Structure for M.E. Mechanical – Manufacturing

Part – I

Sr. No.	SUBJECT	TEACHING Scheme		Examination			Total Marks
		L	T/P	T/W	TP	ORAL	
1	Material Removal Processes	3	1	25	100	-	125
2	CNC and Adaptive Control	3	2	25	100	-	125
3	Advanced Joining Technology	3	1	25	100	-	125
4	Elective - I	3	1	25	100	-	125
5	Elective - II	3	2	25	100	-	125
6	Seminar		2	25	-	-	25
	Total	15	9	150	500		650

Part – II

Sr. No.	SUBJECT	TEACHING Scheme		Examination			Total Marks
		L	T/P	T/W	TP	ORAL	
1	Metal Forming Processes	3	2	25	100	-	125
2	Finite Element Method	3	2	25	100	-	125
3	Elective - III	3	2	25	100	-	125
4	Elective - IV	3	2	25	100	-	125
5	Mechanical Engineering Lab	-	2	25	-	-	125
6	Seminar	2	-	25	-	-	25
	Total	14	10	150	500		650

Electives:

Elective – I	1	Casting and Molding Technology
	2	Machine Tool Design
	3	Sheet Metal Engineering
	4	Plastic Processing Technology
	5	Advanced Tool Design
	6	Treatment of Material
	7	Processing of Advanced Materials

Elective – II	1	Management Information Systems
	2	Technology and Knowledge Management
	3	Manufacturing Planning and Control
	4	Concurrent Engineering
	5	Numerical Methods and Computational Techniques
	6	Hydraulic, Pneumatic and Fluidic Control
Elective – III	1	Manufacturing Automation
	2	Agile Manufacturing
	3	Sensors for Intelligent Manufacturing and Condition Monitoring
	4	Knowledge Based Systems in Manufacturing
	5	World Class Manufacturing
	6	Robotics
	7	Flexible Manufacturing System
Elective – IV	1	Design of Experiments
	2	Quality Control and Reliability
	3	Total Productive Maintenance
	4	Metrology and Computer Aided Inspection
	5	Maintenance Management
	6	Mechatronics

Part – III

Sr. No.	**SUBJECT**	**TEACHING Scheme**		**Examination**			**Total Marks**
		L	T/P	T/W	TP	ORAL	
1	In plant Training	-		50	-	-	50
2	Seminar - III	-	1		-	50	50
3	Desertation Phase – I	-	4	50	-	-	50
	Total	-	5	100	-	50	150

Part – IV

Sr. No.	**SUBJECT**	**TEACHING Scheme**		**Examination**			**Total Marks**
		L	T/P	T/W	TP	ORAL	
1	Desertation Phase – I	-	5	200	-	100	300
	Total	-	5	200	-	100	300

M. E. in Manufacturing Engineering (Semester-I)

Material Removal Processes

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 Term Work 25

Unit 1& 2

- Machine Tools and machining operation: Introduction, generating motions of machine tools, machines using single point tools, machines using multipoint tools, machines using abrasive wheels, summary of machine tool characteristics and machining equations.
- Mechanics of Metal Cutting: Introduction, terms and definitions, chip formation, forces acting on the cutting tool and their measurement, specific cutting energy, plowing force and the "size effect", The apparent mean shear strength of the work material, chip thickness, friction in metal cutting.
- Temperature in Metal Cutting: Heat generation in metal cutting, heat transfer in moving material, temperature distribution in metal cutting, The measurement of cutting temperatures.

Unit 3 & 4

- Tool life and tool Wear: Introduction, progressive tool wear, forms of wear in metal cutting, the tool material, the work material.
- Cutting Fluid and Surface roughness: Cutting fluids, the action of coolants, the action of lubricants, application of cutting fluids, surface roughness.
- Economics of Metal Cutting Operation: Introduction, choice of feed, choice of cutting speed, tool life for minimum cost and minimum production time, estimation of factors needed to determine optimum conditions, example off a constant-cutting-speed operation, machining at maximum efficiency, facing operations, operations with interrupted cuts, economics of various tool materials and tool designs, machinability data systems.

Unit 5 & 6

- Grinding: Introduction, The grinding wheel, effect of grinding conditions on wheel behavior, determination of the density of active grains, testing of grinding wheels, analysis of the grinding process, thermal effects in grinding, cutting fluids in grinding, grinding wheel wear, nonconventional grinding operations.
- Nonconventional Machining Processes: Introduction, range of nonconventional machining processes, ultrasonic machining, water-jet machining, abrasive-jet machining, chemical machining, electrochemical machining, electrolytic grinding, electrical discharge machining, wire electrical discharge machining, laser beam machining, plasma arc machining, comparative performance of cutting processes.
- Surface integrity: Effect of machining on surface/subsurface, various types of surface alterations, assessment of surface integrity, concept of engineered surfaces.

TEXTS/REFERENCES:

- G. Boothroyd and W.A. Knight, *Fundamentals of Maching and Machine Tools*, 2nd Edition, Mercell Dekker, New York, 1989.
- A. Ghosh and A.K. Mullick, *Manufacturing Science*, Affiliated East-West Press, 1985.
- J. McGeough, *Advanced Methods of Machining*, Chapman and Hall, London, 1988.

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M. E. in Manufacturing Engineering (Semester-I)

CNC & Adaptive Control

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks** **100**
Weekly Practical Hours: Pr. 02 Term Work 25

Course Contents

Unit 1
• Introduction to Numerical Control in computer aided manufacturing, components of a CNC system, types of CNC systems, open loop and closed loop control systems.

Unit 2
• Drives and controls, interpolators, feedback devices, CNC machine constructional features.

Unit 3
• CNC design considerations, CNC turret punch press, tooling for CNC, APC, ATC, CNC machine accessories, advanced features of CNC systems.

Unit 4
• CNC part programming for turning and milling, post processors, CNC part programming with CAD-CAM.

Unit 5
• Conversational and graphics based software, solids based part programming, free form surface machining, simulation and verification of CNC programs, computer assisted part programming.

Unit 6
• Adaptive CNC control techniques, integration of CNC machines for CIM, maintenance and installation of CNC systems, utilization of CNC machines.

TEXTS / REFERENCES:

• S.Krar , A.Gill., *CNC Technology and Programming*, McGraw-Hill Publishing Co., 1990.
• P. J. Amic, *Computer Numerical Control Programming*, Prentice Hall, 1996.
• K. J.Astrom, B.Wittenmark , *Adaptive Control* (2nd Ed.), Addison-Wesley, 1994.
• D.Gibbs, T.Crandell, *CNC: An Introduction to Machining and Part Programming*, Industrial Press, 1991.
• M. Lynch , *Computer Numerical Control for Machining*, McGraw-Hill, 1992.
• CNC Turning machines ACE MICROMATIC operation and programming manual.
• CNC Milling machine HASS operation and programming manual.

