	2	1
MMT 282	Comprehensive Exam(Viva-Voce)	0	0	0	0	4
Total OF					6	7
Total:					26	27

M.Tech(Mechanical Engineering)

3rd Sem

Sessional:

CODE	Paper	Contacts periods Per week			Total	Credits
MMT 381	Pre-submission Defense of Dissertation	0	0	0	0	4
MMT 382	Dissertation Progress	0	0	0	24	18
Total:					24	22

4th Sem

Sessional:

CODE	Paper	Contacts periods Per week			Total	Credits
MMT 481	Dissertation (Completion)	0	0	0	24	18
MMT 481	Post-submission Defense of Dissertation	0	0	0	0	6
Total:					24	24

M.Tech(Mechanical Engineering)

UNIVERSITY

DETAILED SYLLABI OF M.TECH PROGRAMME IN MECHANICAL ENGINEERING

SEMESTER - I

Code : Advanced Engineering Mathematics
Contacts : 3L + 1T
Total Contact Hrs: 52 **Internal Assessment: 30**
Lecture: 39 **Examinations: 70**
Tutorial: 13 **Total Marks: 100**

Statistics: Elements of statistics ; frequency distribution ; concept of mean , median, mode ; and different types of distribution ; Standard derivation and variance ; curve fitting by least square method ; Correlation and Regression ; Testing of hypothesis ; Basic types of factorial design and Analyses of Variance.
(L = 13)

Matrix Operation: Matrix Operations; Eigen value and Eigen vector by iterative methods; Diagonalisation of a square matrix. **(L = 08)**

Laplace Transform, Fourier Transform; Fourier Integral and Their Applications. **(L = 06)**

Numerical Methods; Interpolation by Polynomials ; Error Analysis ; Solution of system of linear equation by Gauss – Seidel iterative methods ; Newton Rap son methods ; Numerical integration by Gauss – quadrature ; Solution of ordinary differential equation by Rayleigh – Ritz method.
(L = 12)

Code : Operational Management
Contacts : 4L
Total Contact Hrs: 52 **Internal Assessment: 30**
Examinations: 70
Total Marks: 100

Introduction to Operational Management and Processes: Management perspective and control approach to management, Basic management functions and managerial skills,
Operations Strategy, Process and Technologies, HR in Operations Management, Concept of productivity and its analysis, Quality aspects in Production and Services.

Facility planning: Product and process selection, Facilities locations: Factors influencing selection of locations, Quantitative analysis in facility location: Weight method, Weight cum rating method, Composite measure method, Locational break-even analysis, Median model, Gravity model, Bridgeman's Dimensional analysis. Plant layout: Product layout, Process Layout, G.T based layout.

Production planning and control: Different types of production systems: Mass, Batch, Job, Project and continuous.

Forecasting: Need and importance of Forecasting, Forecasting Techniques: Delphi Method, Simple and Moving average, Exponential Smoothing, Correlation and Regression Analysis, Karl Pearson's Correlation, MAD, Tracking Signal.

Planning & Scheduling: Different types of Planning: Long-term, Aggregate, short-term, Master Production Schedule, Rough cut capacity planning, Detail scheduling, Machine loading and sequencing: Johnson's rule and GANTT chart, Assembly line balancing: Line efficiency, balance delay, smoothing index, Different techniques of balancing,

Materials Management: Concept of inventory and its importance, Types of inventory,
Saw – Tooth model, Computation of EOQ: Deterministic and Probabilistic models, Selective inventories. MRP –I and MRP – II, JIT.

Supply Chains: Evolution of Supply chain and its definition, Push pull view of supply chain, Cycle View of supply chain, Supply chain drivers, Factors affecting the supply chain performance, Efficient supply chain and responsive supply chain and its strategic fit, Bullwhip effect of supply chain, Merits and demerits of supply chain.

