

M.D.UNIVERSITY, ROHTAK
SCHEME OF STUDIES AND EXAMINATION
M.TECH 1st YEAR (MANUFACTURING & AUTOMATION)
SEMESTER 1
CBCS Scheme effective from 2016-17

Sl. No	Course Code	Subject	Credit Pattern				Examination Schedule (Marks)				Duration of Exam (Hours)	No of Hours /week	
			L	T	P	Total Credits	Marks of Class work	Theory	Practical	Total			
1	MTMA21C1	Metal Forming Analysis	4	0	-	4	50	100	-	150	3	4	
2	MTMA21C2	Mechatronics & Product Design	4	0	-	4	50	100	-	150	3	4	
3	MTMA21C3	Total Quality Management	4	0	-	4	50	100	-	150	3	4	
4	MTMA21C4	Welding & Allied Processes	4	0	-	4	50	100	-	150	3	4	
5	MTMA21C5	Mechatronics Lab	-	-	2	2	50		50	100	3	4	
6	MTMA21C6	Welding Lab	-	-	2	2	50		50	100	3	4	
7	MTMA21C7	CAD/CAM Lab	-	-	2	2	50		50	100	3	4	
8	MTMA21C8	Seminar	-		-	2	50	-	-	50		2	
9	MTMA21D1 or MTMA21D2 or MTMA21D3 OR MTMA21D4	Elective I	4	-		4	50	100		150	3	4	
		TOTAL					28						

Elective I: Choose any one from the following three papers:

MTMA21D1 - INDUSTRIAL INSPECTION

MTMA21D2 - DESIGN AND METALLURGY OF WELDED JOINTS

MTMA21D3 - FOUNDRY TECHNOLOGY

MTMA21D4-DESIGN PLANNING CONTROL AND PRODUCTION SYSTEM

NOTE:

Examiner will set nine questions in total. Question One will be compulsory and will comprise short answer type questions from all sections and remaining eight questions to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

M.D.UNIVERSITY, ROHTAK
SCHEME OF STUDIES AND EXAMINATION
M.TECH 1st YEAR (MANUFACTURING & AUTOMATION)
SEMESTER 2
CBCS Scheme effective from 2016-17

Sl. No	Course Code	Subject	Credit Pattern				Examination Schedule (Marks)				Duration of Exam (Hours)	No of Hours/week
			L	T	P	Total Credits	Marks of Class works	Theory	Practical	Total		
1	MTMA22C1	Mechanical Design-I	4	0	-	4	50	100	-	150	3	4
2	MTMA22C2	Diagnostic Maintenance & Monitoring	4	0	-	4	50	100	-	150	3	4
3	MTMA22C3	Seminar	-	-	-	2	50	-	-	50		2
4	MTMA22C4	CIM Lab	-	-	2	2	50	-	50	100	3	4
5	MTMA22C5	Diagnostic Maintenance & Monitoring Lab	-	-	2	2	50	-	50	100	3	4
6	MTMA22D1 or MTMA22D2 or MTMA22D3 or MTMA22D4	Elective-II	4	0	-	4	50	100	-	150	3	4
7		Open Elective	3	0	-	3						
8		Foundation Elective	2	0	-	2						
		TOTAL	23									

NOTE: Examiner will set nine questions in total. Question One will be compulsory and will comprise short answer type questions from all sections and remaining eight questions to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Elective II : Choose any one from the following three papers:

MTMA22D1 - QUALITY CONTROL TECHNIQUES

MTMA22D2 - FINITE ELEMENT METHODS

MTMA22D3 - ARTIFICIAL INTELLIGENCE IN MANUFACTURING

Open Elective: A candidate has to select this paper from the pool of Open Electives provided by the University.

Foundation Elective: A candidate has to select this paper from the pool of Foundation Electives provided by the University.

MTMA21C1- METALFORMINGANALYSIS

L T P CREDIT
4 0 0 4
TOTAL :150 Marks

SESSIONAL:50 Marks
THEORY :100 Marks

DURATION OF EXAM. :3 Hrs.

Unit 1

Stress-StrainrelationsinElasticandplasticDeformations ,True stress and true strain,true stress-straincurves,selectionof stress-straincurvesfor cold and hotworking,yield of isotropicplastic material,yieldcriteria.Trescamaximumsheer-strain-energyriterion,plasticincompressibility,Poisson'sratioforplasticdeformationflowrule, applicationoftheory ofplasticity forsolvingmetal formingproblemsusingSlabmethod,Upper andlowerBound methods,Sliplinefieldtheory.