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M. E. in Manufacturing Engineering (Semester-I)

Advanced Joining Technology

Weekly Teaching Hours: Th. 03	**Marks for Examination:**	**Max. Marks**	**100**
Tutorial : 01		**Term Work**	**25**

Course Contents

Unit 1
• Introduction to metal joining processes, heat sources for joining of metals.

Unit 2
• Modern welding processes like EBW, LBW, USW, diffusion bonding etc.

Unit 3
• Pulsed current welding processes, welding of ceramics, plastics, composites, joint design and design of weldments.

Unit 4
• Metallurgy of welding, heat treatment, residual stresses and stress relief methods.

Unit 5
• Failure of welds, NDT of welds, inspection codes for weldments.

Unit 6
• Introduction to adhesive bonding, soldering and brazing.

TEXTS / REFERENCES:

• C. Howard, *Modern Welding Technology*, Prentice Hall, 1979.
• P. T.Houldcroft , *Welding Process Technology*, Cambrige University Press, 1985.
• M. M.Schwartz , *Metal Joining Manual*, McGraw Hill, NewYork, 1979.
• L. P.Connur , *Welding Handbook, Vol. 1 & 2*, American Welding Society, 1989, 1990.

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M. E. in Manufacturing Engineering (Semester-I)

Casting and Moulding Technology (Elective-I)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• Metal casting processes part and tool materials, foundry layout and equipment, patterns and cores.

Unit 2
• Melt flow: Flow in gating channels and mold cavity, fluidity, gating systems, flow analysis.

Unit 3
• Solidification: Heat transfer, shrinkage, feeding, growth structures, simulation, casting defects type: attributes, causes and remedies, inspection techniques, expert system.

Unit 4
• Plastics for molding types, chemical composition and structures, polymerization, synthesis techniques.

Unit 5
• Processing methods: calendaring, injection, compression, blow, extrusion and transfer molding, casting and reaction injection molding.

Unit 6
• Plastic flow in mold pressure and shear stress distribution, gating layout, cooling analysis, CAD/CAM for casting and molding: review of existing packages.

TEXTS / REFERENCES:

• R.W.Heine, C. R.Loper and P.C.Rosenthal, *Principles of Metal Casting*, McGraw Hill, Newyork, 1976.
• P. C.Mukherjee, *Fundamentals of Metal Casting Technology*, Oxford and IBH Publ. Co. 1979.
• J. H.Dubois And W. I.Pribble, *Plastics Mold Engineering Handbook*, Van Nostrand Reihnhold, New York, 1987.
• A. C.Street , *The Die Casting Book*, Portcullis Press Ltd., Surrey England, 1986.

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M. E. in Manufacturing Engineering (Semester-I)

Machine Tool Design (Elective-I)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1

• Introduction to metal cutting machine tools- criteria for the selection of operating capacity and design parameters, kinematics of machine tools.

Unit 2

• Basic principles of machine tool design, estimation of drive power, machine tool drives, electrical, mechanical and fluid drives, stepped and step less speed arrangements and systems.

Unit 3

• Design of machine tool spindles and bearings, design of power screws, design of slide ways, selective and preselective mechanisms.

Unit 4

• Machine tool structures-beds, columns, tables and supports, stock feed mechanism, Measurement and control of machine tools, protective and safety devices, design of precision machine tools.

Unit 5

• Micro-feeding mechanisms, concept of modular design and integration of SPM`s, Concepts of aesthetic and ergonomics applied to machine tools.

Unit 6

• Acceptance tests standardization of machine tools, machine tool conditioning, latest trends in machine tool design, introduction to CAD techniques.

TEXTS / REFERENCES:

• N. K.Mehta , *Machine tool design*, Tata Mcgraw-hill, New Delhi, 1989.
• N.Acherkan, *Machine tool design*, Vol. 3 and 4, Mir publisher, Moscow, 1968.
• A.Koenigsburger, *Design principles of metal cutting machine tools*, Pergamon press, 1964.
• C.M.T.I. Machine tool design course notes, C.M.T.I. Bangalore.
• G.Sen and A.Bhattacharya , *Principles of machine tools*, Vol. 2, NCB, Calcutta, 1973.

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M. E. in Manufacturing Engineering (Semester-I)

Sheet Metal Engineering (Elective-I)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• Production of high quality sheet metal and control of its properties during processing.

Unit 2
• Basic applications: shearing processes like blanking, piercing, and punching.

Unit 3
• Drawing processes like shallow and deep drawing of cylindrical and rectangular bodies forming and bending including estimation and control of spring back.

Unit 4
• Computer applications in sheet metal with particular reference to nesting, tool selection and process planning, die design with special reference to compound and progressive dies.

Unit 5
• Equipment for sheet metal working: mechanical and hydraulic presses, design features and force diagrams.

Unit 6
• Formability studies: forming limit diagrams, their creation and use, soft tool processes: hydro-forming analysis and applications.

TEXTS / REFERENCES:

• D. Eary and E. Reed, *Techniques of Press Working*, Prentice Hall, 1989.
• Die Design Handbook, ASTME, 1989.
• A. S. Deshpande, *Sheet Metal Engineering*, 1999.
• ASM Handbook (10th edition) Vol. 15 on Metal Forming, ASM Publication, Metals Park, Ohio, 1989.
• C. W.Hinman , *Press Working of Metals*, McGraw Hill, NY, 1980.
• J. A.Waller, *Press Tools and Press Work*, Porttoculis Press, 1978.

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M. E. in Manufacturing Engineering (Semester-I)

Plastic Processing Technology (Elective-I)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1

- Properties of polymers: Physical, chemical, electrical and mechanical properties of plastics, thermal properties- types of plastics, thermosets and elastomers.
- Additives, fillers and reinforcement materials, liquid crystal polymers, engineering and mechanical plastics.

Unit 2

- Design of products: selection of plastics based on product requirement-reinforcing methods, aesthetic design, Stress strain in plastic components, design limitations- CAD/CAM application in product design by modeling, mold flow analysis.

Unit 3

- Molding of components: design of moulds, selection of material mould design for compression, injection and blow molding.
- Design of runner gate nozzle and cores, transfer molding coloring, texturing, rotational molding and casing of thermosets plastic molding machine injection, compression and blow molding machines.