Project Management: Concept of project and network analysis and network diagram, Computation of project completion time (Forward pass and backward pass), CPM, Computation of float, Difference between PERT and CPM, Probabilistic time estimates, probability of project completion by a target date, Project crushing.

Queuing Model: Waiting line problem and its application, Characteristic of the Queue and the service facilities, Poisson arrival and Exponential service distribution, Traffic intensity, Computation of Waiting time, number of customers in the system, decision problems in queuing.

Recommended Texts:

1. Essentials of Management by Koontz & Weihrich, TMH.
2. Modern Production / Operations Management by E.S. Buffa and R.K. Sarin, John Wiley & Sons.
3. Quantitative techniques in Management by N. D. Vohra, Tata McGraw Hill.
4. Production Planning and Inventory Control by Narasimhan, McLeavey, Billington, PHI.
5. Production and Operation Management by Muhlemann, Oakland and Lockyer, Mcmillian India Ltd.
6. An Introduction to Management science by Anderson, Sweeny and Williams, Thomson South west.
7. Logistic and supply chain management by Martin Chirstopher, Pearson Education.
8. Supply Chain Management by Chopra and Meindl, Pearson Education, 3rd Ed.,. 2007

Code : Principles of Machining Process
Contacts : 4L
Total Contact Hrs: 52 **Internal Assessment: 30**
Examinations: 70
Total Marks: 100

Classification of Manufacturing Process: Importance and perspective of machining process, Schematic Representation of machining system, Different types of motions to generate different shapes.

Mechanics of chip formation: Orthogonal and oblique cutting**,** shear plane and shear strain, , Computation of chip reduction coefficient, Velocity triangle, different process variables, actual feed and actual depth of cut, Different types of chips, computation of MRR for different processes.

Cutting tool geometry: ASA, ORS and NRS systems, conversion from one system to others, Cutting tool nomenclature.

Cutting force: Theoretical **a**nalysis of cutting force, Merchant circle diagram, Theory of Ernst and Merchant 1st and 2nd Model, Theory of Lee and Shaffer model, Ploughing force and size effect, Dynamometry, Friction in metal cutting, Cutting energy and power in metal cutting.

Cutting tool materials: Properties, different types of cutting tool materials e.g. HSS, Carbides, Coated carbides, ceramics, Cermets, PCBN and Diamonds and other advanced cutting tool materials, ISO specification of modern throw away inserts.

Temperatures in metal cutting: Heat generation and temperature distribution in metal cutting (Primary and secondary zone), Measurement of cutting temperature, Effect of process variables and tool geometry in temperature rise.

Cutting fluid and surface roughness: Need for cutting fluid, characteristics of an efficient lubricant, Different applications: flood, jet, mist and Z-Z cooling, Cutting fluid maintenance and its disposal, Concept of dry cutting.

Surface roughness: Theoretical computation of surface roughness, Measurement of surface roughness, Modification of tool geometries for improved surface finish, Effect of process variables on surface roughness.

Tool wear, Tool life and machinability: Causes and mechanism of wear, Types of wear: Crater wear and flank wear, Tool life criteria, Effect of built-up-edges and tool geometries on wear, Concept of tool life, Taylor's tool life equation, Effect of process variables on tool life, Concept of machinability and machinability rating, Variables affecting machinability.

Abrasive processes: Grinding, Chip removal in grinding, Cutting force in grinding, Types of abrasive and specification of grinding wheel, Effect of variables on grinding performance. Types of abrasive machining and finishing processes: honing, lapping, super finishing and buffing.

Recommended Texts:

1. Metal Cutting Theory & Practice by A. Bhattacharya, New Central Book Agency Pvt. Ltd.
2. Fundamentals of machining and machine tools by Boothroyd, G. and Knight, W. A. (2006), 3rd Edition, CRC Press, Taylor and Francis Group.
3. Metal Cutting Principles, Shaw by M. C. (2005), 2nd Edition, New York: Oxford University Press.
4. Principles of Engineering Manufacture, Black, S. C., Chiles, V., Lissaman A. J. and Martin, S.J. (2004) 3rd Edition, New Delhi: Viva Books Pvt. Ltd.
5. Fundamentals of Machining Processes, H. El-Hofy (2007), CRC Press, Taylor and Francis Group.
6. Production Technology by HMT, McGraw-Hill, India.

