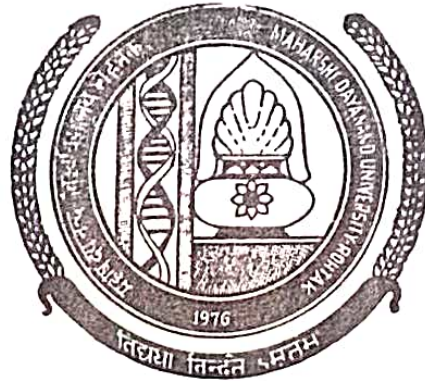


# Maharshi Dayanand University Rohtak



## Ordinances, Syllabus and Courses of Reading for M.Tech.(Manufacturing Technology & Automation)New Examination

Session—2005-2006

**Available from :**

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**Y.M.C.A. INSTITUTE OF ENGINEERING, FARIDABAD**  
**(DEPARTMENT OF MECHANICAL ENGINEERING)**

**Scheme of Examinations Syllabi of M.Tech.- 2005-06**

Enclosed course : M.Tech (Manufacturing Technology and Automation)

The credit requirements of the course are :

.....	:	64
Core courses	:	11
Programme Elective courses	:	02

**FIRST SEMESTER**

<b>Subject Code</b>	<b>Credit (L.T.P)</b>		<b>Marks Weightate</b>	
			<b>Theory</b>	<b>Sessional</b>
601 Metal Forming analysis	3	3-0-0	100	50
603 Welding & Allied Processes	3	3-0-0	100	50
605 Mechatronics & Product Design	3	3-0-0	100	50
607 Design, Planning and control of production systems	3	3-0-0	100	50
610 Foundry Technology	3	3-0-0	100	50
			<b>Ext.</b>	<b>Int.</b>
611 Object Oriented Programming Lab	1	0-0-2	25	25
613 Welding Lab	1	0-0-2	25	25
615 Mechatronics Lab	1	0-0-2	25	25
<b>Total</b>	<b>18</b>	<b>15-0-6</b>	<b>575</b>	<b>325</b>

**SECOND SEMESTER**

<b>Subject Code</b>	<b>Credit (L.T.P)</b>		<b>Marks Weightate</b>	
			<b>Theory</b>	<b>Sessional</b>
602 Metal cutting technology	3	3-0-0	100	50
604 Automation in Mfg.	3	3-0-0	100	50
606 CAD.CAM for Mfg.	3	3-0-0	100	50
608 Material management	3	3-0-0	100	50
610 Principles of Mgt.	3	3-0-0	100	50
			<b>Ext.</b>	<b>Int.</b>
612 Mfg./Metal cutting Lab	1	0-0-2	25	25
614 Automation Lab	1	0-0-2	25	25
616 CAD/CAM lab	1	0-0-2	25	25
<b>Total</b>	<b>18</b>	<b>15-0-6</b>	<b>575</b>	<b>375</b>

THIRD SEMESTER

Subject Code	Credit (L.T.P)		Marks Weightage	
			Theory	Sessional
M 701 Computer Integrated Mfg.	3	3-0-0	100	50
M 703 Program Elective-I	3	3-0-0	100	50
M 705 General Elective-II	3	3-0-0	100	50
M 707 CIM Lab	1	0-0-2	25	25
M 709 Seminar	1	0-0-2	25	-
M 711 Minor Project	5	0-0-10	100	100
<b>Total</b>	<b>16</b>	<b>9-0-14</b>	<b>450</b>	<b>275</b>

– Student will have to select one subject from List of Program Elective I and one subject from List of General elective -II as under:

**List of Program Elective - I**

1. Industrial Inspection
2. Quality Control Techniques
3. Design and Metallurgy of Welded Joint
4. Forging
5. Tool Design & Engg.
6. Machine Tool Dynamics

**List of General Elective - II**

1. Artificial Intelligence in Manufacturing
2. Value Engg.
3. Advance Theory of Vibrations
4. Instrumentation and Automatic control
5. Non Conventional Sources of Energy
6. Energy Ecology & Environment

