

Gujarat Technological University
Mechanical (Advance Manufacturing System)
PROPOSED TEACHING SCHEME (W.E.F. July 2012)

Semester I

Subject Code	SUBJECT	TEACHING SCHEME(HOURS)			CREDITS
715001	Production and Operation Management	4	2	0	5
715002	CAD-CAM Systems	4	0	2	5
715003	Advanced Manufacturing Processes	4	0	2	5
710001	Communication and Research Skills	2	2	0	3
	Institute Elective	3	2	0	4
	Major Elective -1	3	0	0	3
	Total Credit				25

Subject Code	Major Elective -1
715005	Design for Manufacture and Assembly
715006	Flexible Competitive Manufacturing System
710807	Advanced Materials and Processes

Subject Code	Institute Elective
715004	Optimization Methods For Engineering Systems

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M.E Semester: 1

Mechanical Engineering (Advanced Manufacturing Systems)

Subject Name: Production and Operations Management

Subject Code: 715001

1	Introduction: Objectives to production and operations, Objectives to development of production and operations strategies.
2	Sales Forecasting: Advanced forecasting Methods, Forecasting Errors, Sensitivity Analysis, Box zerkins method, Problem solving by using Software.
3	Capacity Management and facilities arrangement: Capacity planning, facility planning work system design, managing information for production system,
4	Queuing Theory: Open and close channel queuing networks, Application of Queuing in production system, Application of software packages for queuing models.
5	Project Management: PERT/CPM, Resource Leveling, Project Scheduling
6	Simulation Techniques: Application and importance of simulation, Simulation packages
7	Production planning and scheduling: Aggregate production planning, JIT, Scheduling and sequencing, Assignment models, replacement and maintenance techniques, Line of balancing, Computer added process planning.
8	Material Planning: MRP systems – Master production schedule – MRP concepts – terminology - MRP II – embedding JIT into MRP – advanced MRP systems – example on MRP.
9	Management Information System: Concepts, Information systems for Decision Making, Information systems development life cycle, Information systems for strategic planning, General Steps in Information System Design, Data flow diagrams and E-R diagrams, Introduction to data structures and relational database, System Implementation, Introduction to Capability Maturity Model (CMM), System Testing, System Evaluation, Distributed data management.
10	Emerging areas in POM: Decision Support System, Application Packages in POM, Enterprise Recourse Planning, Group Technology

Reference books:

- 1) Operation research, Analysis and Application by Wilkes Michael (McGraw Hill Publication)
- 2) Production and Operations Management by Martinich (Willey Publication)
- 3) Production and Operations Management by Ray Wild (Cassell Publication)
- 4) Production and Operations Management – RogertoRussel, Taylor – Prentice Hall,
- 4) Production Systems by J.L. Riggs (John Willey & Sons)
- 5) Operation Research by Lieberman & Hiller
- 6) POM by Adam and Ebert
- 7) Production and Operations Management – James Dilworth – Pearson International
- 8) Modern production management by Buffa

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M.E Semester: 1

Mechanical Engineering (Advanced Manufacturing Systems)

Subject Name: CAD-CAM Systems

Subject Code: 715002

1	Fundamental of CAD: Introduction, Reasons for implementing a CAD system, conventional design v/s CAD, Benefits, Hardware, CAD software, Technical specification of CAD workstation, computer software
2	Computer graphics: Scan conversion, Bresenham's Algorithm, Geometric transformations, 2D and 3D translation, scaling, rotation, shear and reflection, homogeneous transformations
3	Geometric modeling: Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves Hermit cubic splines Bezier curves, B-splines rational curves. Representations: B-rep and C-rep, Feature based modelling.
4	Surface modeling: Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder.
5	Geometric modelling-3D: Solid modeling, Solid Representation, Boundary Representation (B-rep), Constructive Solid Geometry (CSG).
6	Graphics Standards: Standards for graphics programming, features of GKS, other graphics standards, PHIGS, IGES, PDES. Standards in CAD. Graphics and computing standards, data exchange standards, Design Database, Interfacing design and drafting
7	Computer Aided Manufacturing: Principles of optimum design – CAD optimization techniques, Application of CAD – computer-aided processplanning – post processing – NC code generation – principles of computer aided engineering and concurrentengineering.

Practical List:

1. To prepare a computer program for scan converting a line bresenham's algorithm.
2. To prepare a computer program for scan converting a circle bresenham's algorithm.
3. Preparation of computer program for 2D transformation.
4. Preparation of computer program for 3D transformation.
5. Study of DFX, IGES and script file formats.
6. Study of solid modeling and making models using commercial software.
7. Preparing mechanical assembly using commercial software.
8. Manual part programming preliminaries.
9. Manual part programming Exercises.
10. CAD/CAM Integration and case study.