Code : Computer Graphics and CAE

Contacts : 4L
Total Contact Hrs: 52

Internal Assessment: 30
Examinations: 70
Total Marks: 100

Graphics System: Hardware, Types of systems, Input/Output devices, Workstations, Raster scan display, Workstations and peripherals, graphics standards.

Geometric modeling: Types and mathematical representation of lines & curves: DDA – Algorithm, Algorithm for various conic sections,

Transformations: 2-d and 3-D transformations, Projections, Viewing and clipping, Hidden surface removal, Windowing, Segmentation, Trimming, Integration, Projection and Transformations engineering applications.

Surface Modeling: Types and mathematical representation of curves and surfaces: Parametric description of analytic and synthetic curves, Curve and Surface Design, Composite Curves and Splines, Composite Surfaces,

Solids Modeling: Half spaces, Boundary representation (B-Rep), Constructive Solid Modeling (CSG), sweep representation, Solid modeling based application.

Finite Element Analysis: Basic concept of the finite element method, comparison with finite difference method; Variational methods: calculus of variation, the Rayleigh-Ritz and Galerkin methods; Finite Element analysis of 1-D problems: formulation by different approaches (direct, potential energy and Galerkin); Derivation of elemental equations and their assembly, solution and its post processing.

CAM: Stock boundary definition and Generation of machining paths from CAD Database. Cutter paths for Numerical Control, CAD-CAM interface.

Recommended Text:

1. Computer Graphics by D. Hearn & M. P. Baker, PHI
2. Principles of Interactive Computer Graphics by W. M. Newman & R. F. Sproull, McGraw Hill.
3. Procedural Elements for Computer Graphics by D.F. Rogers, Tata McGraw-Hill.
4. Computational Geometry for Design and Manufacture, by I. D. Faux and M. J. Pratt, Ellis Horwood, Chichester, 1979.
5. CAD/CAM by I. Zeid, Tata McGraw-Hill.
6. An Introduction to the Finite Element Method by J.N.Reddy, McGrawHill, NewYork.
7. The Finite Element Method by O. C. Zienkiewicz and R.L.Taylor, 3rd ed. McGraw-Hill.
8. Introduction to Finite elements in Engineering by Chandrupatla & Belegundu, PHI.

Elective – I: (Select any one)

1. **Hydraulics & Pneumatics**
2. **Ergonomics & Work System Design**
3. **Statistical Process Control**

Code : Hydraulics and Pneumatics

Contacts : 4L
Total Contact Hrs: 52

Internal Assessment: 30
Examinations: 70
Total Marks: 100

Introduction: Power hydraulics & its applications, Hydraulic symbols,

Positive displacement Pumps: Gear, Vane, Piston and other special types of pumps.

Control valves: Pressure Control: relief valve, Unloader valve, Pressure reducing valve, Counter balance valve, sequence valve, Flow Control: Meter in Meter out, Bleed off, Pressure and Temperature compensated flow control valve, Direction Control: Check valve, 2/3 position, ¾ position, Open centre, closed centre, Tandem centre and others, Cartridge valves, Flow forces on valve spools and valve design.

Hydraulic actuators: Linear (S/T, D/T, Cushion) and rotary, Design of Hydraulic actuators, Accessories in hydraulic systems: Accumulator, Air-breathe valve, Pressure switches etc. Hydraulic power packs.

Servo valves: Torque motor, electro-hydraulic Servo valves: Types and principles of operations.

Design of Hydraulic circuits and its application: Regeneration, Pre-fill, Twin Pump and others.
Maintenance of hydraulic systems and working fluid:

Pneumatics: Air Filter, Lubricators and Regulators, Pneumatic control elements: Air Cylinders and their Design, Pneumatic safety circuits, Pneumatic Logic control.