Unit 2

Technologyandanalysisofimportantmetalformingprocesses- Forging,Roiling,Extrusion.Wiredrawing,SheetMetalforming processeslikeDeepdrawing,Stretchforming,Bending,defectsinariousmetal formingprocesseslikerolling,foraging,extrusion,wiredrawinganddeepdrawingandtheircauses andremedialmeasures,Effectsoftemperatureand strainratein metalworking,friction andlubricationinHotandColdworking.

Unit 3

Lubricationinmetal formingprocesses,principlesandmechanismoflubrications,hydrodynamicand theirfilmlubrication,boundary andextremepressurelubricants,solidlubricants,lubricantsusedfor rollingandcolddrawing,foraging,

Unit 4

Applicationof FiniteElementMethodstoMetalForming Processes-special Discretization,Shapefunction,Stiffness matricesandtheir assembly,Implicitandexplicit formulations, Elasto-plasticapproximations,LagrangianVsEularianschemes, Materialintegrationschemes,auxiliaryequationsfor contact, frictionandincompressibility, Thermo-mechanicalproblem formulation

REFERENCEBOOKS:

1. MetalFormingAnalysis-R.H.Wagoner,CambridgeUniversityPress.
2. Theory ofElasticity-Dallyand Riley
3. MechanicalMetallurgy-Dieter, McGrawHillInc.
- 4.AnIntroductiontothePrinciplesofMetalworkingbyRowe,Arnold.
5. MetalforminganalysisbyAvitzter,Mcgrawhill.

MTMA21C2-MECHATRONICS & PRODUCT DESIGN

L T P CREDIT
4 0 0 4
TOTAL :150 Marks

SESSIONAL:50 Marks
THEORY :100 Marks

DURATION OF EXAM. :3 Hrs.

Unit 1

Introduction to Mechatronic 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/microcontroller, Integrated circuits-signal conditioning processes, various types of amplifiers, low pass and high pass filters.

Unit 2

Sensors-sensors and transducers. Displacement, position proximity sensors, velocity, force sensors. Fluid pressure 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 Mechatronics system.

Unit 3

Principles of Electronic system communication, Interfacing, A.D. and D.A. converters. 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, elected mechanical, Hydraulic mechanical system., System Transfer functions. First-second order system in series

Unit 4.

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

REFERENCE BOOKS:

1. Mechatronics by W. Bolton, published by Addison Worley Longman Pvt. Ltd., India Brander, Delhi.
2. Automation Production System System and CIMS by Mikel P Groover, Prentice Hall of India Pvt. Ltd, New Delhi.
3. Production Systems and CIM, Groover, PHI.
4. Flexible Manufacturing systems, by Maleki, Prentice Hall.

MTMA21C3- TOTAL QUALITY MANAGEMENT

L T P CREDIT
4 0 0 4
TOTAL :150 Marks

SESSIONAL:50 Marks
THEORY :100 Marks

DURATION OF EXAM. :3 Hrs.

Unit1

1. TQM Perspective and TQM Implementation:

Quality, Chain Reaction, Dimensions of Quality, Evolution Of Quality, Quality Control, Quality Assurance, Quality Planning, Quality Improvement, Quality Management, Total Quality Management, Cost Of Quality, Classification of Failure Cost, Reducing Costs, Juran's Model Of Optimum Quality Costs, Analysis of COQ For Improvement, Analysis Of External And Internal Failure Costs, TQM, Elements Of TQM, Leadership For TQM, Demings 14 Points For Top Management, TQM Tools And Techniques, PDSA, Barriers For TQM Implementation

Unit 2

2. TQM principles and Strategies:

Customer Satisfaction & Employee Involvement.
Service Quality, Features Of Services, The Kano Model, Employee Motivation, Motivation Theory Of Individual Employees, Effective Communications, Training And Mentoring, Recognition And Reward.
Continuous Process Improvement and Process Approach.
Juran's Trilogy, Kaizan, PDCA, Seven Quality Tools, BPR, Seven Deadly Wastes, ETX Model, Lean Manufacturing, Kanban System, Cellular Manufacturing, Single Piece Flow, Zero Defects

Unit3

3. Statistical Process Control & TQM Tools

The Seven Quality Control Tools, Standard Normal Distribution, AQL, Seven Management Tools, Benchmarking, QFD, Taguchi's Design, TPM, FMEA

Unit 4

4. Quality Systems

ISO9000 standard, EMS14001, Quality Awards
Supplier Partnership and Performance Measures-
Importance Of Suppliers, Selection And Standards, Quality Audit, Product Audit, Vendor Rating System, PDCA For Measurements, Performance Measure Design, BSC.

