

ANNA UNIVERSITY TIRUCHIRAPPALLI**Tiruchirappalli – 620 024****Regulations 2008****Curriculum****M.E. MANUFACTURING ENGINEERING****SEMESTER I**

S. No.	Subject Code	Subject	L	T	P	C
Theory						
1	MA5143	Engineering Statistics and Probability	3	1	0	4
2	MF5102	Computer Aided Metrology and Inspection	3	0	0	3
3	MF5103	Computer Aided Product Design	3	0	0	3
4	MF5104	Precision Engineering	3	0	0	3
5	E1****	Elective I	3	0	0	3
6	E2****	Elective II	3	0	0	3
Total						19

SEMESTER II

S. No.	Subject Code	Subject	L	T	P	C
Theory						
1	MF5151	Advanced Material Technology	3	0	0	3
2	MF5152	Computer Integrated Manufacturing	3	1	0	4
3	MF5153	Industrial Robotics	3	0	0	3
4	MF5154	Mechatronics	3	1	0	4
5	MF5155	Metal Cutting Theory and Practice	3	0	0	3
6	E3****	Elective III	3	0	0	3
Total						20

SEMESTER III

S. No.	Subject Code.	Subject	L	T	P	C
Theory						
1	E4****	Elective IV	3	0	0	3
2	E5****	Elective V	3	0	0	3
3	E6****	Elective VI	3	0	0	3
Practical						
4	MF5251	Project Work Phase I	0	0	12	6
Total						15

SEMESTER IV

S. No.	Subject Code	Subject	L	T	P	C
Practical						
1	MF5251	Project Wok Phase II	0	0	24	12
Total						12

Total Credits to be Earned for the Award of the Degree = 66

ELECTIVES

S. No.	Subject Code	Subject	L	T	P	C
Theory						
1	MF5001	Fluid Power Automation	3	0	0	3
2	MF5002	Instrumentation and Control	3	0	0	3
3	MF5003	Design for Manufacture	3	0	0	3
4	MF5004	Metal Forming Theory and Practice	3	0	0	3
5	MF5005	Advances in Casting and Welding	3	0	0	3
6	MF5006	Total Quality Management	3	0	0	3
7	MF5007	Maintenance and Reliability Engineering	3	0	0	3
8	MF5051	Systems and Simulation	3	0	0	3
9	MF5052	Diagnostic Techniques	3	0	0	3
10	MF5053	Image Processing in Manufacturing	3	0	0	3
11	MF5011	Advances in CNC Systems	3	0	0	3
12	MF5012	Special Purpose Machine Tools	3	0	0	3
13	MF5013	Manufacturing System Design	3	0	0	3
14	MF5014	Human Factors in Engineering	3	0	0	3
15	MF5015	Engineering Economics and Financial Management	3	0	0	3
16	MF5016	Purchasing and Material Management	3	0	0	3
17	MF5017	Advances in Production Management	3	0	0	3
18	MF5018	Integrated Product and Process Development	3	0	0	3

MF5102 – COMPUTER AIDED METROLOGY AND INSPECTION

L	T	P	C
3	0	0	3

UNIT I LASER METROLOGY 8

LASER light source – LASER interferometer – LASER alignment telescope – LASER micrometer – on-line and in-process measurements of diameter and surface roughness using LASER – Micro holes and topography measurements – Straightness, flatness and roundness measurements.

UNIT II CO-ORDINATE MEASURING MACHINES 10

Coordinate measuring machines – Accessory elements – CMM software – Performance evaluations – Environmental control – Accuracy enhancement – Applications of CMM.

UNIT III OPTO ELECTRONIC MEASUREMENT SYSTEMS 10

Opto electronic devices contact and non contact types – Applications in on-line and in-process monitoring systems – Tool wear measurement – Manufacturing metrology – 3D Surface roughness – Pattern generation studies.