Fluidics:

Recommended Text:

1. Hydraulic Control Systems by H.E. Merritt, Wiley New York.
2. Fluid Power by Esposito, Peaerson Education
3. Hydraulics and Pneumatics by Andrew Parr, Jaico Publishers.

Code : Ergonomics and Work System Design

Contacts : 4L
Total Contact Hrs: 52

Internal Assessment: 30
Examinations: 70
Total Marks: 100

Work Study Fundamentals: Productivity and Work Study, Definitions, Scope, and History of Work Study, Tools of productivity, Productivity index, Kinds of productivity Measurements, Causes of low productivity and techniques of their elimination, technical Methods to improve productivity.

Analysis of Work Content: Management techniques to reduce work content Method Study: Process Analysis, Process and Activity Charts, Operation Analysis, Basic procedure, Micro Motion Study, Principles of Motion Economy.

Work Measurement: Purposes and uses, Basic procedure, Techniques – Work Sampling, Stop-Watch Time Study, Rating and Allowances, Setting Standard Times for Jobs, Standard Data, Predetermined Time Standards.

Ergonomics: Fundamental Concepts, Issues in Work system Design, Measuring Work by Physiological means, Muscle Physiology, Muscle Metabolism, Work Posture, Fatigue Measurement and Evaluation, Work rest cycles, Applied anthropometry and work space design, Biomechanics of Human Motion, Sensorimotor responses.

Environmental Factors and Work Systems: Characteristics of Illumination, colour cone, Measurement of illumination parameters, effect of glare on Human eyes, Effect stress on Human Health and performance, thermoregulation, Physiological effects of noise and vibration, Measurements of Noise level parameters.

Job Evaluation: Basic concepts, Objective and Subjective methods, Compensation Schemes, Relationship of Work Study to Incentive Schemes, Wage Incentive Plans.

Recommended Text:

1. Human factors in engineering and Design by Sanders and McCormick, McGraw Hill.
2. Ergonomics (Man in his working environment) by Murrell, Chapman and Hall.
3. Ergonomics at work by d.J.Oborne, Wiley and sons.
4. A guide to Ergonomics of Manufacturing by Martin Helander, East - West and Taylor Francis.
5. Introduction to work study by ILO Geneva, Oxford and IBH.
6. Work Study and Ergonomics by Sharma and Sharma, S. K. Kataria and sons.

M.Tech(Mechanical Engineering)

Code : Statistical Process Control

Contacts : 4L
Total Contact Hrs: 52 **Internal Assessment: 30**
Examinations: 70
Total Marks: 100

Introduction: History Of Statistical Process Control, Quality And Quality Management Techniques, Basic Principles Of Statistical Quality Control.

Basic principles of Statistics: Basic Statistics and Types of Distributions (Normal, Exponential, Binomial, And Poisson's Distributions).

Control chart for variables: Different types of control charts, Preparation of control charts for variables ($\overline{X}$, $\overline{R}$ charts and σ chart),

Some adaptation of control charts for variables: Group Control Chart, Moving Average, Moving Range, Difference Control Charts and Cumulative Sum Control Charts.

Control chart for attributes: Control charts for attributes (p-and n.p-chart, c-chart, u-chart, U-chart).

Process and measurement system capability analysis: Process Capability Analysis, Method of Calculating Process capability, Process Capability Index.

Some aspects of Specification and Tolerances: Purpose of specification, effect of Careless setting of specification limits, setting of Realistic Tolerances, Statistical tolerancing, Statistical Theorem.

Acceptance sampling: Sampling techniques, Lot formation, Sampling Methods, OC Curve.

