Maharshi Dayanand University, Rohtak

SCHEME OF STUDIES & EXAMINATIONS

M.Tech. 1st YEAR (SEMESTER-I) Manufacturing & Automation

w.e.f. 2016-17

The credit requirement of the course:
Hard core courses
Soft core courses
Open elective courses
Foundation course

Subject code	Subject	Credit	L	T	P	Marks of class work	Examination Marks		Total	Duration of exam. (hrs)
							Theory	Practical		
Hard Core1=MTMA 501A	Metal Forming Analysis	4	4			50	100		150	3
Hard Core2=MTMA 503A	Mechatronics & Product Design	4	4			50	100		150	3
Hard Core3=MTMA 505A	Total Quality Management	4	4			50	100		150	3
Hard Core4=MTMA 507A	Welding & Allied Processes	4	4			50	100		150	3
Hard Core Lab1=MTMA 509A	Mechatronics Lab	1.5			3	50		100	150	
Hard Core Lab2=MTMA 511A	Welding Lab	1.5			3	50		100	150	
Hard Core Lab3=MTMA 513A	CAD/CAM LAB	1.5			3	50		100	150	
Seminar =MTMA 515A		1.5			3	50			50	
Soft core-I =MTMA 517A-MTMA 525 A		4	4			50	150		150	3
Total		26	20		12	450	500	300	1250	15

MTMA 501A- METAL FORMING ANALYSIS

L	T	P	CREDIT	SESSIONAL:50 Marks
4	0	0	4	THEORY :100 Marks
				TOTAL :150 Marks
				DURATION OF EXAM. :3 Hrs.

Unit 1

Stress- Strain relations in Elastic and plastic Deformations ,True stress and true strain, true stress-strain curves, selection of stress-strain curves for cold and hot working, yield of isotropic plastic material, yield criteria. Tresca maximum sheer-strain- energy criterion, plastic incompressibility, Poisson's ratio for plastic deformation flow rule, application of theory of plasticity for solving metal forming problems using Slab method, Upper and lower Bound methods, Slip line field theory.

Unit 2

Technology and analysis of important metal forming processes- Forging, Roiling, Extrusion. Wire drawing, Sheet Metal forming processes like Deep drawing, Stretch forming, Bending,defects in various metal forming processes like rolling, forging, extrusion, wire drawing and deep drawing and their causes and remedial measures,Effects of temperature and strain rate in metal working, friction and lubrication in Hot and Cold working.

Unit 3

Lubrication in metal forming processes, principles and mechanism of lubrications, hydrodynamic and their film lubrication, boundary and extreme pressure lubricants, solid lubricants, lubricants used for rolling and cold drawing, forging,

Unit 4

Application of Finite Element Methods to Metal Forming Processes- special Discretization, Shape function, Stiffness matrices and their assembly, Implicit and explicit formulations, Elasto-plastic approximations, Lagrangian Vs Eularian schemes, Material integration schemes, auxiliary equations for contact, friction and incompressibility, Thermo-mechanical problem formulation

REFERENCE BOOKS:

1. Metal Forming Analysis- R. H. Wagoner, Cambridge University Press.
2. Theory of Elasticity- Dally and Riley
3. Mechanical Metallurgy- Dieter, McGraw Hill Inc.
4. An Introduction to the Principles of Metal working by Rowe, Arnold.
5. Metal forming analysis by Avitzer, Mcgraw hill.

MTMA 503A- MECHATRONICS & PRODUCT DESIGN

L	T	P	CREDIT	
4	0	0	4	

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

Unit 1

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/rnicrocontrolles, 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 Mechatronic 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 Mechatronics 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 products etc, 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 Grooer, Phentice Hall of India Pvt. Ltd, New Delhi.
3. Production Systems and CIM, Groover, PHI.
4. Flexible Manufacturing systems, by Maleki,Prentic Hall.

MTMA 505A- TOTAL QUALITY MANAGEMENT

L	T	P	CREDIT	
4	0	0	4	

SESSIONAL:50 Marks
THEORY :100 Marks
TOTAL :150 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 Nd 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 Triology, 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.

REFERENCE BOOKS:

1. "Total Quality Management" by Oakland (Butterworth - Heinamann 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. "A slice 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

MTMA 507A- WELDING AND ALLIED PROCESSES

L	T	P	CREDIT	
4	0	0	4	

SESSIONAL:50 Marks
THEORY :100 Marks
TOTAL :150 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. CO_2 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.

Under water Welding: Introduction, methods and applications.

Automation in Welding: Introduction, Semiautomatic 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. Gourd ELBS/ Edward Arnold
4. The Physics of welding by Lancaster; Pergaman Press.
5. The Metallurgy of welding by Lancster; 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.

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MTMA 509A- MECHATRONICS LAB

L	T	P	CREDIT	
0	0	3	1.5	

SESSIONAL:50 Marks
THEORY :100Marks
TOTAL :150 Marks
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.

MTMA 511A- WELDING LAB

L	T	P	CREDIT	
0	0	3	1.5	

SESSIONAL:50 Marks
THEORY :100 Marks
TOTAL :150 Marks
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, Micro structure 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

MTMA 513A- CAD/CAM LAB

L	T	P	CREDIT	SESSIONAL:50 Marks
0	0	3	1.5	THEORY :100 Marks
				TOTAL :150 Marks
				DURATION OF EXAM. :3 Hrs.