UNIT IV IMAGE PROCESSING 10

Shape identification – Edge detection Techniques – Normalisation – Grey scale correlation – Template Techniques – Surface roughness using vision system – Interfacing robot and image processing system – Measurement of length and diameters.

UNIT V COMPUTER INTEGRATED INSPECTION 7

Statistical evaluation of data using computer – data integration of CMM and data logging in computers.

Total: 45

REFERENCES

1. WATSON .J, "Optoelectronics", Van Nostrand Rein hold (UK)Co ltd.,1988
2. ROBERT.G. SEIPPEL, "Optoelectronics for technology and engineering", Prentice Hall,1989
3. ULRICH-REMBOLD, ARMBRUSTER AND ULZMANN, "Interface Technology for Computer Controlled Manufacturing Processes", Marcel Dekker Publication, 1993
4. THOMAS.G.G., "Engineering Metrology", Butterworth Publication, 1974.

MF5103 – COMPUTER AIDED PRODUCT DESIGN

L	T	P	C
3	0	0	3

UNIT I PRODUCT DEVELOPMENT PROCESS 8

Integrated Product development process – concurrent engineering – work structuring and team Deployment – Product and process systemization – problem, identification and solving methodologies.

UNIT II PRODUCT MODELLING 10

Product Modeling – Definition of concepts – Fundamental issues – Role of Process chains and product models –Types of product models – model standardization effort – types of process chains – Industrial demands.

UNIT III FRAMEWORKS AND ARCHITECTURES 10

Introduction – General Architecture – Distributed computing – Work group computing – PIM – Computational Architecture – Standards – Generic concurrent engineering development environment.

UNIT IV TYPES OF ANALYSIS TOOLS 10

Design for manufacturability – machining – casting and metal forming – optimum design – Design for assembly and disassembly – probabilistic design concepts – FMEA – QFD – Taguchi Method for design of experiments – Design for product life cycle.

UNIT V RECENT ADVANCES 7

Intelligent Information Systems – Knowledge based product and process models – Applications of soft computing in product development process – Advanced database design for integrated manufacturing – Use of STEP standards in CIM – Design for manufacturability – casting, forming, welding and machining.

L: 45 T:15 Total: 60

REFERENCES

1. BIREN PRASAD, "Concurrent Engineering Fundamentals Vol II", Prentice Hall, 1997.
2. KARL T.ULRICH, STEPHEN D.EPPINGER, "Product Design and Development", McGraw Hill, 1994.
3. DONALD E. CARTER, "Concurrent Engineering", Addison Wesley, 1992.
4. JAMES G. BRALLA, "Handbook of Product Design for Manufacturing", McGraw Hill, 1986.

MF5151 – ADVANCED MATERIALS TECHNOLOGY

L	T	P	C
3	0	0	3

UNIT I REVIEW OF MECHANICAL BEHAVIOUR OF MATERIALS 9

Plastic deformation in poly phase alloys – Strengthening mechanisms – Griffith's theory of failure modes – Brittle and ductile fractures – Damping properties of materials – fracture toughness – Initiation and propagation of fatigue cracks – Creep mechanisms – Hydrogen embrittlement of metals.

UNIT II SURFACE MODIFICATION OF MATERIALS 9

Mechanical surface treatment and coating – Case hardening and hard facing – thermal spraying – vapour deposition – ion implantation – Diffusion coating – Electroplating and Electroforming – Conversion coating – Ceramic and organic coatings – Diamond coating – Advanced surface modification of steels.

UNIT III ADVANCED HEAT TREATMENT OF MATERIALS 9

Unconventional surface hardening techniques – Heat treatment of critical mechanical elements like gears tools, dies, springs, shafts – Heat treatment of Al, Cu, Ni and Ti alloys – Polymer quenchants.