Unit 4

- Extrusion of plastics: Design of extrude screw-barrel break plate die profile design pooling and take off equipment, PPE, sheet and film manufacture, thermoforming and thermoforming processes, Packaging applications
- Machining and joining of plastics: Machining of plastics by turning, drilling, milling and cutting parameters.

Unit 5

- Bending and forming of plastic components, jigs used, joining of plastics-adhesives, Solvents-cements-elastomeric cements, thermosetting adhesives, hot gas welding, spin welding and induction welding
- Unconventional processing methods: ultrasonic welding, ultrasonic assembly, ultrasonic stacking, heat sealing, thermal heat sealing and dielectric sealing, testing and quality control: melt index test, spiral flow test, volume change test, differential scanning calorometry.

Unit 6

- Thermo gravimetric analysis, thermo mechanical analysis, radiography, liquid penetrates,acoustics, photo elastic stress analysis.
- Finishing and decoration of plastic products: surface appearance, surface modification, washing, solvent cleaning and etching, chemical etching, screen printing, ink printing, laser marking, dying embossing and surface texturing, grinding and polishing.

TEXTS / REFERENCES:

- W. J.Patton, *Plastic Technology: Theory design and Manufacture*, Tharaporwala and sons, 1981.
- Laszlosor, *Plastic mould and dies*,Van Nostrand,1981.
- V. Dominick ,V. Rosato, *Plastic processing, Data hand book*, Van Nostrrand, 1990.
- A. W.Birley , *Plastic Materials*, Leonard Hill 1982.
- S. S.Middleman , *Fundamental of polymer processing*, McGraw Hill 1977.
- Donstatus, *Plastic finishing and decorating*, Van Nostrand, 1986.
- Ronald, *Plastic product design*, Van Nostrand, 1970.

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M. E. in Manufacturing Engineering (Semester-I)

Advanced Tool Design (Elective-I)

Weekly Teaching Hours: Th. 03	**Marks for Examination:**	**Max. Marks**	**100**
Tutorial : 01		**Term Work**	**25**

Course Contents

Unit 1

• Influence of tooling on quality and productivity, requirement of tooling for flexible, small lot production with constraints on lead time.

Unit 2

• Jigs and fixtures: basic principles of locating, development of fixture using locating, clamping, indexing tool setting elements.

Unit 3

• Force analysis- standardization of elements, illustrative examples of machining, welding, assembly, and inspection fixtures.

Unit 4

• Design of special tooling (form cutters, broaches etc.) tooling for CNC, development of modular fixtures and tools, flexi tools, etc. innovative concepts like tooling or fragile parts, plastics for tooling etc.

Unit 5

• Manufacture and maintenance of tools, technology and management of a tool room, cost estimation and cost benefit analysis, CAD of tools: customization of CADD.

Unit 6

• Tool design software, parametric programming of tool libraries, mechanistic analysis, use of finite element methods, techniques for integration of part modeling, tool design and tool manufacture.

TEXTS / REFERENCES:

• Donaldson, Lecain &Gold, *Tool Design*, Tata McGraw-Hill, New Delhi, 1978.
• F. W.Wilson ,*Tool Engineers Handbook*, Tata McGraw-Hill, New Delhi, 1980.
• P. H.Joshi, *Jigs and Fixtures*, Tata McGraw-Hill, New Delhi, 1988.
• E. G.Hoffman , *Fundamentals of Tool Design*, S. M. E. Michigan, 1984.
• V.Korskov ,*Fundamentals of Fixtures Design*, Mir Publishers, Moscow, 1989.

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M. E. in Mechanical Engineering (Semester-I)

Treatment of Material (Elective-I)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• Surface engineering-concepts.

Unit 2
• Functional characteristics of surfaces-precision machining of surfaces.

Unit 3
• Applications-importance of surfaces chemistry.

Unit 4
• Basic thermal treatment of materials-carbonizing.

Unit 5
• Nitriding and surface hardening processes-ion treatment processes.

Unit 6
• Laser processing engineering materials-quality control concepts.

TEXTS / REFERENCES:
• V. Raghvan, *Physical Metallurgy: Principles and Practice*, Prentice Hall of India, 2001.
• ASM Handbook, Vol. 6(Surface cleaning, finishing and coating), ASM Publications, ASM, Metal Park, Ohio, 1996.
• K.G. Budinski, *Surface Engineering For Wear Resistance*, Prentice Hall, Englewood Cliffs, N. J., 1988.
• J. A.Murphy , *Surface Preparation and Finishes for Metals*, McGraw Hill, NY, 1971.

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M. E. in Manufacturing Engineering (Semester-I)

Processing of Advanced Materials (Elective-I)

Weekly Teaching Hours: Th. 03	**Marks for Examination:**	**Max. Marks**	**100**
Tutorial : 01		**Term Work**	**25**

Course Contents

Unit 1

• Advanced materials such as ceramics and glasses, polymers, composites, their properties and applications, non-ferrous alloys and their properties and applications, special alloys, shape memory alloys.

Unit 2

• Polymers and polymerization, structure and properties of thermoplastics and thermosets, engineering applications, property modifications, mechanical thermal behaviors, composites with polymer matrix, ceramics, glasses.

Unit 3

• Glass ceramics, fabrication methods, metal matrix and ceramic matrix composites, machining (traditional and non-traditional) of composite materials such as MMC, GFRP, nickel alloys, refractory metals, powder metallurgy materials.
• Processing of polymers, fabrication of composites, processing of ceramics, super plastic forming.

Unit 4

• Machining (traditional and non-traditional) of composite materials such as MMC, GFRP, nickel alloys, refractory metals, powder metallurgy materials.

Unit 5

• Processing of polymers, fabrication of composites, processing of ceramics, super plastic forming.
• Application of non-traditional machining processes such as EDM, USM, AJM, AFM, LBM, EBM.

Unit 6

• Plasma machining, high speed machining etc. to the above advanced materials with special emphasis on mechanism of material removal, characteristic features and applications in each case.
• Recent trends and future prospects.

TEXTS / REFERENCES:

• ASM Handbook, Vol. 16, Machining, 9th edition, ASM Publication, Metals Park, Ohio, 1988.
• Conference Proceedings on "Processing, Fabrication and Applications of Advanced Composites", Edited by K. Upadhya.
• J. S. Campbell, *"Principles of Manufacturing Materials and Processes"*, McGraw-Hill, New York.
• E. P.DeGarmo, *"Materials and processes in manufacturing"*, Collier MacMillan, New York.
• Zehev Tadmor,*"Principles of Polymer Processing"*, Wiley-Interscience Publications.
• Serope Kalpakjian and Steven R. Schmid, *"Manufacturing Engineering and Technology"*, Addison Wesley Longman (Singapur) Pvt. Ltd., India Branch.
• Ghosh, A., and Mallik , A.K.," Manufacturing Science", East -West Press Private Ltd.
• P.C. Pande, and H.S.Shah, *"Modern Machining Processes"*, Tata McGraw-Hill, New Delhi, 1980.