REFERENCEBOOKS:

1. "Total Quality Management" by Oakland (Butterworth- Heinemann Ltd.)
2. "Managing for total quality from Deming to Taguchi and SPC" by Logothetis N. (PHI)
3. "Total Quality Control" by Feigenbaum A. V. (MGH)
4. "Total Quality Management" by Besterfield Dale H (Pearson Education)
5. "Aslice by slice guide to TQM" by John Gilbert (Affiliated East West Press).
6. "The TQM toolkit- a guide to practical techniques for TQM" by Waller Jenny, Allen Derek and Burna Andrew (Kogan Page)

MTMA21C4- WELDING AND ALLIED PROCESSES

L T P CREDIT
4 0 0 4
TOTAL :150 Marks

SESSIONAL:50 Marks
THEORY :100 Marks

DURATION OF EXAM. :3 Hrs.

Unit 1

Introduction: Basic classification of welding processes, weldability, weld thermal cycle, metallurgy of fusion welds, solidification mechanism and microstructural products in weld metal, epitaxial, cellular and dendritic solidification, metallurgical changes in weld metal, phase transformation during cooling of weld metal in carbon and low alloy steel, prediction of microstructures and properties of weld metal. Heat affected zone, re-crystallization and grain growth of HAZ, gas metal reaction, effects of alloying elements on welding of ferrous metals.

Unit 2

Welding Arc: Arc efficiency, temperature distribution in the arc; arc forces, arc blow, electrical characteristics of an arc, mechanism of arc initiation and maintenance, role of electrode polarity on arc behaviour and arc stability, analysis of the arc.

Types of electrodes, AWS and Indian system of classification and coding of covered electrode for mild steel, Shielding gases and associated mixtures

Unit 3

Metal transfer: Short circuit/dip transfer. Free flight. Globular type. Spray type, Forces affecting metal transfer. Weld bead geometry and shape factors, Weld dilution.

Electric arc welding principle, 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 (SAW):- principle of processes, applications, fluxes and

welding electrodes used. CO₂ welding:-

difference from MIG welding, Principle of operation, equipment, welding parameters and applications.

Unit 4

Solid state welding: Introduction, main features and applications

of Ultrasonic welding, Friction welding and Explosive welding, friction stir processing and welding.

Welding of plastics: Difficulties in welding of Plastics, Processes for welding of Plastics.

Underwater Welding: Introduction, methods and applications.

Automation in Welding: Introduction, Semi automatic welding, Automatic welding, Welding mechanization, Flexible Automated

Welding, Robotic welding, Types of Welding

Robots, Robot

Selection Mechanics, Joint tracking system.

REFERENCE BOOKS

1. Welding processes & technology by Dr. R.S. Parmar Khanna Publishers
2. Welding Engineering & Technology by Dr. R.S. Parmar Khanna Publishers
3. Modern Arc Welding Technology by S.V. Nandkarni Oxford & IDH Publishing Co. Principles of Welding Technology by L.M. Gourde LBS/Edward Arnold
4. The Physics of welding by Lancaster; Pergamon Press.
5. The Metallurgy of welding by Lancaster; George Allen & Unwin Ltd. U.K.
Welding handbook, Vol. 1 & 2, seventh edition; American Welding Society. Metal Handbook, Vol 6, 73; ASME
6. Procedure Handbook of ARC welding; Lincoln Electric Co. USA.
7. The Solid phase welding of metals by Tylecote; Edward Arnold Pvt. Ltd.
Welding & Welding Technology Richard L. Little, McGraw Hill.
Welding Technology by Rossi; McGraw Hill.
8. Welding Technology by Koenigsberger and Adaer; Macmillan.

MTMA 21C5- MECHATRONICSLAB

L T P CREDIT
0 0 3 2
TOTAL :100 Marks

SESSIONAL:50 Marks
PRACTICAL :50Marks

DURATION OF EXAM. :3 Hrs.