FOURTH SEMESTER

Subject Code	Credit (L.T.P)		Marks Weightage	
			Theory	Sessional
M 702 Major Project	12	0-0-24	300	20 J
<b>Total</b>	<b>12</b>	<b>0-0-24</b>	<b>300</b>	<b>20 J</b>

**M 601 Metal Forming Analysis**

Stress-strain relations in elastic and plastic deformations, Yield criteria for ductile metals, work hardening and Anisotropy in yielding, Flow curves. Elements of theory of plasticity, Formulation of plastic deformation problems, Application of theory of plasticity for solving metal forming problems using slab method, Upper and Lower bound methods, slipline field theory, extremum principles.

Effect of temperature and strain rate in metal working, Friction and lubrication in cold and hot working.

Technology and Analysis of important metal forming processes—Forging, Rolling, Extrusion, Wire Drawing, Sheet metal forming processes like Deep drawing, Stretch forming, Bending.

Introduction to Finite Element Analysis of metal forming processes.

**Reference Books :**

1. Theory of elasticity – Daily Railey
2. Fundamental of metal forming – Wagoner
3. Experimental stress analysis – L Srinath
4. Theory of elasticity and Plasticity – Dr. Sadhu Singh
5. Metal Forming Processes – G. R. Nagpal

**M. 603 Welding and allied Processes**

General survey and classification of welding processes gas, arc and resistance welding.

Welding arc characteristics : welding arc structure and mechanisms types of measurement of temperature of welding arcs, arc characteristics : VI characteristics, VL characteristics, anode spot characteristics.

Electric arc welding - principle, welding procedure, arc length,

are force and arc blow, equipment and accessories - AC and DC power sources, rectifiers, inverter systems, VI curves for constant current and constant voltage sources, types of electrodes, Indian system of classification and coding of covered electrode for mild steel, electrode polarity and its effect, shielding gases and associated mixtures.

Metal transfer : free flight, globular type, spray type, short circuit type, dip transfer, forces affecting metal transfer, weld bead geometry and shape factors, weld dilution, duty cycle.

Are welding processes : MIG - welding equipment and processes, shielding gas, types of metal transfer. Tungsten inert gas arc welding (GTAW) - welding equipment, electrodes, inert gases and torches. Submerged arc welding - principle of processes, applications, fluxes and welding electrodes used. CO<sub>2</sub> welding - difference from MIG welding, principle of operation, equipment, welding parameters, joint design and applications.

Soldering and Brazing: soft and hard solders, fluxes, soldering iron procedure, principle of brazing and methods, concept, procedure and testing of adhesive bonding.

Resistance welding : welding principle, equipment, techniques and applications of variants of resistance welding like spot welding, seam welding, flash butt welding, projection welding and percussion welding procedures.

Solid state welding : introduction, main features and applications of diffusion (bonding) welding, ultrasonic welding, and friction welding, explosive welding.

Radiant energy welding : introduction, main features and applications of electron beam, laser beam welding, procedures.

Newer welding processes : introduction main features and applications of thermit welding, electro slag and electro gas welding procedures.

Welding of plastics : principles of operation, weld joint design, plastic welding process like ultrasonic and friction welding.

Surfacing and metal spraying : surfacing methods such as SMAW, MIG, TIG, SAW, classification of thermal spraying procedures, introduction, applications, advantages and disadvantages.

Thermal cutting of metals : introduction, types, principle and operation of flame and plasma cutting.

#### Reference books :

1. Modern welding technology : carry H.B. (PH).
2. Welding technology - A.C Devis
3. Welding and welding Technology - Little (TMH)
4. Welding technology - R.S. Parmar
5. AWS - welding handbook (IV-VI) Edition.

#### M. 605 Mechatronics Product Design

Introduction to Mechatronics systems and components, Principles of basic electronics – Digital logic, number system logic gates, Sequence logic flip flop system, JK flip flop, D-flip flop.

Microprocessors and their applications – Microcomputer computer structure/microcontrollers, Integrated circuits – signal conditioning processes, various types of amplifiers, low pass and high pass filters.