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M. E. in Manufacturing Engineering (Semester-I)

Management Information System (Elective-II)

Weekly Teaching Hours: Th. 03	**Marks for Examination:**	**Max. Marks**	**100**
Tutorial : 01		**Terw Work**	**25**

Course Contents

Unit 1
• Introduction, conceptual information system design.

Unit 2
• Detailed information system design, evolution of information systems.

Unit 3
• Information systems for decision-making.

Unit 4
• Strategic and project planning for management information system.

Unit 5
• Information technology and management information system.

Unit 6
• Pitfalls and solutions in MIS development.

TEXTS / REFERENCES:

• R.G.Murdick, J.E.Ross and J.R.Claggett, *Information Systems For Modern Management*, Prentice Hall Of India Pvt., 3rd Edition, 1992.
• C.Henry , Lucas Jr., *The Analysis, Design And Implementation Of Information Systems*, Mitchell Mcgraw Hill Co. 4th Edition, 1992.
• J. E.Burch, F. R.Starter and G.Grudnikski, *Information Systems: Theory And Practice*, John Wiley And Sons, New York, 1987.

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M. E. in Manufacturing Engineering (Semester-I)

Technology and Knowledge Management (Elective-II)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Marks** **100**
Tutorial : 01 **Term Work** **25**

Course Contents

Unit 1 & 2

- Introduction: Knowledge & necessity of Knowledge, KM's value proposition, behind the buzz, assumptions about your company.
- The Knowledge Edge: A common theme, intellectual capital, knowledge, market value, and prosperity, the 24 drivers of KM, knowledge centric drivers, technology drivers, organizational structure based, drivers, personnel focused drivers, process drivers, economic drivers, creating the knowledge edge.
- From Information to Knowledge: From data to information to knowledge, from data to knowledge, classifying knowledge, the three fundamental steps, knowledge management systems and existing technology, taming the tiger's tail, business and knowledge.

Unit 3 & 4

- The 10-Step Knowledge Management Road Map: The 10 step knowledge management road map, phase1: infrastructural evaluation, phase2: knowledge management system analysis, design, and development, phase3: deployment, phase4: matrices for performance evaluation.
- The Leveraged Infrastructure: The approach leverage, leverage , leverage, leveraging the internet, enabling technologies for the knowledge management, technology framework, knowledge server.
- Aligning Knowledge management and Business Strategy: From strategic programming to strategic planning, codification or personalization, knowledge maps to link knowledge to strategy, strategic imperatives for a successful km system, assessing focus.

Unit 5 & 6

- Infrastructural Foundations: Technology components of the km architecture, the seven-layer km system architecture, foundation for the interface layer, the web or notes?, collaborative intelligence and filtering layer, audit knowledge.
- Knowledge Audit and Analysis: Measuring knowledge growth, the knowledge audit team, choosing your company's k-spots, sources of expertise, team composition and selection criteria, team life span and sizing issues, the knowledge management project leader, the km team's project space, points of failure.
- Creating Knowledge Management Blueprint: Analyzing lost opportunities, the knowledge management architecture, components of a knowledge management system, designing integrative and interactive knowledge applications, interoperability considerations, performance and scalability, user interface design consideration, a network view of the km architecture, future-proofing the knowledge management system

TEXTS / REFERENCES:

- Amrit Tiwana, *The Knowledge Management Tool Kit*, Pearson Education Asia Pte. Ltd., 2000.
- T.H.Davenport and Laurence, Prusak, *Working Knowledge: How Organizations Manage what they Know*, Harvard Business School Press, Boston, 1998.
- I.Nonaka and H.Takeuchi, *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford University Press, New York, 1995.
- IGNOU, Technology Management, 6 booklets viz. Block I to VI, IGNOU Publication No. MS-94, 1997.
- J.B.Quinn, *Intelligent Enterprise: A Knowledge and Service-Based Paradigm for Industry*, Free Press, New York, 1992.
- Betz Frederic, *Strategic Technology Management*, McGraw Hill, Inc., New York, 1993.

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M. E. in Manufacturing Engineering (Semester-I)

Manufacturing Planning & Control (Elective-II)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• Overview of manufacturing systems and various issues of interest: assembly line, repetitive batch manufacturing.

Unit 2
• Cellular manufacturing, FMS, JIT, CIM, preplanning: forecasting, economic analysis, aggregate planning, capacity planning, inventory planning.

Unit 3
• Decision making in design of manufacturing systems: group technology, line balancing, plant layout.

Unit 4
• Operations planning: MRP, MRP II, hierarchical planning systems, JIT systems.

Unit 5
• FMS Operation and control: lot sizing decisions, production scheduling, line of balance.

Unit 6
• Quality planning and control, cost planning and control, Simulation analysis of manufacturing systems, case studies.

TEXTS / REFERENCES:

• D.D.Bedworth and J.E Bailey, *Integrated Production Control, System-management, Analysis and Design*, John Wiley, 1983.
• E. A.Elsayed and T.O.Boucher , *Analysis and Control of Production Systems,* Prentice Hall, 1985.
• J. R.King , *Production Planning and Control*, Pergamon Press, Oxford, 1975.
• P.F.Bestwick and K.Lockyer, *Quantitative Production Management*, Pitman Publications, 1982.
• A.C.Hax and D.Candea, *Production and Inventory Management*, Prentice-Hall, 1984
• M.G.Korgaokar, *JIT Manufacturing*, Macmillan, 1992.

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M. E. in Manufacturing Engineering (Semester-I)

Concurrent Engineering (Elective-II)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1

- Concurrent engineering: Introduction-principles-tradition Vs concurrent approach-schemes and tools of concurrent engineering-applications of computers in the practice of concurrent engineering, basic process issues- process models-types-importance.

Unit 2

- Relation between models specifications, technology, automation and process improvement, fabrication processes, assembly processes, models of manufacturing, testing and inspection, Concurrent engineering.

Unit 3

- Approach in manufacturing systems: System design procedure, features-intangibles-assembly resource alternatives-task assignment, tools and tool changing-material handling alternatives.

Unit 4

- Concurrent automated fabrication systems: Introduction-methodology-preliminary and detailed work content analysis, alternatives, human resource considerations, "Technical-Economic" performance evaluation concurrent.

