PROGRAM SPECIFIC OUTCOMES (PSO): M.Tech(Manufacturing & Automation)

At the end of the programme, the student will have

PSO1 an ability to apply knowledge and skill of various approaches in manufacturing technology and automation, for solving complex engineering problems.

PSO2 use research based knowledge and research methods including design of experiments, analysis and interpretation of data and IT tools.

PSO3 an ability to automate a mechanical system or a process to meet desired needs within realistic constraints such as health, safety and manufacturability.

PSO4 understanding about the concept of Quality in manufacturing

PSO5 Should be able to handle research problems and write dissertations.

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	16MMA21C1	Metal Forming Analysis	4	0	-	4	50	100	-	150	3	4
2	16MMA21C2	Mechatronics & Product Design	4	0	-	4	50	100	-	150	3	4
3	16MMA21C3	Total Quality Management	4	0	-	4	50	100	-	150	3	4
4	16MMA21C4	Welding & Allied Processes	4	0	-	4	50	100	-	150	3	4
5	16MMA21CL1	Mechatronics Lab	-	-	2	2	50		50	100	3	4
6	16MMA21CL2	Welding Lab	-	-	2	2	50		50	100	3	4
7	16MMA21CL3	CAD/CAM Lab	-	-	2	2	50		50	100	3	4
8	16MMA21C5	Seminar	-		-	2	50	-	-	50		2
9	16MMA21D1 or 16MMA21D2 or 16MMA21D3 OR 16MMA21D4	Elective I	4	-		4	50	100		150	3	4
		TOTAL	**28**									

Elective I: Choose any one from the following three papers:
16MMA21D1 - INDUSTRIAL INSPECTION
16MMA21D2 - DESIGN AND METALLURGY OF WELDED JOINTS 16MMA21D3 - FOUNDARY TECHNOLOGY
16MMA21D4-DESIGN PLANNING CONTORL 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	16MMA22C1	Mechanical Design-I	4	0	-	4	50	100	-	150	3	4
2	16MMA22C2	Diagnostic Maintenance & Monitoring	4	0	-	4	50	100	-	150	3	4
3	16MMA22C3	Seminar	-		-	2	50	-	-	50		2
4	16MMA22CL1	CIM Lab	-	-	2	2	50	-	50	100	3	4
5	16MMA22CL2	Diagnostic Maintenance & Monitoring Lab	-	-	2	2	50	-	50	100	3	4
6	16MMA22D1 or 16MMA22D2 or 16MMA22D3	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:

16MMA22D1 - QUALITY CONTROL TECHNIQUES
16MMA22D2 - FINITE ELEMENT METHODS
16MMA22D3 - ARTIFICIAL INTELLEGENCE 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.

16MMA21C1- METALFORMINGANALYSIS

L	T	P	CREDIT	SESSIONAL:50 Marks
4	0	0	4	THEORY :100 Marks

TOTAL :150 Marks

DURATION OFEXAM. :3 Hrs.

Course Outcomes (CO'S): At the end of the course, the student shall be able to:
CO1 Understand application of finite element methods to metal forming processes.
CO2 Understand the formulations of plastic deformation problems for metal forming analysis.
CO3 Understand technology and analysis of important metal forming processesforging, rolling, extrusion, wire drawing, sheet metal forming processes.
CO4 Understand the thermos-mechanical problem formulation.
CO5 Analyse the effect of friction and lubrication in hot and cold working of materials

Unit 1

Stress-Strain relations inElasticand plasticDeformations ,True stress and true strain, true stress-strain curves, selection of stress-strain curves forcold and hot working, yield of isotropicplasticmaterial, yield criteria .Trescamaximum sheer-strain- energycriterion, plasticincompressibility, Poisson's ratio forplasticdeformation flowrule, application of theoryofplasticityforsolvingmetal forming Problems usingSlab method, Upperand lower Bound methods, Sliplinefield theory.

Unit 2

Technologyand analysis ofimportant metal formingprocesses- Forging, Roiling ,Extrusion. Wiredrawing ,Sheet Metal forming processes likeDeep drawing, Stretch forming, Bending, defects in various metal formingprocesses likerolling, forging, extrusion, wiredrawingand deep drawingand theircauses and remedial measures, Effects oftemperatureand strain rate in metal working, friction and lubrication in Hotand Cold working.