1. To verify truth table of various gates such as AND, OR, NOR, NOT, etc
2. To realize a logic equation $Y=AB+CD$
3. Selection of sensor for a particular application from Catalogue/ Internet.
4. Design a mechatronics product/system and incorporate application of mechatronics for enhancing product values
5. To study the hardware's and softwares of mechatronics kit.
6. To move a table in X-direction within the range of proximity sensors using Control-X software.
7. To rotate a table using DAC system.
8. To move a table in Y-direction within the range of proximity sensors using Control-X software.
9. To run a motor with PLC.
10. To run a conveyor with computer.
11. To study the movement of actuating cylinders and sensors.
12. To study mechatronics and their interfacing in a CNC machine.
13. Life prediction from computer programme based on mathematical model.

MTMA21C6- WELDINGLAB

L T P CREDIT
0 0 3 2
TOTAL :100 Marks

SESSIONAL:50 Marks
PRACTICAL :50Marks

DURATION OF EXAM. :3 Hrs.

LIST OF EXPERIMENTS IN WELDING

1. To study Heat flow in Welding

(Equipment for use - Gas Welding equipment)

2. To study tensile property, Bead Geometry, Hardness of Bead, Microstructure of welding Bead in case of:

i) MIG Welding ii) TIG Welding

iii) SAW Welding iv) Arc welding

3 To study mechanical behaviour (tensile strength Hardness of Bead, Micro structure of welding Bead , impact strength , corrosion and wear , fatigue behaviour) in case of.

1. Friction stir welding

2. Friction stir processing

MTMA21C7- CAD/CAM LAB

L T P CREDIT
0 0 3 2
TOTAL :100 Marks

SESSIONAL:50 Marks
PRACTICAL :50Marks

DURATION OF EXAM. :3 Hrs.

SECTION-I

1. Develop a general purpose code to carry out the Rotation of an object about an axis passing through two points
2. Develop a general purpose code to carry out
 - i) an Orthographic projection
 - ii) Dimetric projection, given foreshortening factor F_z
 - iii) An Isometric projection
 - iv) A Perspective Projection given Z_c, IT
3. Develop a general purpose code, given two arbitrary projections and the respective transformation matrices and the reconstructed coordinates of the vertices of the Object.
4. Develop a general purpose code to carry out the Reflection of an Object about an arbitrary plane passing through Three points.

SECTION-II

1. Develop a general purpose code for integrated
 - i) Cubic Spline with Different Boundary conditions
 - ii) Bezier curve
 - iii) B-spline - its various types and Best Fit B-spline. Given:
 - a) Coordinates of the Control Points
 - b) Boundary conditions, if any.
 - c) Order of the curve, if required, and Match the output to projected image of any CAD/CAM package.

SECTION-III

1. Develop an optimized Tool Path for Economic Machining and generate the same in GUI (IDEAS/PRO-E/any CAD software) for interpretation
2. Study of Graphics Formats and Conversion from one format to another
3. Generate the Meshing of the CONICAL Cylindrical Surface (a part of stepped cylindrical surface) using any simulation Package
4. Study of OpenGL programming for the customization of any CAD package
5. Development of following surface patches
 - i) Bilinear Coons Patch
 - ii) Tensor Product Bezier Surface

SECTION-IV

1. Solid Modelling Exercises using any CAD/CAM package. (from a given list of 10 Tutorials)
2. Generative machining interpretation for various tool paths for machining of Curved surfaces.

List of Soft Core –I

MTMA21D1- INDUSTRIAL INSPECTION

MTMA21D2- DESIGN AND METALLURGY OF WELDED JOINTS

MTMA21D3- FOUNDRY TECHNOLOGY

MTMA21D4- DESIGN, PLANNING AND CONTROL OF PRODUCTION SYSTEMS

MTMA21D1: INDUSTRIAL INSPECTION

L T P
4 0 0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam : 3 Hrs

UNIT1.

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

UNIT2.

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

UNIT3

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.

UNIT 4

Geometrical and positional tolerances
Geometrical and physical limitations in measuring devices.

REFERENCES:

1. Metrology:-1 .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

MTMA21D2- . DESIGN AND METALLURGY OF WELDED JOINTS

L T P Sessional : 50 Marks

4 0 0 Theory : 100 Marks

Total : 150 Marks

Duration of Exam : 3 Hrs

UNIT 1.