UNIT IV MODERN MATERIALS AND ALLOYS 9

Super alloys – Refractory materials – Ceramics and their applications – Low melting alloys – shape memory alloys – Metal matrix and ceramic matrix composites

UNIT V APPLICATIONS OF ADVANCED MATERIALS 9

Ti and Ni based alloys for gas turbine applications – Maraging and Cryogenic steels – Newer materials and their treatment for automobile applications – Materials for Aerospace, Marine and nuclear systems.

Total: 45

REFERENCES

1. Dowling, "Mechanical Behaviour of Materials, Engineering Methods of Determination, Fracture", McGraw Hill, 1999
2. P. Rama Rao, "Advances in Materials and their Applications", Wiley Eastern Ltd., 1993
3. Serope Kalpakjian, "Manufacturing Engineering and Technology" Third Edition, Addison Wisley Publishing co., 1995
4. Kenneth G. Budinski, "Surface Engineering for Wear Resistance", Prentice Hall, 1988.
5. D.R. Gabe, "Principles of Metal Surface Treatment and Protection", Pergamon Press, 1978.
6. Dieter, "Mechanical Metallurgy", McGraw Hill, 1989.
7. Dieter, "Engineering Design, A materials and Processing Approach", Third Edition, McGraw Hill, 1999.

MF5152 – COMPUTER INTEGRATED MANUFACTURING

L	T	P	C
3	1	0	4

UNIT I MANUFACTURING TECHNOLOGY 8

Overview – current themes in manufacturing – design – manufacture interface – overview of process planning technique.

UNIT II PRODUCTION PLANNING AND CONTROL 10

Discrete parts manufacturing – topology in manufacturing classification of FMS decision Lean production – BPR Master Production scheduling – Requirements Planning – JIT.

UNIT III GROUP TECHNOLOGY AND PROCESS PLANNING 10

Part families, classification and coding-type of codification – case study – computer aided process planning – retrieval and generative

UNIT IV FLEXIBLE MANUFACTURING SYSTEMS 10

Need classification – Integration – Interface – Software for FMS – Production flow analysis – flexible material handling – Petri network – applications.

UNIT V MANUFACTURING SIMULATION 7

Simulation language – type of software package – Simulation process – FIST codes – Case study

L: 45 T:15 Total: 60

REFERENCES

1. Chris McMohan and Jimmi Brown, "CAD CAM", Addison Wiley, 2000.
2. Donatas tijunela & Kirth E. Mckee, "Manufacturing High Tech Handbook", 2000.
3. Narahari and Viswanadham, "Performance Modelling and Analysis of Automated Manufacturing systems", Prentice Hall, 1998.

MF5153 – INDUSTRIAL ROBOTICS

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 8

Fundamentals of Robotics – Classification – Overview of drives, Sensors, grippers and manipulators – selection of robot

UNIT II MODELLING OF ROBOT MANIPULATOR 12

Kinematics – Differential Kinematics and static – dynamics – Trajectory planning – motion control – interaction control – Rigid body mechanics

UNIT III CONTROL IN ROBOTS 10

Actuators and Sensors – Fundamentals in electronic control – Instrumentation – feedback control – Robot arm control architecture of control – interfacing

UNIT IV PROGRAMMING OF ROBOTS & VISION SYSTEMS 10

Types – Selection of procedure – Case study of differential methods – Vision system – Robot intelligence – task planning.

UNIT V APPLICATION OF ROBOTICS 5

Application of robotics in machine shop – assembly – automation – tele operated robot – MHS – Processing operation.

Total: 45

REFERENCES

1. Lorenzo Scravico, “Modelling and Control of Robot Manipulator”, Tata Mc Graw Hill, 1990
2. James G Kerames, “Robot Technology Fundamentals”, Delmer Publisher, 2000.
3. Eolfram Staches, “Analytical Robotics and Mechatronics”, Tata Mc Graw Hill, 1999.

MF5154 – MECHATRONICS

L	T	P	C
3	1	0	4

UNIT I INTRODUCTION TO MECHATRONICS 8

Mechatronics – Integrated Design issues – Key elements – Design process – Advanced approaches in Mechatronics. Basics of fuzzy logics, neural networks and artificial intelligence.