Unit 3

Lubrication in metal formingprocesses, principles and mechanism oflubrications, hydrodynamicand theirfilm lubrication, boundaryand extremepressurelubricants, solid lubricants ,lubricants used forrollingand cold drawing, forging,

Unit 4

Application of FiniteElement Methods to Metal Forming Processes-special Discretization ,Shapefunction,Stiffness matrices and theirassembly, Implicit and explicit formulations, Elasto -plasticapproximations, Lagrangian Vs Eularian schemes, Material integration schemes, auxiliaryequations forcontact, friction and incompressibility, Thermo-mechanical problem formulation

REFERENCEBOOKS:

1. Metal FormingAnalysis- R.H. Wagoner,CambridgeUniversityPress.
2. TheoryofElasticity-Dallyand Riley
3. Mechanical Metallurgy- Dieter,McGrawHill Inc.
4.An Introduction to the Principles ofMetal workingbyRowe, Arnold.
5. Metal forminganalysis byAvitzer, Mcgrawhill.

16MMA21C2-MECHATRONICS& PRODUCT DESIGN

L T P CREDIT **SESSIONAL:50 Marks**
4 0 0 4 **THEORY :100Marks**
TOTAL :150 Marks

DURATION OF EXAM. :3 Hrs.

Course Outcomes (CO's): At the end of the course, the student shall be able to:
CO1 Understand conceptual design for mechatronics products based on potential custom requirements.
CO2 Analyze appropriate sensors and transducers and devise an instrumentation system
CO3 Understand design of a control system for effective functioning of mechatronics systems using digit electronics, microprocessors, microcontrollers and PLC.
CO4 Develop system model for mechanical system.

Unit 1

Introduction to Mechatronics systems and components, Principles of basic electronics-Digitallogic, number system logic gates, Sequence logic flipflop system, JK flipflop, D-flipflop.
Microprocess and their applications- Micro computer computer structure/ rnicro controlles, 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
.Electri calactuation system .Other Electrical/ Electronichardwarein Mechatronicsystem.

Unit 3

Principles of Electronic system communication, Interfacing, A. D.andD.A. converters. Software and hardware principles and tools to build mechatronic systems.,Basic system models mathematicalmodels,mechanical and other system Building blocks.
System models-Engg.Systems, rotational ,translation ,elected mechanical ,Hydraulic mechanical system.,System Transfer functions. First-second ordersysteminseries

Unit 4 .

Design and selection of Mechatronics systems namely sensors line encoders and revolvers, steppe rand servomotors Ball screws, solenoids, line actuators and controllers with application to CNC system, robots, consumer electronics products etc, Design of a MechatronicProductusingavailablesoftwareCADpackages MATLAB and SIMULINK

REFERENCEBOOKS:

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

4. Flexible Manufacturingsystems ,byMaleki, Prentic Hall.

16MMA21C3- TOTAL QUALITY MANAGEMENT

L	T	P	CREDIT	SESSIONAL:50 Marks
4	0	0	4	THEORY :100 Marks

TOTAL :150Marks

DURATION OF EXAM. :3 Hrs.

Course Outcomes (CO's): At the end of the course, the student shall be able to:

CO1 Understand the concepts & dimensions of quality.
CO2 Understand the definition of quality given by different quality gurus.
CO3 Understand the quality at different stages.
CO4 Understand the hard, soft & human factors of quality.
CO5 Develop knowledge of tools & techniques, quality awards

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, Deeming 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, Kabana 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 QualityManagement "byOakland (Butterworth- Heinamann Ltd.)
2. "Managingfortotal qualityfrom Demingto Taguchiand SPC"byLogothetis N.(PHI)

3. "Total QualityControl"byFeigenbaum A.V.(MGH)
4. "Total Quality Management "by Besterfield Dale H(PearsonEducation)
5. "Aslicebyslice guideto TQM"byJohn Gilbert (AffiliatedEastWestPress).
6. "TheTQM toolkit- aguideto practical techniques fo rTQM"byWallerJenny, Allen Derekand BurnaAndrew (KoganPage

16MMA21C4- WELDINGANDALLIEDPROCESSES

L	T	P	CREDIT	SESSIONAL:50 Marks
4	0	0	4	THEORY :100 Marks

TOTAL :150Marks

DURATION OF EXAM. :3 Hrs.