Recommended Text:

1. Introduction to Statistical Quality Control by Douglas C. Montogomery, Wiely Pub, U.K.
2. Statistical Quality Control by E. L. Grant, Tata Mc Graw Hill.
3. Statistical Quality control by M. Mahajan, Dhanpat Rai & Co.
4. Quality Planning and Analysis by Juran, Tata Mc Graw Hill.

Code : Numerical Control of Machine Tools

Contacts : 4L
Total Contact Hrs: 52 **Internal Assessment: 30**
Examinations: 70
Total Marks: 100

Fundamentals of Numerical Control: Introduction to numerical control, Classification of NC/CNC machines and axis nomenclature, PTP and Continuous Contouring, Absolute and Incremental Programming, Difference between NC and CNC, Different types of software's in CNC.

Control system fundamentals: feedback, transfer function, system stability. Open Loop and Closed Loop control: Servo Mechanism, Position and Velocity feedback.

Engineering Analysis of NC/CNC systems: Computations of total number of pulses and pulse frequency in Open Loop and Closed Loop control, Precision in NC/CNC: Resolution, Accuracy and Repeatability. Interpolation in NC and CNC: Linear and Circular, Tolerance Analysis: Inward, Outward and Secantial.

System components: Machine Control Unit (MCU), Transducers, Actuators.

Design considerations of NC/CNC machine tools: Re-circulating ball screw, lost motions in NC systems, Turning Centers and Machining Centers.

Part Programming: Manual programming: Different G codes and M codes, Stock Removal Cycle, Canned Cycles. Computer assisted Part Programming. Tool path generation from CAD models, CNC Toolings.

Process optimization: Online condition monitoring in CNC, Adaptive control: ACC, ACO & GA.

DNC: Direct and Distributed Numerical Control, Merits of DNC, Concept of BTR, Data Multiplexing.

Economic analysis of NC/CNC: Various cost elements of CNC, Break-Even analysis, ROI and other techniques.

Recommended Texts:

1. Computer Control of Manufacturing Systems by Y. Koren, McGraw-Hill
2. Numerical Control and Computer Aided manufacturing by R. S. Pressman & J. E. Williams, John Wiley & Sons
3. Computational Geometry for Design and Manufacture, by I. D. Faux and M. J. Pratt, Ellis Horwood, Chichester, 1979.
4. Numerical Control in Manufacturing by F. W. Wilson, McGraw-Hill Book Company New York.

Code : Non-traditional and Modern Manufacturing

Contacts : 4L
Total Contact Hrs: 52

Internal Assessment: 30
Examinations: 70
Total Marks: 100

Non Traditional Machining Processes: Importance and need, Classifications.

Mechanical Processes: Abrasive Jet Machining (AJM), Water Jet Machining (WJM)
Abrasive Water Jet Machining (AWJM): Principles of material removal, Computation of MRR, Salient process variables, equipments, applications.
Ultrasonic Machining (USM): Mechanism of material removal, factors affecting material removal, equipment, transducers, different types of horn, Dimensional accuracy.

Electrochemical Processes: Electrochemical Machining (ECM): Basic mechanics of ECM, Electrochemistry & process characterization, Computation of MRR for single metal and alloys, Dynamics of ECM, ECM hydrodynamics, Operating variables, equipments and applications.

Electro-Thermal Processes: Electro-discharge machining (EDM): Principles of EDM, Process variables and characteristics, Modeling of material removal, Equipments: Types of power supply, Analysis of RC Relaxation EDM Generator, Determination of Surface roughness and over cut, Applications. Laser Beam Machining (LBM): Laser generation and types, Laser construction, Mechanism of material removal,

Process characteristics of different lasers, Applications. Electron Beam Machining (EBM): Principle, Mechanism of material removal, Effect of process variables on process criteria, Applications. Plasma Arc Machining (PAM): Principle, Mechanism of material removal, Effect of process variables on process criteria, Applications. Ion Beam Machining (IBM)

Computer Integrated Manufacturing: Batch Production and Mass Customization, Concept of Integrated automation, Concurrent Engineering.