UNIT II SENSORS AND TRANSDUCERS 9

Introduction to sensors and transducers – Sensors for motion and position measurement – Force, Torque and tactile sensors – flow sensors – temperature sensing devices – ultrasonic sensors – range sensors – vibration control using magneto structure transducers – fibre optic devices in mechatronics.

UNIT III ACTUATING DEVICES 9

DC and AC Drives – stepper motor – servo motor – fluid power – piezoelectric actuators – design and selection of actuating devices.

UNIT IV SIGNALS, SYSTEMS AND CONTROLS 10

Introduction to signals – systems and controls – system representation – Linearisation of Non linear systems – time delays – measures of system performance – Root locus and Bode plots.

UNIT V APPLICATIONS IN MECHATRONICS 9

Sensors for condition monitoring – Mechatronic control in Automated manufacturing – Artificial Intelligence – Fuzzy Logic applications in Mechatronics – Micro Sensors and Case studies.

L: 45 T: 15 Total: 60

REFERENCES

1. Devadas Shetty and Richard A.Kolk , "Mechatronics system Design", PWS publishing company, 1997
2. BOSCH, "Mechatronics Theory and Applications", 1998
3. W.Bolton , "Mechatronics" , Longmen, 1999
4. HMT, "Mechatronics", 1998.
5. D.A. Bradly, D. Dawson, N.C.Burd and A.J. Loader, "Mechatronics, Electronics in Products and Processes", Chapman and Hall, 1993.

LIST OF ELECTIVES

MF5001 – FLUID POWER AUTOMATION

L	T	P	C
3	0	0	

UNIT I INTRODUCTION 5

Need for Automation – comparison with other power system – ISO symbols for fluid power elements – Economic consideration of fluid power systems – Oil hydraulics – pneumatic – Introduction and selection criterion.

UNIT II HYDRAULIC POWER GENERATION, CONTROL AND REGULATING ELEMENTS 12

Basic elements in a fluid power system – Hydraulic pumps, Gear, Vane, piston-selection and specification – drive characteristics Hydraulic actuators – Linear and Rotary – Selection specification and characteristics – cushioning.

UNIT III PNEUMATIC AND ELECTRO PNEUMATIC 8

Generation and control of compressed air – Elements in pneumatic circuits – Fluidic devices and its application Flip-Flop, SRT Flip flop – Use of electrical switches – relays – timers in fluid power circuits – Electro pneumatics.

UNIT IV CIRCUIT DESIGN 12

Design and methodology – Sequential circuits – cascade – Karnaugh –Veitch map – step counter methods – Compound and combination circuit design – Typical Industrial and hydraulic circuits – Synchronising and accumulator circuits – Circuits for machine tools – Aerospace application – Design and selection criteria – Electro pneumatic circuit design – Ladder diagram.

UNIT V COMPUTER CONTROL & MAINTENANANCE OF FLUID POWER CIRCUITS 8

Fuzzy logic in fluid power circuits – PLC in fluid powers – PLC ladder diagram – Installation – Fault diagnosis in fluid power circuits.

Total: 45

REFERENCES

1. Antony Esposito, "Fluid power system and control", Prentice Hall, 1998.
2. E.F. Fitch and J.B. Suryaat Madyn, "Introduction to fluid power Logic", McGraw Hill, 1988
3. Peter Rohner, "Fluid Power Logic circuit design", Macmillan Press, 1994.
4. "Hydraulic systems Handbook", Utility Publication, 1988.
5. Majumdar, "Oil Hydraulics Systems: Principles and Maintenance", Tata Mc Graw Hil, 2003.
6. Majumdar, "Pneumatic Systems: Principles and Maintenance", Tata Mc Graw Hil, 2003.

MF5003 – DESIGN FOR MANUFACTURE

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 6

Economics of process selection – General design principles of manufacturability – Proper material selection – Strength and mechanical factors – Application of form design.