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.

UNIT2.

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.

UNIT3.

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 tests: 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.

UNIT4.

.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, economics 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.

MTMA21D3- FOUNDRY TECHNOLOGY

L T P
4 0 0

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam : 3 Hrs.

UNIT 1

1. Items (Domestic and Engg.) made by foundry technology. Advantage and limitations of foundry technology and other manufacturing process.
2. Castability and factors favoring castability. Ferrous and Non ferrous casting metals and alloys and items made of them.
3. Melting furnaces for cast iron , cast steels, aluminium alloys, brass and bronzes.
4. Solidification of castings.

UNIT 2

5. Mold design considerations: Conceptual, functional and production phase. Pattern and core design considerations, traffic rules applications. Examples, case studies.
6. Gating system elements: objectives,practicalrules,optimal time filling, types of pouring basin, types of gates, types of risers.

UNIT3

7. Special casting methods: Gravity die casting, cold chamber die casting, hot chamber die casting, investment casting, centrifugal casting,shell mold casting.continuous casting.
8. Rough cleaning (Fettling) and surface cleaning of castings.
9. Casting inspection.

UNIT 4

10. Repair and salvage of castings.
11. Heat treatment of castings.
12. Quality control of castings.
13. Pollution control in foundry.
14. Modernisation of foundry.

REFERENCE BOOKS:

1. Principal of metal casting by Richard W.Heine , Carl R Hoper. Philip C. RosenthaT, Tata Me Graw Hill.
2. Principal of foundary technology by P. L. Jain , Tata Me Graw Hill
3. Foundary practice by W.H. Salmon

MTMA21D4: DESIGN PLANNING AND CONTROL OF PRODUCTION SYSTEM

L-T-P

4 0 0

Sessional :50

Theory :100 marks

Total :150 marks

Duration of Exam :3hrs

UNIT 1

Introduction to production systems : Aim of production system, generalized model and types of production systems Features compiling service organizations, life cycle approach to production management.

UNIT 2

Product development and design : New product development and process selection, stages in new product development, use of decision tree, Break even analysis, Make// buy decision, Problems for break even analysis non linearity in B.E. analysis, selection of location among alternatives- A case study, systematic layout planning, objectives , types, comparison and application of different types of layouts,.

UNIT 3

Assembling line balancing concept and problems for maximum line efficiency. Planning for production : Importance, objective and types of forecasting methods, Analysis and comparison standard error of estimate, Material Requirement planning, (MRP) objective, dependent demand, input to MRP, MRP model, Production schedule, MRP logic comparison.

UNIT 4

Sequencing & 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\

Reference Books ; 1. Production operations management : Buffa, Edwood 2. Elements of production , planning and control - Eilon Samuel A 3. Production control: A quantitative approach - Biegel. J 4. Industrial engineering and production management - MartandTelsang 5. Operations management- Theory and problems- Joseph Monks

MTMA22C1- MECHANICAL DESIGN-I

L	T	P	CREDIT
4	0	0	4

SESSIONAL:50 Marks
THEORY :100 Marks
TOTAL :150 Marks
DURATION OF EXAM. :3 Hrs.

Unit 1

1. Concept Design: Brainstorming methods and sketching

Unit 2

- 2 Quality Function Development
- 3 Material Characteristics: Mechanical, thermal and electrical properties.

Unit 3

- 4 Design: Design for assembly. Design for manufacturing.

Unit 4

- 5 Production technologies: Metal forming, casting, machining, surface treatment, welding, bonding, fastening, clinching.

REFERENCE BOOKS:

1. Quality Function development, L. Cohen.
2. Manufacturing Engg.: Principles for Organization, D.T. Koenig.
3. Materials Science and Engineering: An Introduction, W.D. Callister Jr.
4. Handbook of Aluminum: Alloy Production and Materials Manufacturing Vol.2, G.E. Totten.
5. CAD Software Catia, Dassault system.

MTMA22C2- Diagnostic Maintenance & Monitoring

L T P CREDIT
4 0 0 4

SESSIONAL: 50 Marks

THEORY : 100 Marks

TOTAL : 150 Marks

DURATION OF EXAM. : 3 Hrs.