Sensors – sensors and transducers. displacement, position proximity sensors, velocity, force sensors. Fluid presence temperature, liquid level and light sensors. Selection of sensors. Actuators, Pneumatic and hydraulic systems, Mechanical actuation system, Electrical actuation system. Other Electrical/Electronic hardware in Mechatronic system.

Principles of Electronic system communication, Interfacing, A.D. and D.A convertors, Software and hardware principles and tools to build mechatronic systems. Basic system models mathematical models, mechanical and other system Building blocks.

System models – Engg. Systems, rotational, translation, electrical, mechanical, Hydraulic mechanical system., System Transfer functions, First-second order system in series.

Requirement Planning (MRP) objective, dependent demand, inputs to MRP, MRP model, Production schedule, MRP logic comparison.

Design and selection of Mechatronics statements namely sensors line encoders and revolvers, stepper and servomotors Ball screws, solenoids, line actuators and controllers with application to CNC system, robots, consumer electronics products etc. Design of a Mechatronic Product using available software CAD packages MATLAB and SIMULINK.

#### Sequencing and scheduling

Criteria for sequencing, priority sequencing and rules, n job 2 machine, n job 3 machine, n job m machine problems.

Element of monitoring and follow up.

1. Production operations management.
2. Elements of Production, planning and control - Eilon Samuel A
3. Production control : A quantitative approach - Biegel. J
4. Industrial Engineering and production management - Martand Telsang
5. Operations Management - Theory and Problems - Joseph Monks.

#### Reference Books :

1. Mechatronics by W.Bolton, published by Addison Worley Longman Pvt. Ltd., India Brander, Delhi
2. Automation Production System and CIMS by Mikel P Groover, Phentice Hall of India Pvt. Ltd, New Delhi.

#### M. 607 Design, Planning and Control of Production System

##### Introduction to production systems :

Aim of production system, generalized model and type of production systems Features compiling service organization, Life cycle approach to production management.

##### Product development and design :

New product development and process selection, stages in new product development, use of decision tree, Breakeven Analysis, Make/buy decision, Problems for Break even Analysis Non-linearity in B.E. Analysis, selection of location among alternatives – A care study, systematic layout planning, objectives, types, comparison and application of different types of layouts. Assembly line balancing concept and problems for maximum line efficiency.

##### Planning for production :

Importance, objectives and types of forecasting methods, Analysis and comparison standard error of estimate, Material

#### M. 609 Foundry Technology

Selection of metals and alloys for casting cast irons - Grey, Nodular, Al-base alloys, copper-bare alloys, Melting of metals – Furnaces, Solidification fo castings, Casting Design considerations, Mold design for sand and Die castings.

Gating system design – requisites of gating system, gating ratio, Riser design – objectives, riser's variables, types.

Casting defects, their causes and remedies, Cleaning of castings, Heat Treatment of castings, Inspection, Repair, Salvage of casting.

Quality control in foundries, Special casting processes, Specific foundry consideratins for gray cast iron, Steel foundry practice, Foundry Mechanizations.

Pollution control in foundries

Reference Books :

1. Principles of Metal Casting – Heine, Tata Mc Graw Hill.
2. Principles of Metal casting – Rosenthal, Tata McGraw Hill.
3. Principles of Manufacturing Materials and Processes – J.S. Campbell, Tata McGraw Hill, New Delhi.
4. Production Technology – P.C. Sharma, S.Chand & Co, Delhi.
5. Materials and Processes in Manufacturing – E.P. Degarmo, McMillan Publishing Co, Inc, New York.

2. To construct all gates from NAND universal gate.
3. To realize a logic equation such as  $Y = AB + CD$  etc.
4. Practical demonstration of operational amplifier as an inverting, non-inverting and summing amplifier.
5. To design a switching circuit using transistors.
6. Design of a mechanical product/system and incorporate applications of electronics for enhancing product values.
7. Use of SIMULINK software for determining overall gain of a feedback system.
8. Solution of mechanical design problems using MAT Lab.
9. To observe the response of P-I-D- controller using simulator.
10. Demonstration of a infrared matched pair for sensing applications.