UNIT II CASTING DESIGN AND WELDMENT DESIGN 10

Factors affecting casting design – Strength aspects – Sand casting and die casting design – Factors affecting weld-ment design – Gas and arc welding design

UNIT III FORMED METAL COMPONENTS AND NON METALLIC PARTS DESIGN 10

Design considerations for the manufacture of extruded – cold headed metal parts – Tube and section bends – powder metal parts – Thermo setting plastic parts – Reinforced – plastic/composite parts.

UNIT IV MACHINED COMPONENTS DESIGN 10

Design considerations for the manufacture of Turned parts – drilled parts – milled parts, planned, shaped and slotted parts – Ground parts – parts produced by EDM.

UNIT V ADVANCED TECHNOLOGY REQUIREMENTS 9

Product design requirements for group technology concepts and CNC machining – Part family concept and design principles

Total: 45

REFERENCES

1. James G.Bralla, "Handbook of Product Design for Manufacture", McGraw Hill Book co., 1986
2. Henry Peck, "Designing for Manufacture", Sir issac Pitman & Sons Ltd., 1973.
3. Matousek, "Engineering Design", Blackie & Sons, 1956.

MF5004 – METAL FORMING THEORY AND PRACTICE

L	T	P	C
3	0	0	3

UNIT I THEORY OF PLASTICITY 15

Theory of Plastic deformation – Yield criteria – Work of plastic deformation – Equilibrium in Cartesian, Cylindrical and Spherical coordinates – Energy – Slab method – Upper bound and Lower bound solution methods – Overview of FEM Applications in Metal Forming Analysis – Formability studies

UNIT II THEORY AND PRACTICE OF BULK FORMING PROCESSES 12

Analysis of Plastic deformation in Forging, Rolling, Extrusion and rod/wire drawing processes – Effects of friction – Calculation of forces – Work done – process parameters – equipments used – Defects – Applications – Recent advances in forging, Rolling, Extrusion and drawing processes – Experimental techniques of evaluation of friction in metal forming, ring compression and double cup extrusion tests.

UNIT III SHEET METAL FORMING 6

Conventional processes – HERF techniques – Explosive forming – electro-hydraulic forming – magnetic pulse forming – Principles and process parameters – Advantages – Limitations and Applications

UNIT IV P/M FORMING 6

Overview of P/M technique – Advantages – applications – Powder perform forging – Hot and cold Isostatic pressing – powder rolling – Tooling and process parameters.

UNIT V SPECIAL FORMING PROCESSES 6

Orbital forging – Isothermal forging – High speed extrusion – Rubber pad forming – Water hammer forming – Fine blanking – Super-plastic forming techniques – electro forming

Total: 45

REFERENCES

1. Schuler, "Metal Forming Handbook", Springer Verlag Publication, 1998
2. Hosford, W F and Caddell, R.M.. "Metal Forming: Mechanics and Metallurgy", Prentice Hall, 1993
3. Dieter, G.E., "Mechanical Metallurgy", Second Edition, McGraw Hill Co, 1980
4. Nagpal, G.R., "Metal Forming Processes", Khanna Publishers, 1998
5. Chakrabarthy, J, "Theory of Plasticity", McGraw Hill Co, 1987
6. Shiro Kobayashi, Soo-Ik-Oh-Altan, T, "Metal Forming and Finite Element Method", Oxford University Press, 1989
7. Narayanasamy, R., "Theory of Metal Forming Plasticity", Second Edition, Ahuja Book Company, 2001.
8. Altan T, Soo-Ik-Oh, Gegel, HL, "Metal Forming, fundamentals and applications", American Society of Metals, Metals Park, 1983.