Unit 1

Maintenance Management

Relevance of maintenance, maintenance: an overview, maintenance services, problems of the plant manager, automation and maintenance, maintenance objectives and costs, quality and quality circle in maintenance, Engineering reliability, maintainability

Unit 2

Failure analysis

Defect generation, types of failures, FTA, FMEA, FMECA

Maintenance Types/systems

Planned and unplanned

maintenance, breakdown, corrective, opportunistic, routine, preventive, predictive, CBM, Design out maintenance

Unit 3

Condition monitoring

NDT concepts, visual and

temperature monitoring, leakage monitoring, vibration monitoring, lubricant monitoring- methods, equipments, ferrography, spectroscopy, cracks monitoring, thickness monitoring, corrosion monitoring, noise monitoring, sound monitoring, smell monitoring

Unit 4

Total productive maintenance

Development and scope of concept, TPM, terotechnology, basic systems of TPM, procedure and steps of TPM, productivity circle

Books:

Maintenance planning and control - Kelly, A. Buttersworth & Co. 1984

Maintenance and spare parts Management - Krishanan G, Prentice Hall - 1991

MTMA22C4- CIM LAB

L T P CREDIT

0 0 3 2

TOTAL :100 Marks

SESSIONAL:50 Marks

PRACTICAL :50Marks

DURATION OF EXAM. :3 Hrs.

LIST OF EXPERIMENTS:

1. To study general features of Machining Center.
2. To prepare the CNC part program for machining a prismatic component on CNC machining centre.
3. To study the general features of a CNC Turning center.
4. To prepare the CNC part program for machining of a Cylindrical Component.
5. Study and Application of Robotics system in Automated storage and Retrieval system.
6. Application and Control of robotics system in Flexible manufacturing System.
7. To study the general features of Automated Guided Vehicle.
8. To study the general configuration of CMM and its Application in CIM environment.
9. Machine Vision and Quality Control in CIM environment.
10. Study and Application of Conveyor System in CIM system.
11. Study and application of CIM software

MTMA22C5- Diagnostic Maintenance & Monitoring Lab

L T P CREDIT
0 0 3 2
TOTAL :100 Marks

SESSIONAL:50 Marks
PRACTICAL :50Marks

DURATION OF EXAM. :3 Hrs.

List of Experiments.

1. To study the introduction to maintenance techniques, preventive and predictive Maintenance
2. To study and perform Non-Destructive Testing techniques , liquid dye penetrant and leak testing.
3. To study and perform, Boroscope , Flexiscope.
4. To study and perform Eddy current testing & Ultrasonic testing .
5. To study and perform Magnetic particle detection and Particle counter.
6. To study wear Analysis through thermography and Ferrography.
7. To study the applications of Diagnostic Maintenance to Industrial Machines and plants such as Sugar Industry or Textile Mills or Thermal Power plants and Railways.
8. To study the Maintenance planning and control of a large factory, work planning and work control.

List of Soft Core –II

MTMA22D1- QUALITY CONTROL TECHNIQUES

MTMA22D2- FINITE ELEMENT METHODS

MTMA22D3- ARTIFICIAL INTELLIGENCE IN MANUFACTURING

MTMA22D1- QUALITY CONTROL TECHNIQUES

L T P CREDIT
4 0 0 4

SESSIONAL:50Marks
THEORY :100 Marks
TOTAL :150Marks
DURATION OF EXAM. :3 Hrs.

UNIT I

Statistical concepts in Quality Control, variables and attributes, Graphical Representation, 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, X, R and P charts, fixation of control limits, Type I and Type II Errors,

UNIT II

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 subgrouping, 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.

UNIT III

Special control charts for variables, group control chart, control charts with large sub groups, control chart with reject limits, use of control limits for moving averages

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, CUSUM or Cumulative sum control chart, Average run length (ARL) Relative efficiency or sensitivity of control chart.

UNIT IV

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,

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. Bestfield
4. Total Quality Control by A. Y. Feigenbaum
5. Elementary S.O.L. by I.W. Burr, M. Dekkar.

MTMA22D2- FINITEELEMENTMETHODS

L T P CREDIT
4 0 0 4

SESSIONAL:50 Marks
THEORY :100 Marks
TOTAL :150 Marks
DURATION OF EXAM. :3 Hrs.