Reference Books:

1. CAD/CAM, Theory and practice, Ibrahim Zeid& R. Sivasubramanian, Tata McGraw Hill international
2. Mathematical elements for computer graphics, David F. Rogers & J. Alan Adams, McGraw Hill
3. CAD/CAM, Computer Aided design and Manufacturing , MikellGroover and Zimmer, Pearson Education
4. Finite Element Analysis, Chendraupatla, EEE Publication.
5. Computer Graphics & design, P. Radhakrishnan& C.P. Kothanadaraman, New age publication
6. Geometric Modelling, Mortenson, M.E., John Wiley & Sons, NY, 1985.

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M.E Semester: 1

Mechanical Engineering (Advanced Manufacturing Systems)

Subject Name: Advanced Manufacturing Processes

Subject Code: 715003

1	Advanced Machining Processes • Introduction • Process principle • Material removal mechanism • Parametric analysis and applications of processes such as ultrasonic machining (USM) • Abrasive jet machining (AJM) • Water jet machining (WJM) • Abrasive water jet machining (AWJM) • Electrochemical machining (ECM) • Electro discharge machining (EDM) • Electron beam machining (EBM) • Laser beam machining (LBM) processes
2	Advanced Casting Processes • Metal mould casting • Continuous casting • Squeeze casting • Vacuum mould casting • Evaporative pattern casting • Ceramic shell casting
3	Advanced Welding Processes • Details of electron beam welding (EBW) • laser beam welding (LBW) • ultrasonic welding (USW)
4	Advanced Metal Forming Processes • Details of high energy rate forming (HERF) process • Electro-magnetic forming, explosive forming • Electro-hydraulic forming • Stretch forming • Contour roll forming

Reference books:

1. "Materials and Processes in Manufacturing" (8th Edition), E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi (ISBN 0-02-978760).
2. "Manufacturing Science" A. Ghosh, and A. K. Mallik, Affiliated East-West Press Pvt. Ltd. New Delhi.
3. "Nontraditional Manufacturing Processes", G.F. Benedict, Marcel Dekker, Inc. New York (ISBN 0-8247-7352-7)

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M.E Semester: 1

Mechanical Engineering (Advanced Manufacturing Systems)

Subject Name: Optimization Methods For Engineering Systems

Subject Code : 715004

1	Introduction: Engineering Applications; Statement of the Optimal Problem: Classification; Optimization Techniques.
2	Classical Methods: Single Variable Optimization; Multivariable Optimization without any Constraints with Equality and Inequality Constraints.
3	One-Dimensional Minimization Methods: Uni-model Function; Elimination Methods – Dichotomous Search, Fibonacce and Golden Section Methods; Interpolation Methods – Quadratic and Cubic Interpolation Methods.
4	Unconstrained Minimization Methods: Univariate, Conjugate Directions, Gradient and Variable Metric Methods.
5	Constrained Minimization Methods: Characteristics of a constrained problem; Direct Methods of feasible directions; Indirect Methods of interior and exterior penalty functions.
6	Geometric Programming: Formulation and Solutions of Unconstrained and Constrained geometric programming problems.
7	Dynamic Programming: Concept of Sub-optimization and the principle of optimality; Calculus, Tabular and Computational Methods in Dynamic Programming
8	Integer Programming : Gomory’s Cutting Plane Method for Integer Linear Programming; Formulation & Solution of Integer Polynomial and Non-linear problems.

Text books:

1. Optimization (Theory& Applications) – S.S. Rao, Wiley Eastern Ltd., New Delhi.
2. Optimization Concepts and Applications in Engineering – Ashok D.Belegundu and Tirupathi R Chandrupatla — Pearson Education.

Reference books:

1. Optimization: Theory and Practice, C.S.G. Beveridge and R.S. Schechter, MGH, New York.

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M.E Semester: 1

Mechanical Engineering (Advanced Manufacturing Systems)

Subject Name: Design for Manufacture and Assembly

Subject code : 715005

1	INTRODUCTION General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances - Geometric tolerances Assembly limits – Datum features - Tolerance stacks.
2	FACTORS INFLUENCING FORM DESIGN Working principle, Material, Manufacture, Design - Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.
3	COMPONENT DESIGN-MACHINING CONSIDERATION Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area - simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly.
4	COMPONENT DESIGN - CASTING CONSIDERATIONS Redesign of castings based on parting line considerations - Minimising core requirements, machined holes, redesign of cast members to obviate cores.
5	REDESIGN FOR MANUFACTURE AND CASE STUDIES Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

Text Books:

1. Harry Peck, "Design for Manufacture", Pittman Publication, 1983.
2. Robert Matousek, "Engineering Design - A systematic approach", Blackie & sons Ltd., 1963.