MF5005 – ADVANCES IN CASTING AND WELDING

L	T	P	C
3	0	0	3

UNIT I CASTING METALLURGY AND DESIGN 9

Heat transfer between metal and mould – Solidification of pure metal and alloys – Shrinkage in cast metals – progressive and directional solidification – Principles of gating and restraining – Degasification of the melt – Design considerations in casting – Designing for directional solidification and minimum stresses – casting defects

UNIT II SPECIAL CASTING PROCESSES 9

Shell moulding – Precision investment casting – CO₂ – moulding – centrifugal casting – Die casting – Continuous casting.

UNIT III WELDING METALLURGY AND DESIGN 12

Heat affected Zone and its characteristics – Weldability of steels, cast iron, Stainless steel, aluminum and Titanium alloys – Hydrogen embrittlement – Lamellar tearing – Residual stress – Heat transfer and Solidification – Analysis of stresses in welded structures – pre and post welding heat treatments – Weld joint design – Welding defects – testing of weldment.

UNIT IV UNCONVENTIONAL AND SPECIAL WELDING PROCESSES 6

Friction welding – Explosive welding – Diffusion bonding – High frequency Induction welding – Ultrasonic welding – Electron beam welding – Laser beam welding

UNIT V RECENT ADVANCES IN CASTING AND WELDING 9

Layout of mechanised foundry – sand reclamation – Material handling in foundry – pollution control in Foundry – Recent trends in casting – Computer Aided design of Castings, Low pressure die casting, Squeeze casting and full mould casting process – Automation in welding – Welding robots – Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

Total: 45

REFERENCES

1. Jain, "Principles of Foundry Technology", Third Edition, Tata McGraw Hill, 2000.
2. Lal.M. and Khanna.O.P, "A Text Books of Foundry Technology", Dhanpat Rai & Sons, 1996.
3. Titoun.D. and Stepanov .YU.A., "Foundry Practice", MIR Publishers, 1981.
4. Iotrowski, "Robotic welding – A guide to selection and application", Society of Mechanical Engineers, 1987.
5. Cornu. J., "Advanced Welding systems", Volumes I,II and III, JAICO Publishers, 1994.
6. Lancaster. J.F., "Metallurgy of Welding", George Allen & Unwin Publishers, 1980.
7. Serope Kalpakjian, "Manufacturing Engineering and Technology" Third Edition, Addison Wesley Publishing Co.1995
8. P.N.Rao, "Manufacturing Technology (Foundry, Forming and Welding), Second Edition", Tata McGraw Hill Pub.Co. Ltd, 1998.

MF5007 – MAINTENANCE AND RELIABILITY ENGINEERING

L	T	P	C
3	0	0	3

UNIT I MAINTENANCE MANAGMENT 10

Need for maintenance – Objective – Concepts – Types of maintenance – Organisation – Trade force mix, type and location – Maintenance costs – Benefits – Computer Aided Maintenance management – Total productive maintenance.

UNIT II TYPES OF MAINTENANCE 8

Breakdown and Preventive maintenance – Advantages and Limitations – Maintenance prevention – Diagnostic maintenance – Design out maintenance – Opportunity maintenance.

UNIT III DIAGNOSTIC MAINTENANCE 10

Leak detection – wear monitoring – Temperature monitoring – Vibration monitoring – Signature analysis – Shock monitoring – Lubricant – Analysis – Methodology – Equipments – Applications

UNIT IV CONCEPTS OF RELIABILITY 7

Elements of Probability – Reliability Definition – Measures of Reliability – Failures – Classification of failures – Failure data Analysis – Availability – Criticality matrix – Event tree analysis - Utilization factor – Factors affecting reliability.