Unit 5

- Assembly work station-strategic issues-technical issues-economic analysis, economic analysis of systems: types of manufacturing costs, proforma cash flow determining allowable investment, evaluation of investment alternatives.

Unit 6

- Sensitivity analysis, effect of recycling and rework, case studies of concurrent engineering practice: automobile air-conditioning module-robot assembly of automobile rear axles.

TEXTS / REFERENCES:

- J.L. Nevins and D.E.Whitney, *Concurrent design of products and processes*, McGraw Hill, 1989.
- D.D.Bedworth, M.R.Handerson, P.M.Wilze, *Computer Integrated Design and manufacturing*, Mcgraw Hill International Edition, 1991.

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M. E. in Manufacturing Engineering (Semester-I)

Numerical Methods and Computational Technique (Elective-II)

Weekly Teaching Hours: Th. 03	**Marks for Examination:**	**Max. Marks**	**100**
Tutorial : 01		**Term Work**	**25**

Course Contents

Unit 1

• Newton forward, backward; central difference, Gauss, Stirling, Bessel's numerical differentiation and integration.

Unit 2

• Solution of numerical algebraic, transcendental and simultaneous linear equations.

Unit 3

• Numerical solution of ordinary differential equation (ODE) and partial differential equation(PDE),computational Techniques.

Unit 4

• Types of Computer: Digital, analog and hybrid, organization of a digital computer system-CPU, memory, I/O devices, representation of numbers-integer and floating point arithmetic, round off errors and their propagation operations planning: MRP, MRP II, hierarchical planning systems, JIT systems.

Unit 5

• Introduction to Computer Languages: Machine language, assembly language., higher level languages, compilers and interpreters, problem solving using computers algorithm, flow chart. FORTRAN programming constants and variables, arithmetic expression, I/O statements, specification statement, control statements, subscripted variables, logical expression function and subroutines, examples of programming should include numerical as well as non numeric applications, matrix operations, searching. sorting (bubble).

• FMS Operation and Control: lot sizing decisions, production scheduling, line of balance.

Unit 6

• Iterative Techniques for Solution of Equations: Simple iteration scheme, Newton-Raphson method, secant method, their rates of convergence, order of errors, roots of polynomial equation, Gaussian elimination, Gauss-Siedel iteration; matrix inversion by Gaussian method, computation of determinant; polynomial approximation.

•Quality planning and control, cost planning and control, Simulation analysis of manufacturing systems, Case studies.

TEXTS / REFERENCES:

• V. Rajaram,*Computer Oriented Numerical Methods*, Prentice Hall of India. (Delhi).
• S.D. Conte, *Elementary Numerical Analysis*.
• S.S. Shastry, *Introductory Methods of Numerical Analysis*.
• M.G. Salve, *Numerical Methods in Engineering*.
• R.T.Fennes , *Computing for Engineering*.

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M. E. in Manufacturing Engineering (Semester-I)

Hydraulic, Pneumatic and Fluidic Control (Elective-II)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• Introduction to control system, types of control system and their utility.

Unit 2
• Hydraulic power generation and transmission, valve control pressure flow relationship and constructions.

Unit 3
• Steady state operating forces, transient forces and valve instability.

Unit 4
• Circuit design, pneumatic valves, hydraulic and pneumatic drives, introduction to fluidic devices and sensors.

Unit 5
• Lumped and distributed parameter fluid systems, fluid mechanics of jets, wall attachment and vortex devices.

Unit 6
• Pure fluidic analog amplifiers, analog signal control techniques, design of pure fluid digital elements.

TEXTS / REFERENCES:
• J.F.Blackburn, G.Rechthof, J.L. Shearer, *Fluid Power Control*, MIT.
• B.W.Anderson, *The Analysis and Design of Pneumatic Systems*, Wiley.
• K.Foster, G.Parker, *Fluidic Components and Circuits*, Wiley.
• A.B.Goodwin, *Fluid Power Systems*, Macmillan.

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M. E. in Manufacturing Engineering (Semester-II)

Metal Forming Process

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• Introduction to basic concepts, theory of plasticity, yield criteria (isotropic).

Unit 2
• Hot, cold, and warm working, bulk forming like rolling.

Unit 3
• Forging, extrusion and wire drawing, analytical techniques like upper bound equilibrium (slab).

Unit 4
• Slip line field analysis, forming tools, tools and dies for forging.

Unit 5
• Design of rolls for forging, design of rolls for rolling, extrusion dies.

Unit 6
• Latest trends: forming from mashy stage, isothermal forging, near-net-shape manufacturing.

TEXTS / REFERENCES:

• K.Lange, *Handbook of Metal Forming*, McGraw Hill, 1985.
• A. M.Sabaroff , *Forging material and Practices*, Reinhold Publishers, 1982.
• C.Pearson , *Extrusion of Metals*, Wiley, NewYork, 1980.
• G.W.Rowe, *Manufacturing Technology*, Vol. I & Vol. II, Ellis Horwood, Chichester, John Willy, New York, 1987.

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M. E. in Manufacturing Engineering (Semester-I)

Finite Element Method (Elective-II)

Weekly Teaching Hours: Th. 03		**Marks for Examination:**		**Max. Marks**	**100**
Tutorial	**: 01**			**Term Work**	**25**

Course Contents

Unit 1

• **1-D Problems:** Introduction to structural analysis and FEM, Introduction to approximate solutions and FEM, summary of linear elastic mechanics.

Unit 2

• **1-D Problems:** Principles of linear elastic mechanics, principles of virtual displacements and minimum potential energy, Rayleigh Ritz method, exact v/s approximate solution, beam elements.

Unit 3

• **2-D Problems:** Plane stress and plane strain conditions, triangular elements, constant strain triangle, linear strain triangle, Boundary conditions, body forces and stress recovery, quadrilateral elements.

Unit 4

• **2-D Problems:** Lagrange and Serendipity shape functions, isoparametric formulation, numerical integration, modeling with isoparametric elements, requirements for convergence, patch test, nonconforming elements, reduced integration.

Unit 5

• **3-D Problems:** Axisymmetric solids, governing equations, axisymmetric elements and their applications, mixed formulations, bending of flat plates (Kirchhoff Theory), continuity requirements and boundary conditions.

Unit 6

• **3-D Problems:** Discrete Kirchhoff's elements, thick plate elements, plate bending applications, shells as assemblage of flat plates, finite element formulation for dynamic problems, mass properties, introduction to elastic stability for frames and plates.