SECTION -I

1. Develop a general purpose code to cany 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 Fz
   iii) An Isometric projection·
   iv) A Perspective Projection given Zc, I T
3. Develop general purpose code, given two arbitrary projections and the respective transformatio n 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

MTMA 519 A- INDUSTRIAL INSPECTION
MTMA 521 A- DESIGN AND METALLURGY OF WELDED JOINTS
MTMA 523 A- FOUNDARY TECHNOLOGY
MTMA 525 A- DESIGN, PLANNING AND CONTROL OF PRODUCTION SYSTEMS

MTMA 519 A: INDUSTRIAL INSPECTION

L T P	Sessional : 50 Marks
4 0 0	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

MTMA 521 A . 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

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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 jobsfabrication 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.

MTMA 523 A- FOUNDRY TECHNOLOGY

L T P	Sessional : 50 Marks
4 0 0	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,practical rules,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

MTMA 525 A: 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, ues 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 - Martand Telsang 5. Operations management- Theory and problems- Joseph Monks

Maharshi Dayanand University, Rohtak
SCHEME OF STUDIES & EXAMINATIONS
M.Tech. 1st YEAR (SEMESTER-II) Manufacturing & Automation
w.e.f. 2016-17

Subject code	Subject	Credit	L	T	P	Marks of class work	Examination Marks		Total	Duration of exam. (hrs)
							Theory	Practical		
Hard Core1=MTMA 502A	Mechanical Design –I	4	**4**			50	100		150	3
Hard Core2=MTMA 504A	Diagnostic Maintenance & Monitoring	4	**4**			50	100		150	3
Open Elective=MTMA 514A	List	3	**3**			50	100		150	3
Hard Core Lab1=MTMA 506A	CIM lab	1.5			3	50		100	150	
Hard Core Lab2=MTMA 508A	Diagnostic Maintenance & Monitoring Lab	1.5			3	50		100	150	
Seminar =MTMA 510A		1.5			3	50			50	
Soft core-II= MTMA 512A-MTMA 518A	List	4	**4**			50	100		150	3
Foundation		2	**3**			**50**	**100**		**150**	**3**
Total		21.5	**18**			**400**	**500**	**200**	**1100**	**15**

MTMA 502A- 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.

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Unit 1

1. Concept Desgin : 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 , maching, surface treatment, welding, bonding, fastening, clinching.

REFERENCE BOOKS:

1. Quality Function development ,L. Cohen.
2. Manfacturing 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 Manfacturing Vol. 2, G.E. Totten.
5. CAD Software Catia, Dassault system.

MTMA 504A- Diagnostic Maintenance & Monitoring

L T P CREDIT **SESSIONAL:50 Marks**
4 0 0 4 **THEORY :100 Marks**
TOTAL :150 Marks
DURATION OF EXAM. :3 Hrs.

Unit 1

Maintenance Management

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

Unit 2

Failure analysis

Defect generation,types of failures,FTA,FMEA,FMECA
Maintenance Types/sytems
Planned and unplanned maintenance,breakdown,corrective,opportunistic,routine,preventive,predictive,CBM,Design out maintence

Unit 3

Condition monitoring

NDT concepts,visual and temperarture monitoring,leakage monitoring,vibration monitoring,lubricant monitoring-methods,equipments,ferrography,spectroscopy,cracks monitoring,thickness monitoieng,corrosion monitoing,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

MTMA 506A- CIM LAB

L T P CREDIT **SESSIONAL:50 Marks**

4 0 3 1.5 **THEORY :100 Marks**

TOTAL :150 Marks

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 Applications of Robotic system in Automated storage and Retrieval system.
6. Application and Control of robotic 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 Applications of Conveyer System in CIM system.
11. Study and application of CIM software

MTMA 508A- Diagnostic Maintenance & Monitoring Lab

L T P CREDIT **SESSIONAL:50 Marks**
0 0 3 1.5 **THEORY :100 Marks**
TOTAL :150 Marks
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

MTMA 512 A- QUALITY CONTROL TECHNIQUES
MTMA 514 A- FINITE ELEMENT METHODS
MTMA 516 A- ARTIFICIAL INTELLEGENCE IN MANUFACTURING
MTMA 518 A- AUTOMOBILE ENGINEERING

MTMA 512A- 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 concept s 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 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.

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

MTMA 514A- FINITE ELEMENT METHODS

L	T	P	CREDIT	
4	0	0	4	

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

UNIT I

Review of basic FEM concepts

FEM Discretization and the Direct Stiffness Method: Basic concepts of structural modeling, Review of the stiffness method of structural analysis, Modeling stiffness, loads and displacement boundary conditions

Formulation of Finite Elements: Mathematical interpretation of finite elements, variational formulation, Development of continuum elements, shape functions, consistent loads, Isoparametric elements for plane stress, Numerical integration, Convergence requirements.

Computer Implementation of the Finite Element Method : Pre processing: model definition, Element level calculations, Equation assembly, Equation solver, Post processing: strain and stress recovery.

UNIT II

Advanced topics in linear problems : Static condensation and sub-structuring, Patch test and incompatible element, p- formulation

Advanced Beam, Plate and Shell elements :

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 Baushinger 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 part of this course. Various programming and formulation prob lems will be assigned through the course of study. In addition, students are required to complete one project is related to computer implementation of FEM concepts, application to plasticity, solving nonlinear structural problems using commercial programs

MTMA 516A- ARTIFICIAL INTELLIGENCE IN MANUFACTURING

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

UNIT II

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.

UNIT III

Al theory problems, problem 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.

UNIT IV

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

Domains welding, casting, forming, metal cutting, maintenance