M. Tech. (Manufacturing Technology and Automation)

M 613 Welding Lab (2P)

List of Experiments in Welding

1. To study Heat flow in Welding (Equipment for use-Gas Welding equipment)
2. To study Bead Geometry, Hardness of Bead, Microstructure of welding Bead in case of :
  - i) MIG Welding
  - ii) SAW Welding
  - iii) FCAW Welding
 (By changing electrode diameter & carriage speed)
3. To conduct under water welding (to study bead shape & microstructure).

Expt. S.No.	List of Equipments
1,2,3.	Bread Board, IC's, LED's
4	Bread Board, Op amp, CRO
5	Transistor, Bread Board
6	Project Work
7,8	MAT Lab, SIMULINK available in Electronics & Communication Lab
9	Simulator, CRO
10	Bread Board, CRO Infrared Photomatched pair.

Requirement for Mechatronics Lab for Experiment 10

Infrared photomatched pair Rs. 50 - 100/-  
(Transistor + Diode)

M 602 Metal Cutting Technology

Tool Geometry, Tool & work piece material : Common work and Tool material, Nomenclature system, cutting friction, controlled contact machining.

Physical principle in metal cutting : Chip formation and types of chips, work done in cutting, BUE on metal cutting, curling & contraction of chip, work hardening, quality of machines surfaces, Effect of cutting fluid on cutting process, vibration in metal cutting.

Machining economics, cutting power, Tool wear, lubrication and surface finish, cutting fluids.

M. Tech (Manufacturing Technology and Automation)

M 615 Mechatronics Lab (2P)

List of Experiments in Mechatronics :

1. To verify truth table of various gates such as AND, OR, NOT, NAND, NOR etc.

Turning, Boring and threading tools : Operation, signature of single point tools, Design of single point turning tool, Iso tool shaper, design of flat and circular form tools, Boring tools, threading tools chip breaking methods :

Milling, Broaching, Gear cutting tools : Milling cutter design, design of broach, design of Gear hobs.

Tools for holes : Hole starters, Reaming, Design of Drills, Reamer

Grinding : Features of grinding process, characteristics, shapes, mounting, wear turning, Dress of Abrasive tools, center type cylindrical grinding, centreless grinding, internal grinding, surface grinding, grinding fluid.

Modern machining Processes : USM, Abrasive Jet Machining, water jet machining, electrochemical machining, grinding, deburring, Honing, EDM, plasma arc machining, Laser Beam machining, Electro Beam machining Process detail, Metal cutting mechanics, application.

#### Reference books :

1. Metal Cutting theory and cutting tool design : v Arshino v Mir Publishers, Moscow -G Allekseev Mir Publishers, Moscow
2. Cutting tools : P.H. Joshi, Wheeler Publishing
3. Theory of Metal cutting : E.M. Trent
4. Tool design : Donaldson
5. Production Technology : HMT, Tata McGraw Hill, New Delhi
6. Modern Machining Processes : P.C. Pandey  
H.S. Shah, Tata Megraw-Hill, New Delhi

#### M 604 Automation in manufacturing

Introduction to Automation productivity

Automation material handling systems : rotary disc feeders, rotary

center board feeder, oscillating force feeder, in phase vibratory feeder, elevator type feeder, centrifugal type feeder.

Evaluation of Automatic production : product manufacturability, orientation devices - active type, passive type, parts orientation and rocapement.

Designing for automation : product design for automatic assembly.

Pneumatic and Hydraulic components and circuits : Boolean algebra, pneumatic sensors and amplifiers, characteristics of Jet destruction device, logic devices, Schimit triggering devices, developing pneumatic circuits for automatic wrapping of soap cake, automatic filling and sealing for grains, automatic filling of bottles with liquids, automatic coffee dispenser, automatic die casting machine.

Roborts and application of roborts for automation.