TEXTS / REFERENCES:

• R. D. Cook, *"Concepts and Applications of Finite Element Analysis"*, John Wiley and Sons, second edition, 1981.
• C.S. Krishnamurti, *"Finite element method"*, Tata Mc-Graw Hill Publication.
• K.J. Bathe, *"Finite Element Method and Procedures"*, Prentice hall, 1996.
• Tirupathi, R., and Chandrupatla, *"Finite Elements in Engineering"*, PHI Publication, New Delhi.
• Bruce Irons and Soharab Ahmed, *"Techniques of Finite Elements"*, John Wiley and Sons, New York.
• K.J. Bathe, *"Finite Element Method"*, Prentice Hall, 1987.
• O.P., Goptha, *"Finite and Boundary Element Methods in Engineering"*, Oxford and IBH.

M. E. in Manufacturing Engineering (Semester-II)

Manufacturing Automation (Elective-III)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• Product cycle, manufacturing functions, types of automation, degree of automation, technical, economic and human factors in automation.

Unit 2
• Technologies- mechanical, electrical, hydraulic, pneumatic, electronic, hybrid systems,comparative evaluation.

Unit 3
• Development of small automation systems using mechanical devices, synthesis of hydraulic circuits.

Unit 4
• Circuit optimization techniques, illustrative examples of the above types of systems.

Unit 5
• Industrial logic control systems logic diagramming, programmable controllers.

Unit 6
• Applications, designing for automation, cost-benefit analysis.

TEXTS / REFERENCES:

• A.N.Gavrilov, *Automation and Mechanization of Production Processes in Instrument Industry*, Pergaman Press, Oxford, 1967.
• G.Pippengerm, *Industrial Hydraulics*, MGH, New York, 1979.
• F.Kay , *Pneumatics for Industry*, The Machining Publishing Co., London,1969.
• A. Ray, *Robots and Manufacturing Assembly*, Marcel Dekker, New York, 1982.

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M. E. in Manufacturing Engineering (Semester-II)

Agile Manufacturing (Elective-III)

Weekly Teaching Hours: Th. 03		**Marks for Examination:**	**Max. Marks**	**100**
Tutorial	**: 01**		**Term Work**	**25**

Course Contents

Unit 1
• Agile production systems.

Unit 2
• Agile practices for product development, manufacturing agile practices.

Unit 3
• Building products quickly with agile manufacturing.

Unit 4
• Implementing technology to enhance agility.

Unit 5
• Creating the learning factory, agile product development for mass customization.

Unit 6
• Management in the agile organization.

TEXTS / REFERENCES:

• J.C.Montogomery, L.O.Levine(ed), *The transition to agile manufacturing-staying flexible for competitive advantage*, ASQC Quality Press, Milwaukee, Wisconsin, USA.
• M.David, B.Anderson, J.Pine, *Agile Product Development for Mass Customisation*, Irwin Professional Publishing, Chicago, USA, 1997.

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M.E. in Manufacturing Engineering (Semester-II)

Sensors for Intelligent Manufacturing & Condition Monitoring (Elective-III)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• Introduction-role of sensors in manufacturing automation.

Unit 2
• Principles of different sensors, electrical, optical, acoustic, pneumatic, magnetic, electro-optical and vision sensors.

Unit 3
• Condition monitoring of manufacturing systems: principles, sensors for monitoring force, vibration and noise.

Unit 4
• Selection of sensors and monitoring techniques, acoustic emission: principles and applications, concepts of pattern recognition.

Unit 5
• Sensors for CNC machine tools: linear and angular position and velocity sensors, Automatic identification techniques for shop floor control.

Unit 6
• Bar code scanners, radio frequency systems, optical character and machine vision sensors, smart/intelligent sensors, integrated sensors, adaptive control of machine tools.

TEXTS / REFERENCES:

• D.M.Considiene, G.D.Considine, *Standard Handbook of Industrial Automation*, Chapman and Hall, 1975.
• *Tool and Manufacturing Engineers Handbook*, Tata McGraw-Hill, SME, Vol. I, II, III, IV, 1985.
• S. D.Murphy , *In-process Measurement and Control*, Marcel Dekker, 1983.
• S.Soloman, *Sensors and Control systems in Manufacturing*, McGraw Hill International Editions, USA, 1987.
• N.Zuech , *Applying Machine Vision*, Wiley International, 1991.

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M. E. in Manufacturing Engineering (Semester-II)

Knowledge Based Systems in Manufacturing (Elective-III)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• Introduction, development of databases and knowledge bases.

Unit 2
• Knowledge representing paradigms-rule based, logic based, object oriented, semantic nets and frames.

Unit 3
• Uncertainty, fuzzy logic, neural nets, inference mechanisms: goals, control strategies, forward and backward chaining.

Unit 4
• Conflict resolution, explanation, blackboard model, implementation issues: knowledge acquisition.

Unit 5
• Coding, expert system shells, PROLOG and LISP, Selected applications in manufacturing, product design.

Unit 6
• Process planning and scheduling, robot movement, factory layout, defect analysis, diagnostic maintenance, quality control, etc.

TEXTS / REFERENCES:

• R.Kerr, *Knowledge Based Manufacturing Management*, Addison-Wesley, 1991.
• T. R.Addis, *Designing Knowledge Based Systems*, Prentice Hall, 1985.
• D.W.Rolston, *Principles of Artificial Intelligence and Expert Systems Development*, McGraw Hill, 1988.
• R.Maus & J.Keyes, *Handbook of Expert Systems in Manufacturing*, McGraw Hill, 1991.

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M. E. in Manufacturing Engineering (Semester-II)

World Class Manufacturing (Elective-III)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• The world class manufacturing challenge.

Unit 2
• Developing a world-class manufacturing strategy, just-in-time.

Unit 3
• Total quality, total employee involvement.

Unit 4
• World-class information systems, managing the change.

Unit 5
• Methods and procedures, improved brain storming methods, using the check-total quality.

Unit 6
• The first steps, getting people involved, monitoring world-class performance.

TEXTS / REFERENCES:

• Gunn, G.Thomas, *Manufacturing for Competitive Advantage- Becoming a World Class Manufacturer*, Cambrige, MA: Ballinger, 1987.
• K.Suzaki , *The New Manufacturing Challenge: Techniques for Continuous Improvement*, New York, Free Press, 1987.
• T.Ohno, *Toyoto Production System*, Columbus, OH, Diamond Publishing, 1978.
• T.C E.Cheng and S. Podolsky, *Just-in-Time Manufacturing: An Introduction*, Chapman and Hall, 1996.
• Y.Monden, *Toyota Production System: An Integrated Approach to Just-in-Time*, Institute of Industrial Engineers, 1998.
• H.Mather, *Competitive Manufacturing*, CRC Press, 1998.