UNIT V DESIGN FOR RELIABILITY 10

Analysis of reliability data – Weibull analysis – Design and manufacture for Reliability – Reliability of parts and components – Design for system reliability – Economics of standby or redundancy in a production system – reliability testing – Types

Total: 45

REFERENCES

1. Higgins and Morrow, "Maintenance Engineering Handbook ", Tata McGraw Hill, 1985
2. Collact, "Mechanical Fault Diagnosis and Condition monitoring", McGraw Hill-1985
3. Miller & Blood, "Modern Maintenance Management", Tarapooriwala & sons, 1976.
4. Jentry EJ and Kumamoto,H, "Reliability Engineering and Test assessment", Prentice Hall, 1992.
5. Carter,A.D.S., "Mechanical Reliability", Macmillan, 1984.
6. Nakajima.S., "Introduction to TPM - Total Productive Maintenance", Productivity Press-1995
7. O'connor,P.D.T, "Practical Reliability Engineering", John Wiley, 1994.
8. Kelley.A.& M.J.Harris, "Management of Industrial Maintenance" , Newnes-Butter worth.

MF5051 – SYSTEMS AND SIMULATION

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION TO SYSTEMS AND SIMULATION 9

Basic concepts of systems – General systems – Elements of systems – theory – concept of simulation – Simulation as a decision making tool – types of simulation – System modelling and types of modeling – desk and bench mark simulation.

UNIT II RANDOM NUMBER 8

Probability and statistical concepts of simulation – Pseudo random numbers – Methods of generating random variables – Discrete and continuous distributions – Testing of random numbers – Sampling – simple random and simulated.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 8

Problem formulation – Data collection and reduction time flow mechanism – Key variables – Logic flowchart starting condition – Run size – Experimental design consideration – Output analysis interpretation and validation – Application of simulation in Industries, Engineering and scientific organisations.

UNIT IV SIMULATION LANGUAGE 10

Use of digital computer in simulated sampling – Comparison and selection of simulated languages – Analysis – Study of any simulation language – Modification of simulation models using simulation language.

UNIT V CASE STUDIES 10

Development of simulation models using the simulation language studied for systems like: Queuing systems – Production Systems – Inventory systems – Maintenance and replacement systems – Investment analysis and network.

Total: 45

REFERENCES

1. Jerry Banks and John S.Carson, "Discrete Event System Simulation", Prentice Hall,1984.
2. R.E.Shannon, "Systems Simulation, The Art and Science", Prentice Hall, 1975.
3. Joe h. Mize and J. Grady Cox, "Essentials of Simulation", Prentice Hall Inc., 1968.
4. Jeffrey I. Whitten, Lonnie D.Bentley and Victor M.Barice, "System Analysis and Design Methods", Galgotia Publications Pvt Ltd., 1991
5. Thomas j. Schriber, "Simulation using GPSS", John Wiley, 1974.

MF5052 – DIAGNOSTIC TECHNIQUES

L	T	P	C
3	0	0	3

UNIT I DEFECTS AND FAILURE ANALYSIS 7

Defect generation – types of failures – Defects reporting and recording – Defect analysis – Failure analysis – Equipment down time analysis – Breakdown analysis – TA, FMEA, FMECA.

UNIT II MAINTENANCE SYSTEMS 8

Planned and unplanned maintenance – Breakdown maintenance – Corrective maintenance – Opportunistic maintenance – Routine maintenance – Preventive maintenance, Predictive maintenance – Condition based maintenance system – Design out maintenance – selection of maintenance system.

UNIT III SYSTEMATIC MAINTENANCE 10

Codification and Cataloguing – Instruction manual and operating manual – Maintenance manual and Departmental manual – Maintenance time standard – Maintenance work order and work permit – job monitoring – Feedback and control – Maintenance records and documentation.

UNIT IV COMPUTER MANAGED MAINTENANCE SYSTEM 8

Selection and scope of computerization – Equipment classification – Codification of breakdown – material and facilities – Job sequencing – Material management module – Captive Engineering module.

UNIT V CONDITION MONITORING 12

Condition monitoring techniques – Visual monitoring – Temperature monitoring – vibration monitoring – Lubricant monitoring – Cracks monitoring – Thickness monitoring – Noise and sound monitoring – condition monitoring of hydraulic system – Machine diagnostics – Objectives – Monitoring strategies – Examples of monitoring and Diagnosis – Control structures for machine diagnosis.