CAD & CAE: Feature based Design, parametric design, Fundamentals of FEA, Role of CAD in CIM environment.

Group Technology: Need & Utility, Different types of coding, Clustering Techniques & Benefits. CAPP: Variant & Generative, Feature Recognition, Feature-Process co-relation, Application Programs in CAPP.

Computer aided quality control: Quality control, Inspection, Contact and Non-contact Inspection, Computer aided data acquisition, CMM.

FMS: Types of flexibility, FMM, FMC, Modules of FMS, Materials handling in FMS, Quantitative analysis in FMS, Tool Management, Automatic Tool wear monitoring, Performance evaluation.

CIM: Definition & Concept, CIM wheel, External and Internal challenges, World-class order winning criteria, Product Development Cycle. Concurrent Engineering, Design for Manufacturing & Assembly, Data base requirements in CIM, Computer Networking, CIM Implementation & Barriers.

Emerging trends in manufacturing: High speed machining, micro, meso and nano manufacturing.

Recommended Text:

1. Non-Conventional Machining by P.K.Mishra, Narosa Publishers.
2. Modern machining processes by P. C. Pandey, H. S. Shan, Tata McGraw Hill.
3. Fundamentals of Machining Processes, H. El-Hofy (2007), CRC Press, Taylor and Francis Group
4. Automation, Production Systems and Computer Integrated Manufacturing by Groover, Prentice Hall.
5. Computer-Integrated Manufacturing by Rehg Kraebber, 2nd Edition, Pearson Education.
6. The Design and Operation of FMS by P. G. Ranky, IFS Ltd., U.K., North Holland.
7. Computer Integrated Manufacturing by Joseph Harrington, Industrial Press

Code : Robotics
Contacts : 4L
Total Contact Hrs: 52

Internal Assessment: 30
Examinations: 70
Total Marks: 100

Automation & Robotics; Spatial Descriptions & Transformations, Manipulator Kinematics – Forward and Inverse; Jacobians: Velocities & Static Forces. Robot Arm Dynamics: Lagrange-Euler formulation of manipulator dynamics. Trajectory Planning: Joint-interpolated trajectories, Geometric problems with Cartesian paths, Collision-free path planning. Robot Control Systems: Feedback and Closed-loop control, Transfer Functions, Control of Second-order systems, Non-linear & time varying systems, Adaptive Control. Robotic Prehension: Dexterous manipulation; ANN approach in prehension, Sensors in Robotics: Machine vision, Force & Torque sensors. Robot programming: simulators and languages, Tele-robotics and virtual interfaces for task specification and programming, Concept of nanorobotics, Performance analysis of industrial robots and their manufacturing applications, Economics of robotics, Social issues & future of robotics.

Recommended Text:

1. Robotics for Engineers by Y. Koren, McGraw Hill New York
2. Robotics Technology and Flexible Automation by S.R.Deb, TMH.

3. Industrial Robotic Technology - Programming and Application by M.P.Groover et. al., McGrawHill
4. Robotics: Control, Sensing, Vision and Intelligence by Fu, Lee and Gonzalez, McGraw Hill New York

Elective – II (Select any one)

1. **Reverse Engineering And Rapid Prototyping**
2. **Mechatronics**
3. **Holonic Manufacturing Systems**

Code : Reverse Engineering and Rapid Prototyping

Contacts : 4L
Total Contact Hrs: 52 **Internal Assessment: 30**
Examinations: 70
Total Marks: 100

Prerequisite: Classification of manufacturing processes, Different Manufacturing Systems, Introduction to Rapid Prototyping (RP), Need of RP in context of batch production, FMS and CIM and its application; Basic Principles of Generative Manufacturing Processes.

Reverse Engineering: Need & Techniques, Data collection, Point-Cloud of data.