#### Books for reference :

1. Handbook of design, manufacturing and automation : Richard C. Dorf (John Wiley and sons)
2. Fluid logic controls and Industrial automation - Daniel B. (John Wiley and sons)
3. Industrial automation - David W.P. (John Wiley and sons)
4. Automatic process control systems and Hardware - R.P. Hunter (Prentice Hall)
5. Manufacturing assembly handbook - brunolotter
6. Manufacturing processes and Engg. - W.J. Patton (Prentice Hall)

#### M 606 Cad/Cam for Manufacturing

Mathematical elements. CAD solid modeling methods Database structures for CAD, CSG formulation, b-rep and wire frame methods. Intersection surface generation methods, Boundary file generation methods. Feature based modeling systems Surface modeling. B-splines, curves and Bezier surface, NURBS, surface patches, fitting surfaces for arbitrary digested points, offset surfaces, fillet surfaces, sewn surfaces.

12 Features recognition from the databases. IGES, STE, PDES and DXF data exchange formats. Graphic standards for CAD/CAM such as GKS, PHIGS and VDI.

Concurrent engineering, integration of manufacturing principles and analytical principles in design. Manufacturing information generation from CAD data, planar sectioning, penalty functions, cavity milling, optimization of cutter path, effect of tool profile geometry, and methods for multi-axis machining. Methods of software design for CAD/CAM system, use of software libraries. Development of a software package for a specific problem as part of the course using software libraries.

**Reference Books :**

1. Fundamentals of Computer Graphics - By Hearn and Baker
2. CAM - By P. N. Rao, Tata Mcgraw Hill.
3. Concurrent Engg - Beni Prasad
4. Mathematical formulation of Engg Curves Adams (TMH)

**M 608 Material management**

Introduction : introduction to material management and productivity, functions of material management, organization structures in material management, role of material management techniques in improved material productivity.

Material planning : objectives, material requirement planning, manufacturing resource planning, JIT production planning, strategic material planning, material control : acceptance, sampling, inspection, make or buy decision, simple cost analysis, economic analysis, break even analysis, break even point theory, whether to add or drop a product line store management and warehousing, product explosion.

Purchasing : importance of good purchasing system, organization of purchasing functions, purchase policy and procedures, responsibility and limitations, purchasing decisions, purchasing role in new product development, role of purchasing in cost reduction, negotiations and purchase, purchasing research : identification of right sources of supply, vendor rating.

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standardization, vendor certification plans, vendor and supply reliability developing new source of supply.

Cost reduction : cost control v/s cost reduction, price analysis, material cost reduction techniques, variety reduction, cost reduction and value improvement, techniques of cost control, standard costing, cost effectiveness, cost analysis for material management, material flow cost control.

Inventory management : inventory v/s stores, types of inventory, inventory control, inventory build-up, EOQ, various inventory models, inventory models with quantity discount, exchange curve concept, coverage analysis, optimal stocking and issuing policies, inventory management of perishable commodities, ABC- VED analysis, design of inventory distribution systems, surplus management, information system for inventory management, case studies.

**Reference books :**

1. Material management : W.R. Stelzer Jr. (PHI)
2. Material management : D.S. Ammer & Richard Erwin Inc.
3. Material management : A.K. Dutta (PHI)
4. Material management : An integrated approach - P. Gopal ; akkrishnan, & M. Sundersen (PHI).

**M 610 Principles of Management**

Introduction to management : Theories of management : Traditional behavioural, contingency and systems approach. Organisation as a system. Interaction with external environment. Managerial decision making and MIS Planning approach to organizational analysis, design of organization structure : job design and enrichment; job evaluation and merit rating, Motivation and productivity. Theories of motivation leadership styles and managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control, Japanese management techniques. Case studies.



## M 701 Computer Integrated Manufacturing

Introduction : CAD/CAM defined, computer technology : introduction, central processing unit, types of memory, input/output, the binary number system, computer programming languages. Automation : CIM, reasons of automation, automation strategy.

Conventional Numerical Control : basic components of NC system, NC motion control, system, applications of NC, advantages and disadvantages of NC, problems with conventional NC, NC controller technology, computer Numerical control, advantages of CNC, functions of CNC, Direct Numerical Control, components of a DNC system, functions of DNC, advantages of DNC.