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M. E. in Manufacturing Engineering (Semester-II)

Robotics (Elective-III)

Weekly Teaching Hours: Th. 03			**Marks for Examination:**	**Max. Marks**	**100**
Tutorial	**:**	**01**		**Term Work**	**25**

Course Contents

Unit 1

• Introduction, construction of manipulators, advantages and disadvantages of various kinematic structures.

Unit 2

• Applications, actuators, pneumatic, hydraulic and electric, characteristics and control, non servo robots.

Unit 3

• Motion planning; feed back systems, encoders, servo control PTP and CP, Kinematics.

Unit 4

• Homogeneous so ordinates, solution of the inverse kinematic problem, multiple solutions, Jacobian, work envelopes, trajectory planning.

Unit 5

• Manipulator dynamics and force control, sensors: vision, ranging, laser, acoustic, tactile, developments in sensor technology.

Unit 6

• Sensory control, programming language: VAL, RAIL, AML. Mobile robots, walking robots, walking devices, robot reasoning.

TEXTS / REFERENCES:

• K. S. Fu, R. C. Gonzalez, C. S. G. Lee, *Robotics*, McGraw Hill New york, 1987.
• Y. Koren, *Robotics for Engineers*, McGraw Hill, 1985.
• J. J. Craig, *Robotics*, Addison-Wesley, 1986.

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M. E. in Manufacturing Engineering (Semester-II)

Flexible Manufacturing System (Elective-III)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• An overview, need for FMS, classification, benefits and limitations, FMC Vs FMS.

Unit 2
• FM system development and implementation of an FMS, planning, description, layout and configuration.

Unit 3
• Concepts of distributed numerical control, programmable controllers hardware configurations, FMS software, FMS instillation.

Unit 4
• Modeling, simulation and analysis of FMS design, Scheduling and loading of FMS, network, Economic considerations.

Unit 5
• Automated material handling and storage, automated storage, auxiliary support equipment.

Unit 6
• FMS fixtures, tool management, tool strategies, tool monitoring and fault detection.

TEXTS / REFERENCES:

• D.J.Parish, *Flexible Manufacturing Systems*, Butter Worth-Heinemann Ltd., Oxford, 1993.
• M.P.Groover, *Automation, Production Systems and Computer Integrated Manufacturing*, Prentice Hall of India Ltd., 1989.
• A.Kusiak, *Intelligent Manufacturing Systems*, Prentice Hall, Englewood Cliffs, New Jercy, 1990.
• D.M.Considine, G.D.Considine, *Standard Handbook of Industrial Automation*, Chapman and Hall, London, 1986.
• N.Viswanadhan, Y.Narhari, *Performance Modeling of Automated Manufacturing Systems*, Prentice Hall of India Ltd., 1992.
• P.G.Ranky , *The Design and Operation of FMS*, IFS Publishers. UK, 1988.
• W.W.Luggen , *Flexible Manufacturing Cells and Systems*, Prentice Hall, Eaglewood Chiffs, New Jercy, 1991.

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M. E. in Manufacturing Engineering (Semester-II)

Design of Experiments (Elective-IV)

Weekly Teaching Hours: Th. 03		**Marks for Examination:**	**Max. Marks**	**100**
Tutorial	**: 01**		**Term Work**	**25**

Course Contents

Unit 1& 2

- Introduction: Modern quality control, quality in engineering design, history of quality engineering.
- The Taguchi Approach to quality: Definition of quality, loss function, off-line and on-line quality control, Taguchi`s quality philosophy.
- Full Factorial Designs: Experimentation as learning process, traditional scientific experiments, three factor design, replicating experiments, factor interactions, normal plots of estimated effects, mechanical plating experiments, two factor design, four factor design, Taguchi design and western design.

Unit 3& 4

- Fractional Factorial Design: Fractional factorial design based on eight run experiments, folding over an eight run experimental design, Fractional factorial design in sixteen run, folding over an sixteen run experimental design, blocking two level designs, other two level designs.
- Evaluating Variability: Necessity to analyze variability, measures of variability, the normal distribution, using two level designs to minimize variability, signal-to-noise ratio, minimizing variability and optimizing averages.
- Taguchi Inner and Arrays: Noise factors, experimental designs for control and noise factors, examples.

Unit 5& 6

- Experimental Design for Factors at Three and Four level: Necessity to use more than twolevel, factors at four levels, factors at three levels.
- Analysis of Variance in Engineering Design: Hypothesis testing concepts, using estimated effects as test statistics, analysis of variance for two level designs, when to use analysis of variance.
- Computer Software for Experimental Design: Role of computer software in experimental design, summery of statistical packages, example of use of software packages.
- Using Experiments to improve Processes: Engineering design and quality improvement, steps to implementing use of engineering design.

TEXTS / REFERENCES:

- D.C.Montgomery, *Design and Analysis of Experiments*, 5th Edition, John Wiley and Sons, NewYork, 2004.
- R.H.Lochner and J.E.Matar, *Designing for Quality: An Introduction to the Best of Taguchi and Western Methods of Statistical Experimental Design*, Chapman and Hall, London, 1983.

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M.E. in Manufacturing Engineering (Semester-II)

Quality Control and Reliability (Elective-IV)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1 & 2

- Introduction: New culture of TQM, TQM axioms, consequences of total quality managing, cost of total quality, valuable tools for quality, the Japanese factor.
- The Deming Approach to management: Historical background, Deming's fourteen points for management, deadly sins & diseases, implementing the Deming's philosophy, Deming on management.
- Juran on Quality: Developing a habit of quality, Juran`s quality trilogy, the universal breakthrough sequence, Juran Vs Deming.
- Crosby & the Quality Treatment: Crosby diagnosis of a troubled company, Crosby's quality vaccine, Crosby's absolutes for quality management, Crosby's fourteen steps for quality improvement.
- Imai`s Kaizen: The concept, Kaizen & innovation, the Kaizen management practices, Kaizen & Deming.

Unit 3 & 4

- Basic Techniques for Statistical Analysis: Introduction, measures of central tendency & dispersion, confidence intervals, hypothesis testing, frequency distributions & histograms, probability distributions, measuring linear associations.
- Design & Analysis of Experiments: Introductions, factorial experiments, aliasing, constructing fractional designs, analysis of variance.
- Supporting of Quality Improvement Processes: Affinity diagram, bar chart, block diagram brain storming, cause and effect analysis, control charts, cost benefit analysis, customer-supplier relationship check list, decision analysis, flow charts, force field analysis, line graph/run charts, pareto analysis, quality costing, quality function development (QFD), quality project approach & problem solving process, risk analysis scatter diagrams, Weibull analysis.