Steps in RP: Process chain in RP in integrated CAD-CAM environment, Advantages of RP; Utility of Rapid Prototyping in Reverse Engineering. Classifications of different RP techniques – based on raw material, layering technique (2D or 3D) and energy sources; Comparative study of: - Stereo-lithography (SL) with photo-polymerization, SL with liquid thermal polymerization,

Process Technology: Solid foil polymerization, Selective laser sintering, Selective powder binding, Ballastic particle manufacturing – both 2D and 3D, Fused Deposition Modelling, Shape Melting, Laminated Object Manufacturing, Solid Ground Curing, Repetitive Masking and deposition.

Recommended Text:

Code : Mechatronics

Contacts : 4L
Total Contact Hrs: 52 **Internal Assessment: 30**
Examinations: 70
Total Marks: 100

Introduction to Mechatronics: Definition, Mechatronics System Architecture, Comparison between Conventional and Mechatronics approach. Building Blocks of Automation: Sensors, Analyzers, Actuators, Drives.

Digital Electronics: Fundamentals of digital electronics, logic gates and their operations, Data conversion devices, Truth Tables, Boolean Algebra, Karnaugh Maps, Sequential and Combinational Logic Circuits ,Encoder , Decoder , Data Multiplexing & Demultiplexing.

Sensors and Transducers: Sensor characteristics, different types of sensors and transducers, micro sensors, electrical contacts, actuators, and switches, signal processing devices; relays, output devices.

Drives: Electrical, Mechanical, Hydraulic & Pneumatic.

Automatic Production and Assembly Machines: Transfer lines, Production and throughput, Buffer Storage

Control Systems: Open loop and closed loop control, block diagrams, transfer functions, Laplace transforms; Mathematical model of physical system; P , PD ,PI and PID controllers, Time domain analysis, transient response of first and second order systems; Introduction to nonlinear control; State space analysis.

Microprocessor: 8085 & 8086 Microprocessor Architecture, Instruction Set, Addressing Modes, Interrupts, Programmable Peripheral Interface, Different Interfacing with Keyboard, Stepper Motor, Servo Motor , 7 Segment LED.

PLC: PLC controller and Ladder diagrams, Timers, Response diagrams, Logic Control versus Sequencing, PLC Internal Features, PLC Programming. Logic Networks, Stage Programming, Advantages of PLCs

Design and fabrication of Mechatronics systems.

Recommended Text:

1. Introduction to Mechatronics and Measurement Systems by David G. Alciatore, Michael B. Histand, Mc Graw Hill
2. Mechatronics by Bolton, Pearson Education.
3. AutomaticControl Engineering by F.H.Raven, 5th ed., McGrawHill International.
4. Modern Control Engineering by K.Ogata, 3rd ed., Prentice Hall.
5. Automatic Control Systems by B.C.Kuo, 6th ed., Prentice Hall.
6. Digital Principles and Application by Malvine & Leach, TMH, 1999
7. Microprocessor Architecture Programming and Application with 8085 by Ramesh S. Gaonkar, PHI, 2001
8. Programmable Logic Controllers and Industrial Automation book (PLC book) by Madhuchhanda Mitra and Samarjit Sen Gupta, Penram Int, Pub. (India) Pvt. Ltd.

Code : Holonic Manufacturing System

Contacts : 4L
Total Contact Hrs: 52

Internal Assessment: 30
Examinations: 70
Total Marks: 100

Business requirements analysis, Batch Manufacturing and Mass customization, Hierarchical control limitations, Emergence of heterarchical and Agent based Systems: Scope and limitations. Holonic Control: Definition of holon, holarchy, HMS, Holonic Behavior: Autonomy, Cooperation, Reconfiguration, plug and play, Comparison between Bionic, fractal and holonic behavior. Generic Holonic model: PROSA structure, MAS vs Holonic manufacturing, Distributed Problem Solving (DPS), Unified Modeling Language (UML) [Class diagram], MCDM techniques in Holonic manufacturing, Contract Net Protocol, Ant algorithm, Holonic Scheduling, Adacor, Holonic control implementation & case Study.