NC part programming : introduction, punched tapes in NC, tape coding and format, NC words, manual part programming, computer assisted part programming. The part programmer's job, the computer's job. NC part programming languages, APT language, geometry statements, motion statements, post processor statements, auxiliary statements.

Robotics technology : joints and links, common robot configuration, work volume, drive systems, types of robot control, accuracy and repeatability, end effectors, sensors in robotics, applications of robots.

Automated material Handling and FMS : material handling function, types of material handling equipments, conveyor systems, types of conveyors automated guided vehicle system, applications, FMS, components of a FMS, types of systems, where to apply FMS technology FMS workstation, planning the FMS.

Computer aided quality control : Introduction terminology in quality control, the computer in QC, contact and non contact Inspection methods - optical and non optical, computer aided testign.

Computer Integrated Manufacturing systems : Introduction types of manufacturing systems, machine tools and related equipments.

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material handling system, computer control system, functions of a computer in CIMS, Benefits of CIMS.

### Reference books :

1. Automation, Production systems and computer Integrated Manufacturing - Groover M P. (PHI).
2. CAD/CAM - Zimmers and Groover (PHI)
3. Approach to computer integrated design and manufacturing- Nauna Singh (John Wiley and sons)

## M 703 1 : Industrial inspection

Design consideration for Gauges and measuring instruments : material selection for gauges, hardness and surface finish tolerance for linear and dimensional chains, limits, fits and tolerance as per Indian and International standards, design of plug gauge, snap gauge, center distance gauge.

Inspection of threads and gears : thread gauge design, thread size measurement by two wire and three wire methods, vernier gear tooth gauge design.

Surface textures : components of machined surface texture, specification of surface texture, surface roughness measuring device and techniques design of pneumatic gauges in process gauging methods.

Geometrical and positional tolerances.

Geometrical and physical limitations in measuring devices.

### References :

1. Metrology - I.C. Gupta (Dhanpat Rai Pub.)
2. Engg. Metrology - R.K. Rajput (S.K. Kataria and sons)
3. Metrology - R. K. Jain
4. PSG design data book for Gauge design.

## M 703 2 : Quality Control Techniques

Statistical concepts in Quality Control, Graphical Representation

of Grouped Data, Continuous and Discrete Probability Distributions, control limit Theorem.

Introduction to Quality Control, process control and product control, Chance and Assignable causes of Quality variation, advantages of shewhart control charts, process control charts for variables,  $\bar{X}$ , R and  $\sigma$  charts, fixation of control limits, Type I and Type II errors, Theory of runs, Interpretation of out of control points, probability limits, initiation of control charts, trial control limits, determination of aimed at value of process setting, rational method of sub grouping control chart parameters, control limits and specification limits, Natural tolerance limits, Relationship of a process in control to upper and lower specification limits, process capability studies.

Special control charts for variables, group control chart, arithmetic moving  $\bar{X}$  and R charts, Geometric moving chart, control chart with reject limits, steady trend in process average with constant dispersion, trend chart with sloping limits, variable subgroup size.

Variables inspection and attributes inspection, relative merits and demerits, control charts for attributes, p chart and np chart, varying, control limits, high defectives and low defectives, special severe test limits, C chart, U chart, Dodge demerit chart, quality rating, CUSUM or cumulative sum control chart, Average run length (ARL) relative efficiency or sensitivity of control chart.

Probability theory, binomial and poisson distribution, acceptance inspection, 100% inspection No inspection and sampling inspection, operating characteristic curve (O.C. curve). Effect of sample size and acceptance number, type A and type B O.C. curves. Single, Double and Multiple sampling plans, SS plan. Acceptance/Rejection and Acceptance/Rectification Plans, Producers Risk and Consumer's Risk, Indifference Quality level, Average Outgoing quality (AOQ) curve, AOQL, quality protection offered by a sampling plan, average sample number (ASN) curve average total inspection (ATI) curve.