Total: 45

REFERENCES

1. Sushil Kumar Srivastava, "Industrial Maintenance Management", S.Chand and company Ltd., 1998.
2. Manfred Weck, H.Bibring, "Hand Book of Machine Tools, Vol. 3", John Wiley & Sons,
3. Garg H.P, "Industrial Maintenance", S.Chand & company Ltd., 2000.

MF5015 – ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT

L	T	P	C
3	0	0	3

UNIT I	FINANCIAL ACCOUNTING	12
Accounting Principles – Basic records depreciation – Depreciation methods – Preparation, interpretation of profit and loss statement – Balance sheets – Fixed assets – Current assets		
UNIT II	COSTING	10
Elements of cost – Cost Classification – Material cost – Labour costs – Overheads – Costs of a product – Costing systems – Cost determination – Process costing – Allocation of overheads – Standard costing – Variance analysis.		
UNIT III	WORKING CAPITAL MANAGEMENT	8
Current assets and Liability decisions – Estimation of working capital requirements – Management of accounts receivable – Inventory – cash – inventory valuable methods.		
UNIT IV	CAPITAL BUDGETING	7
Significance of capital budgeting – payback period – Present value method – Accounting rate of return method		
UNIT V	ENGINEERING ECONOMICS	8
Economics – Engineering economics – Demand analysis – Laws of demand – Production and cost – pricing methods – Cost volume profit analysis		

Total: 45

REFERENCES

1. C.James , Vanhorn, "Fundamentals of Financial Management" , PHI, 1996.
2. Charles T. Homgren, "Cost Accounting", PHI, 1985.
3. S.N.Maheswari, "Management Accounting and Financial Control", Sultanchand,1992.
4. Prasanna Chandra, "Financial Management", Tata Mc Graw Hill, 1998
5. J.L.Riggs, "Engineering Economics", McGraw Hill, 1987.
6. G.B.S.Narang, "Production and Costing", Khanna Publishers, 1993.

MF5018 – INTEGRATED PRODUCT AND PROCESS DEVELOPMENT

(For M.E Programmes in Engineering Design/Product Design and Development/CAD)

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 5

Need for IPPD – Strategic importance of Product development – Integration of customer, designer, material supplier and process planner - Competitor and Customer – behaviour analysis
Understanding customer – promoting customer understanding – Involve customer in development and managing requirements – Organization – Process management and Improvement – Plan and establish product specifications.

UNIT II CONCEPT GENERATION AND SELECTION 5

Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

UNIT III PRODUCT ARCHITECTURE 10

Implications – Product change – Variety – Component standardization – Product performance – Manufacturability – Product development Management – establishing the architecture – Creation – Clustering – Geometric layout development – Fundamental and incidental interactions – related system level design issues – Secondary systems – Architecture of the chunks – Creating detailed interface specifications

UNIT IV INDUSTRIAL DESIGN 10

Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process – Investigation of customer needs – conceptualization – refinement – Management of the industrial design process – technology driven products – User – driven products – Assessing the quality of industrial design.

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 15

Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – Principles of prototyping – Planning for prototypes – Economic analysis – Understanding and representing tasks – baseline project planning – accelerating the project – Project execution – N.B.A.Consumer product design project is recommended.

Total: 45

REFERENCES

1. Kart T.Ulrich and Steven D.Eppinger, “Product Design and Development”, McGraw-Hill, 1999.
2. Kemneth Crow, “Concurrent Engg./Integrated Product Development”, DRM Associates, CA 90274(310)377-569, Workshop Book.
3. Stephen Rosenthal, “Effective Product Design and Development”, Business One Orwin, Homewood, 1992.
4. Stuart Pugh, “Tool Design – Integrated Methods for Successful Product Engineering”, Addison Wesley Publishing, 1991.
5. [www./me.mit/2.7444](http://www.me.mit/2.7444)