Recommended Text:

Elective – III: (Select any one)

1. **Reliability**
2. **Quality Function Deployment**
3. **Business Process Reengineering**

M.Tech(Mechanical Engineering)

Code : Reliability

Contacts : 4L
Total Contact Hrs: 52 **Internal Assessment: 30**
Examinations: 70
Total Marks: 100

Elements of Probability: Probability concepts, Rules for addition of probabilities, Complementary events, Conditional probability, Random events, Sample distribution.

Reliability: Fundamental aspects of reliability, Failure patterns and mathematical models (Constant failure rate models and Time Dependent failure models), System Reliability, Fault tree analysis, FMEA and FMECA.

Reliability testing: Burn in testing, Binomial Testing, Acceptance testing, Accelerated life Testing, Degradation Models.

Reliability Improvement: Reliability specification and system measurements, System effectiveness, Economic analysis and life cycle cost, Reliability allocation (AGREE method, Redundancies).

Reliability Design Methods: Parts and material selection, De-rating, Stress-Strength analysis, Complexity and Technology, Redundancy.

Recommended Text:

1. Mechanical Reliability Engineering by ADS Carter, Mc Milan.
2. Reliability Evaluation of Engineering Systems by Roy Bilington and R. N. Allen, Pitman.
3. Introduction to Reliability Engineering by Dhilan & Singh.
4. Reliability Engineering by L. A. Doty, Industrial Press Inc.

Code : Quality Function Deployment

Contacts : 4L
Total Contact Hrs: 52 **Internal Assessment: 30**
Examinations: 70
Total Marks: 100

Quality function parameters: Product planning**,** product design, process planning process control, Customer requirements, Design requirements, Process operation, operation requirements.

QFD Process: Customer requirements, Fuzzy Logic, Planning Matrix, Technical features, Deployment Matrix, Process Plan and Quality control charts, Operating instructions.

House of Quality: Voice of the customer, technical requirements, Relationship between customer requirements and technical requirements, Priorities of technical requirements, Priorities of customer requirements, Competitive evaluation, Trade off.

Four Houses of Quality: Technical requirements, Component characteristics, Process operations, Quality control plan.

Using the House of Quality: Engineering Characteristics strongly influencing the desired attributes, Check for adverse interaction and weigh tradeoff, Set target levels (not ranges), Link to lower level houses-component characteristics, Key process operations, Production requirements.

Problems with QFD: Too large matrix, Customer priorities not clear, Need of Market segmentation, Use of revealed preference techniques, QFD is messy.

Recommended Text:

1. Quality planning and analysis by J.M. Juran, F.M. Gryna, Tata McGraw –Hill
2. Total quality management by K. Shridhara Bhat, Himalaya Publishing House.
3. Total quality management by S. Ramasamy, Tata McGraw –Hill

Code : Business Process Reengineering (BPR)

Contacts : 4L
Total Contact Hrs: 52

Internal Assessment: 30
Examinations: 70
Total Marks: 100

Reengineering: Definition, Reasons for Reengineering, Development of Business Process reengineering, Three 'R's of Reengineering, Requirements of reengineering process, Reengineering in the service industries, Quality and reengineering, Reengineering and TQM.

Human Process Reengineering, Organizational Reengineering, Reengineering Tools, Changes that occur in Reengineering, Success of Reengineering, Role of Information Technology, Reengineering leadership, Style of implementation for reengineering, Role of Industrial engineer in BPR. Employee support for reengineering, Information system for BPR. BPR and innovation, reengineering by OPISys.

Integrating Reengineering and Process Improvements, Benefits and Limitations of Reengineering.

Beyond Business Process Reengineering: The Holonic concept, How the Holonic network works ?, Advantages of Holonic Business systems, Types of Holonic networks.

Recommended Text:

1. Total quality management by K. Shridhara Bhat, Himalaya Publishing House.
2. Total quality management by K. C. Arora, S. K. Kataria & Sons.