Unit 5 & 6

- Statistical Process Control: Introduction, data collection plan, variables charts, attributes, interpreting the control charts.
- Taguchi's Approach to Experimental Design & Offline Quality Control: Introduction, background to the method, Taguchi's recommended design techniques, from Deming to Taguchi & vice-versa.
- Reliability: Introduction, life cycle curves & probability distribution in modeling reliability, system reliability, operating characteristic curves, reliability and life testing plans.

TEXTS / REFERENCES:

- N.Logothetis, *Managing for Total Quality From Deming to Taguchi and SPC* , Prentice Hall of India, New Delhi, 2005.
- R.F.Lochner & J.E.Matar, *Designing for Quality*, Chapman & Hall, 2001.
- A.Mitra , *Fundamental of Quality Control & Improvement* , Prentice Hall of India, New Delhi, 2nd edition, 2003.
- A. Zaidi, *SPC:Concepts, Methodologies and Tools*, Prentice Hall of India, New Delhi, 1995.

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M. E. in Manufacturing Engineering (Semester-II)

Total Productive Maintenance (Elective-IV)

Weekly Teaching Hours: Th. 03	**Marks for Examination:**	**Max. Marks**	**100**
Tutorial : 01		**Term Work**	**25**

Course Contents

Unit 1
• Outline of TPM.

Unit 2
• TPM-challenging limits, maximizing equipment effectiveness.

Unit 3
• Organizing for TPM implementation.

Unit 4
• TPM implementation and stabilization.

Unit 5
• TPM small group activities.

Unit 6
• The PM prize for outstanding TPM plants.

TEXTS / REFERENCES:

• Nahchi-Fujikoshi Corporation, *Training For TPM*, Japan Institute of Plant Maintenance, 1990.
• S.Nakajjima, *Introduction To TPM, The Purtor Factory*, Japan Institute of Plant Maintenance, 1986.
• S. Nakajima, *TPM Nyumon*, The Japan Institute of Plant Maintenance, 1989.
• S.Nakajima, *TPM Maintenance Prevention Design Productivity*, Press Inc. First Indian Edition, 1993.
• K.Shirose, Y.Kimura, and M.Kaneda, *An Advanced Step In TPM Implementation*, Japan Institute Of Plant Maintenance, 1990, 1995.

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M. E. in Manufacturing Engineering (Semester-II)

Metrology and Computer Aided Inspection (Elective-IV)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• Metrological concepts, Abbe's principle, need for high precision measurements, problems associated with high precision measurements.

Unit 2
• Standards for length measurement, shop floor standards and their calibration, light interference, method of coincidence.

Unit 3
• Slip gauge calibration, measurement errors, various tolerances, and their specifications, gauging principles.

Unit 4
• Selective assembly, comparators, angular measurements, principles and instruments, gear and thread measurements.

Unit 5
• Surface and form metrology, computer aided metrology, principles and interfacing, software metrology, laser metrology, CMM, types, probes used applications.

Unit 6
• Non-contact CMM using electro-optical sensors for dimensional metrology, non-contact sensors for surface finish measurements, image processing and its applications in metrology.

TEXTS / REFERENCES:

• D.J.Whitehouse, *Handbook of Surface Metrology*, Inst. of Physics Bristol and Philadelphia, 1994.
• R.K.Jain, *Engineering Metrology*, Khanna Publishers, 2000.
• Galleyer and Shotbolt, *Metrology for Engineers*, ELBS, 1998.

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M. E. in Manufacturing Engineering (Semester-II)

Maintenance Management (Elective-IV)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1
• Introduction, failure analysis.

Unit 2
• Classification of maintenance systems.

Unit 3
• Decision models for maintenance planning.

Unit 4
• Spare planning and control, manpower planning.

Unit 5
• Economical and operational aspects.

Unit 6
• Cost management for maintenance, other relevant topics.

TEXTS / REFERENCES:

• L.T.Higgins and L.C.Morrow, *Maintenance Engineering Handbook*, McGraw Hill, 1988.
• A.Kelly and M.J.Harris , *Management of Industrial Maintenance*, Newness-Butterworths, London, 1978.
• A. K.Jarding , *Operations Research in Maintenance*, Manchestor University Press, 1970.
• J.W.Foster, D.T.Phillips and T.R.Rogers, *Reliability, Availability and Maintainability*, M/A Press, 1981.
• J.E.Heintzelman , *The Complete Handbook of Maintenance Management*, Prentice Hall,1976.

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M.E. in Manufacturing Engineering (Semester-II)

Mechatronics (Elective-IV)

Weekly Teaching Hours: Th. 03 **Marks for Examination:** **Max. Marks 100**
Tutorial : 01 **Term Work 25**

Course Contents

Unit 1

• Introduction - Definition of mechanical systems, philosophy and approach, embedded microprocessor systems-hardware structure, software design and communication, programmable logic devices.

Unit 2

• Application specific ICs, automatic control and real time control systems, fuzzy logic control, systems and design- mechatronic approach, integrated product design, modeling analysis, simulation.

Unit 3

• Man machine interface, Sensors and transducer- classification and developments in transducer technology-semiconductors-thick and thin films elements, signal processing and opto-electronics-shaft encoders CD sensors.

Unit 4

• Optical probe for, vision systems etc. drive and actuators-hydraulic and pneumatic drives, electrical actuators such as servo motor and stepper motor-drive circuits, pen and closed loop control system.

Unit 5

• Piezoelectric and magnetostructive actuators-materials static and dynamic characteristics illustrative examples for positioning, vibration isolation etc. micromechatronic systems-micro sensors, micro actuators smart instrumentation.

Unit 6

• Micro-fabrication techniques-lithography, etching, micro joining etc application examples. Case studies- Examples of mechatronic systems from robotics, manufacturing, machine diagnosis, road vehicles and medical technology.

TEXTS / REFERENCES:

• HMT Limited, *Mechatronics*, Tata McGraw-Hill, 1998.
• V.D.Hunt, *Mechatronics: Japan's Newest Threat*, Chapman and Hall, London, 1988.

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M. E. in Manufacturing Engineering (Semester-II)

Manufacturing Engineering Laboratory

Weekly Teaching Hours: Pract. 02 **Marks for Examination:** Viva-25

Course Contents

- An overview of manufacturing automation.
- Development of process plans for prismatic and shaft type of components and demo of CAPP, shop floor scheduling software's.
- Use of statistical quality control software for process control.
- Use of EDM for metal machining.
- Metal casting simulation using PROCAST.
- Sequencing of cylinders using pneumatic trainer kit.
- Finite element analysis.
- Modeling of component and determination of mass properties.
- Inspection using CMM.
- Simulation of robots.

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