UNIT I

ReviewofbasicFEMconcepts

FEMDiscretizationandthe DirectStiffnessMethod:Basic
conceptsofstructuralmodeling,Reviewofthestiffnessmethod
ofstructuralanalysis,Modelingstiffness,loadsanddisplacement boundaryconditions

FormulationofFiniteElements:Mathematicalinterpretationof
finiteelements,variationalformulation,Developmentofcontinuum elements,shape
functions,consistentloads,Isoparametricelementsforplanestress,Numericalintegration,Conv
ergence requirements.

Computer ImplementationoftheFiniteElement Method: Preprocessing:model
definition,Elementlevelcalculations,
Equationassembly,Equationsolver,Postprocessing:strainand stressrecovery.

UNIT II

Advancedtopicsinlinearproblems:Staticcondensation andsub-structuring,
Patchtestandincompatibleelement,p- formulation
AdvancedBeam,PlateandShellelements:

- a. Timoshenko beam theory (shear locking)
- b. Plate and shell theory
 - i. Thin plate and Mindlin plate (shear and membrane locking)
 - ii. Mixed formulation for plate and shell
 - iii. Degenerated shell formulation

Dynamic analysis using FEM

- a. Consistent mass and lumped mass, mass lumping technique
- b. Time integration methods: explicit, implicit, explicit-implicit methods.
- c. Stability, convergence and consistency
- d. Hyperbolic systems: structural dynamics and wave propagation
- e. Parabolic system: transient heat transfer
- f. Modal solution for natural frequencies and mode shapes g. Modal Superposition
method for structural dynamics

Nonlinear analysis

- a. Nonlinear solution procedures
- b. Newton-Raphson, modified Newton-Raphson, and secant methods
- c. Line search algorithm
- d. Automatic time step control

UNIT III

Material nonlinearity

- a. Rate independent elastoplasticity with return-mapping algorithm

- b. Isotropic and kinematic hardening with Baushing effect
- c. Consistent tangent operator
- d. Objective rate and finite rotation elastoplasticity
- e. Multiplicative decomposition and finite deformation elastoplasticity

Geometric nonlinearity

- a. Generalized strain and stress
- b. Total and Updated Lagrangian formulation
- c. Kirchhoff stress and Cauchy stress

Boundary nonlinearity

- a. Frictionless contact problems
- b. Penalty, Lagrange multiplier, augmented Lagrange multiplier, and perturbed Lagrange multiplier methods
- c. Frictional contact problems including frictional return mapping algorithm
- d. Rigid-flexible contact and flexible-flexible contact
- e. Multiplicative decomposition and finite deformation elastoplasticity

UNIT IV

Geometric nonlinearity

- a. Generalized strain and stress
- b. Total and Updated Lagrangian formulation
- c. Kirchhoff stress and Cauchy stress

Boundary nonlinearity

- a. Frictionless contact problems
- b. Penalty, Lagrange multiplier, augmented Lagrange multiplier, and perturbed Lagrange multiplier methods
- c. Frictional contact problems including frictional return-mapping algorithm
- d. Rigid-flexible contact and flexible-flexible contact

Assignments and Tutorials are essential parts of this course.

Various programming and formulation problems will be assigned throughout the course of study. In addition, students

are required to complete one project related to computer

implementation of FEM concepts, application to plasticity,

solving nonlinear structural problems using commercial programs

MTMA22D3- ARTIFICIALINTELLIGENCEINMANUFACTURING

L T P CREDIT
4 0 0 4

SESSIONAL:50 Marks
THEORY :100 Marks
TOTAL :150 Marks
DURATION OF EXAM. :3 Hrs.

UNIT I

Definition,basicconceptsofartificialIntelligence,scope,roleand potentialofartificialintelligenceinmanufacturing,Expertsystems, PopularAIapplication.

UNIT II

OverviewofExpert systems,architecture,comparisonwith procedural programming,developingExpertsystemfortypical manufacturingdomains,implementationandmaintenance,state-of-art Expert systemapplication, casestudy.

UNIT III

Altheoryproblems,problemspacesandsearch,Heuristicsearch technique,Knowledgeacquisitionandknowledgerepresentation, predicatelogic,procedurals,Declarativeknowledge,forwardV/ s backwardreasoningAI architecture,overviewofadvanced features,planning,learning,naturallanguageprocessing,neural nets,fuzzylogic,objectorientedprograms.

UNIT IV

Case studies,examples ofAI, theoreticalconceptstomanufacturing problems,CAD, CAPP,scheduling GT,CIM system. Domainswelding,casting,forming,metalcutting,maintenance