Reference Books:

1. James G. Bralla, "Hand Book of Product Design for Manufacturing", McGraw Hill Co., 1986.
2. Swift K.G., "Knowledge based design for manufacture, Kogan Page Ltd., 1987.

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M.E Semester: 1

Mechanical Engineering (Advanced Manufacturing Systems)

Subject Name: Flexible Competitive Manufacturing System

Subject Code : 715006

1	MANUFACTURING IN A COMPETITIVE ENVIRONMENT Automation of manufacturing process - Numerical control - Adaptive control - material handling and movement - Industrial robots - Sensor technology - flexible, fixturing - Design for assembly, disassembly and service.
2	GROUP TECHNOLOGY Part families - classification and coding - Production flow analysis - Machine cell design - Benefits.
3	FLEXIBLE MANUFACTURING SYSTEMS Introduction - Components of FMS - Application work stations - Computer control and functions - Planning, scheduling and control of FMS - Scheduling - Knowledge based scheduling - Hierarchy of computer control - Supervisory computer.
4	COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS System issues - Types of software - specification and selection - Trends - Application of simulation - software - Manufacturing data systems - data flow - CAD/CAM considerations - Planning FMS database.
5	JUST IN TIME Characteristics of JIT - Pull method - quality -small lot sizes - work station loads - close supplier ties – flexible work force - line flow strategy - preventive maintenance - Karban system - strategic implications - implementation issues - MRD JIT - Lean manufacture.

Reference books:

1. Groover M.P., " Automation, Production Systems and Computer Integrated Manufacturing ", Prentice-Hall of India Pvt. Ltd., New Delhi, 1996.
2. Jha, N.K. " Handbook of Flexible Manufacturing Systems ", Academic Press Inc., 1991.
3. Kalpakjian, " Manufacturing Engineering and Technology ", Addison-Wesley Publishing Co., 1995.
4. Taiichi Ohno, Toyota, " Production System Beyond Large-Scale production ", Productivity Press(India) Pvt.Ltd., 1992.

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M.E Semester: 1

Mechanical Engineering (Advanced Manufacturing Systems)

Subject Name: Advanced Materials and Processes

Subject Code : 710807

1	ADVANCED MATERIALS: Super alloys, Ferro electric and piezoelectric materials, Advanced magnetic materials, Advanced engineering polymer materials, Advanced ceramic and composite materials, photo conducting and photovoltaic materials, electro-optic materials, Lasers, smart materials
2	PROCESSING OF MATERIALS: Conventional processing techniques for advanced materials, special processing techniques, use of computers in metal processing
3	CHARACTERIZATION AND EVALUATION TECHNIQUES: Destructive and Non-destructive evaluation techniques, Electron and X-ray techniques, Distortion and Residual stress measurement.
4	PERFORMANCE OF MATERIALS IN SERVICE: Service performance, corrosion and its control, Delayed fracture, Performance of materials at High & low temperatures, Radiation damage and recovery.
5	DESIGN: Introduction, Design philosophy – steps in Design process – General Design rules for manufacturability – basic principles of designing for economical production – creativity in design.
6	MATERIALS: Selection of Materials for design – Developments in Material technology – criteria for material selection – Material selection interrelationship with process selection – process selection charts
7	MACHINING PROCESS: Overview of various machining processes – general design rules for machining - Dimensional tolerance and surface roughness – Design for machining – Ease – Redesigning of components for machining ease with suitable examples. General design recommendations for machined parts
8	METAL CASTING: Appraisal of various casting processes, selection of casting process, - general design considerations for casting – casting tolerances – use of solidification simulation in casting design – product design rules for sand casting
9	METAL JOINING: Appraisal of various welding processes, Factors in design of weldments – general design guidelines – pre and post treatment of welds – effects of thermal stresses in weld joints – design of brazed joints
10	FORGING: Design factors for Forging – Closed die forging design – parting lines of dies – drop forging die design – general design recommendations.
11	EXTRUSION & SHEET METAL WORK: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, Deep Drawing – Keeler Goodman Forming Line Diagram – Component Design for Blanking

12	PLASTICS: Viscoelastic and creep behavior in plastics – Design guidelines for Plastic components – Design considerations for Injection Moulding –Design guidelines for machining and joining of plastics
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Reference Books:

1. Design for Manufacture / John Cobert / Addison Wesley, 1995.
2. ASM Handbook, Vol.20.
3. Engineering Design- A Material and Processing Approach / George E. Dieter / McGraw Hill Intl., 2nd Edition, 2000.
4. Product design and Manufacturing / A.K Chitale and R.C Gupta / Prentice – Hall of India, New Delhi, 2003.
5. Design and Manufacturing / Surender Kumar & Goutham Sutradhar / Oxford & IBH Publishing Co. Pvt .Ltd., New Delhi, 1998.