#### Reference Books

1. Statistical quality control by E.L. Grant
2. Quality control and Industrial statistics, by A.J. Duncan

3. Quality control by Dale H. Bestefield
4. Total Quality control by A.Y. Feigenboun
5. Elementary S.O.L. by I.W.Burr, M. Dekkar

#### M 703 3 : Design and metallurgy of welded joints

Weld defects : common weld defects like weld cracks, LOP, LOF, porosity, blow holes etc., remedies and control, welding symbols.

Cost analysis of welded joints : costing factors of welding jobs - fabrication cost, material cost, preparation cost, finishing cost, overhead cost etc., economy in preparation and welding a job, labour accomplishment factor, cost calculation of welded jobs.

Prediction and control of distortion : calculation of longitudinal contraction, transverse contraction, angular contraction due to single weld pass, control of welded distortion, and calculation of shrinkage.

Residual stresses : introduction, types, effect of thermal stresses, control of residual welding stresses.

Destructive and non destructive testing of welds : destructive tests, equipment required and test piece geometry for tensile test, bend test, impact test, hardness test, brittle and fatigue failure tests, non destructive tests for welds : dye penetrate inspection, magnetic particle inspection etc.

Weldability test : definition and concept of weldability, purpose and types of weldability tests such as hot cracking test, root cracking tests, hydrogen induced cracking test, cruciform test.

Weld ability of metals : welding techniques, preparation of joints and electrode types for gray cast iron welding, aluminium welding, austenitic steels, titanium and its alloys.

Welding metallurgy : thermal effect of welding on parent metal, structure of fusion welds, effect of cooling rate, weld metal solidification and heat affected zone.

Automation in welding : introduction and concept classification of welding automation, economies of welding automation.

**Reference Books :**

1. Modern welding technology - carry H.B. (PH)
2. Welding technology - A.C. Devis
3. Welding and welding Technology - Little (TMH)
4. Welding technology - R. S. Parmar
5. AWS - welding handbook (IV-VI) Edition
6. Elements of machine design - Pandya and shah.

**M 703 4 : Forging**

Syllabus to be defined before the start of Third Semester.

**M 703 5 : Tool Design and Engineering**

Syllabus to be defined before the start of Third Semester.

**M 703 6 : Machine Tool Dynamics**

Chatter in machine Tools sources of chatter, primary chatter regenerative, chatter frequency, forced vibration for machine tools, forced vibration due to perturbation of the cutting process forced vibration due to perturbation of equivalent elastic system theories of machine tool chatter : Tlusty's, Kudinovs, Toblas theories

Machine tool stability : dynamic characteristics of the cutting process, general procedure for assessing the dynamic characteristic of machine tool in single degree and many degree of freedom system, methods of reducing the instability in machine tool, dynamic acceptance tests.

Damping in machine tools : requirements of damping system, Viscous dampers, active dampers.

Static and dynamic analysis of machine tools : Imped parameter method, finite element method,

Chatter in grinding machine.

**Reference Books :**

1. Principles of machine Tools : G.C.Sen and Amitabh Bhattacharya (new central book agency Calcutta)
2. Machine Tool Design - S.K. Mehta (TMH)

**M 705 1 : Artificial Intelligence in manufacturing**

Definition, basic concepts of artificial intelligence, scope, role and potential of artificial intelligence in manufacturing, Expert systems, Popular AI application.

Overview of Expert systems, architecture, comparison with procedural programming, developing Expert system for typical manufacturing domains, implementation and maintenance, state-of-art Expert system application, case study.

AI theory problems, problems spaces and search, Heuristic search technique knowledge acquisition and knowledge representation, predicate logic, procedurals Declarative knowledge, forward V/s backward reasoning AI architecture, overview of advanced features, planning, learning, natural language processing, neural nets, fuzzy logic, object oriented programs.

Case studies, examples of AI, theoretical concepts to manufacturing problems, CAD, CAPP scheduling GT, CIM system.

Domains welding, casting forming, metal cutting, maintenance.

**M 705 2 : Value Engineering**

Introduction, Life cycle of a product, definition, objectives and methodology of value engineering, comparison with other cost reduction techniques, unnecessary cost.

Quantitative definition of values, alternatives to increase value, Type of value, estimation of product quality/performance.

Functions : definition types and relationship between different

functions in design of a product, functional cost, functional worth, test for poor value, aim of value engineering. Systematic approach, Phases of value engineering Job plan : General phase, information phase, function phase creation/speculation phase, evaluation phase, investigation phase, recommendation and implementation phase.

Decision/evaluation Matrix : quantitative comparison of alternatives, estimation of weight factors and efficiency.

FAST diagramming : Critical path of function, How, why and when logic, supporting and all time functions, Ground rule for FAST diagram.

Case studies :

1. Value Engineering – A systematic approach - A.E. Mudge.
2. Techniques of value analysis and value engineering - L.D. Miles.
3. Value engineering for cost reduction and product improvement - H.S. Mittal.

### M 705 3 : Advanced theory of Vibrations

Single degree of freedom systems, two degree of freedom systems: spring coupled, mass coupled, vibration absorbers, and vibration isolation.

Multi degree of freedom systems : Lagrange's equation, close couples and far coupled systems, dunker ley's approximation method, rayleigh method, matrix method, matrix, iteration, orthogonality principle, orthogonality, expansion theorem and modal analysis, stodola method, holzer method, galerkin method, rayleigh-ritz method, myklested prohl method for far coupled systems, transfer matrix method.

Experimental methods in vibration analysis : vibration instruments, vibration exciters, transducers and measurement devices, analyzers vibration tests - free and forced vibration tests.

Vibration of continuous systems : Transverse flexural, torsional vibration of beams, timoshenko beam, Hamilton principle, vibration of plates, collocation method, myklested prohl method.

Transient vibrations : duhamel's integral, method of step input, phase plane method, method of laplace transformation, drop test spectra by laplace transformations.

Non linear vibrations : non linear vibrations and superposition principle, examples of non linear vibrations, method of dealing with non liner vibrations, phase plane trajectories, method of direct integration, perturbation method, iteration method, Fourier series.

### References Books :

1. Theory of vibration with applications - W. T. Thomson (PHI)
2. Theory and practice of mechanical vibrations : J.S. Rao & K. Gupta (Wiley eastern)
3. Mechanical vibration - S.S. Rao (Addison Wesley)
4. Vibration and noise for Engineers - Kewal Pujara (Dhanpat Rai and Co.)
5. Mechanical vibrations - G.K. Grover and Nigam (Nem chand and sons)
6. An introduction to mechanical vibrations - Steidel (John Wiley)
7. Elements of vibration analysis - Meirovitch (TMH).

### M 705 4 : Instrumentation and Automatic Control

Syllabus to be defined before the start of Third Semester.

### M 705 5 : Non-Conventional sources of Energy

Introduction to non-conventional sources of energy, difference between conventional and non-conventional sources of energy.

Geothermal energy : hot springs and steam ejection, site selection, power plants, and advance concepts.

Solar energy : principles scope and application solar water heating, solar stills, solar cooling, solar cells.

Fusion : nuclear reactions, fuel ignition temperature.

Wind energy : wind energy potential measurement, aerofoil design, windmill and windmill electric generator.

Hydropower : mini and micro hydel

Biogas : aerobic and anaerobic bio conversion processes, raw material properties of biogas (calorific value and comparison), biogas plant technology and status.

#### Reference books :

1. Application of solar energy : Dr. N.D. Tiwari
2. Energy Technology : G.D. Rai.

### M 705 6 : Energy Ecology and Environment

Origin of the earth, Earth's temperature and atmosphere. Sun as a source of energy, nature of its radiation, Biological processes, photo-synthesis, Food chains, Marine ecosystem, Ecosystem theories, Autecology, sources of energy, classification of energy sources, quality and concentration of an energy source, characteristics temperature. Fossil fuel : coal, oil, gas, geothermal, tidal and nuclear energy. Solar, wind, hydropower, biomass. Resources of energy and energy use pattern in different regions of the world. Environmental degradation, primary and secondary pollutants. Thermal and radioactive pollution, air and water pollution. Micro climatic effects of pollution, Pollution from stationary and mobile sources. Biological effects of radiation, heat and radioactivity disposal. Pollution abatement methods.