Course Outcomes (CO's):

At the end of the course, the student shall be able to:

CO1 Understand principles of various traditional and newer welding processes

CO2 Develop concept of welding specific materials such as plastics, stainless steel.

CO3 Develop concept and techniques of welding automation.

CO4 Analyze methods of advanced welding processes like underwater welding.

CO5 Analyze arc welding parameter section and types of metal transfer.

Unit 1

Introduction : Basic classification of welding processes, weld ability, weld thermal cycle, metallurgy of fusion welds, solidification mechanism and micro structural products in weld metal, epitaxial, cellular and dendrite solidification, metallurgical changes in weld metal, phase transformation during cooling of weld metal in carbon and low alloy steel, prediction of micro structures 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 initiate on and maintenance ,role of electrodepolarityon arc behaviorand arcstability, analysis ofthearc.

Types of electrodes, AW Sand Indian system of classification and coding of covered electrode formild steel, Shieldinggases and associated mixtures

Unit 3

Meta transfer: Short circuit/dip transfer. Free flight. Globular type. Spray type, Forces affectingmetal transfer. Weld bead geometryand shapefactors, 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 weldingelectrodesused.CO2welding:-difference from MIG welding, Principle of operation, equipment, weldingparameters and applications.

Unit 4

Solid state welding : Introduction, main feature sand applications of Ultrasonic welding, Friction weldingand Explosivewelding friction stir processing and welding.

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

UnderwaterWelding: 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 SelectionMechanics,Jointtrackingsystem.

REFERENCE BOOKS

1. Weldingprocesses &technologybyDr .R S ParmarKhannaPublishers
2. WeldingEngineering& TechnologybyDr. R. S .Parmar KhannaPublishers
3. Modern Arc Welding Technology by S.V. Nandkarni Oxford & IDH publishing Co. Principles ofWeldingTechnologybyL.M. Gourd ELBS/Edward Arnold
4. ThePhysics of weldingby LancasterPergaman Press.
5. The Metallurgy of welding by Lancster ;George Allen & Un win Ltd. U.K. Weldinghandbook,Vol.1&2,seventhedition;Americanweldingsociety. MetalHandbook,Vol6, 73;ASME
6. ProcedureHandbook of ARC welding; LincolnElectricCo.USA.
7. The Solid phase welding of metals by Tylecote ;Edward Arnold Pvt .Ltd. Welding&Welding TechnologyRichardL. Little ,McGrawHill. WeldingTechnologybyRossi;McGrawHill.
8. WeldingTechnologybyKoenigs bergerand Adaer; Macmillan.

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16MMA21CL1- MECHATRONICSLAB

L	T	P	CREDIT		
0	0	4	2	PRACTICAL :50Marks	SESSIONAL:50 Marks

TOTAL :100Marks

DURATION OF EXAM. :3 Hrs.

Course Outcomes (CO's): At the end of the course, the student shall be able to:
CO1 Understand the various practical demonstrations of mechatronics.
CO2 To utilize the theories for designing digital system.
CO3 Selection of equipments and practical demonstration.
CO4 Prepare computer programme based on mathematical model

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 ofsensorforaparticularapplication from Catalogue/Internet.
4. Design a mechatronics product/system and incorporate application of mechatronics for enhancing product values
5 To studythehardware's and softwares ofmechatronics kit.
6 To move a table in X-direction within the range of proximity sensors using Control-X software.
7 To rotateat ableusingDAC system.
8 To move a table in Y-direction within the range of proximity sensors using Control-X software.
9 To ornament to with PLC.
10To run aconvey orwith computer.
11To studythemovemen to factuatingcylinders and sensors.
12To studymechatronic and the reinter facing in aCNC machine.
13 Lifeprediction from computer programmebased on mathematical model.

16MMA21CL2- WELDINGLAB

L	**T**	**P**	**CREDIT**	**SESSIONAL:50 Marks**
0	**0**	**4**	**2**	**PRACTICAL :50Marks**

TOTAL :100 Marks

DURATION OF EXAM. :3 Hrs.

Course Outcomes (CO's): At the end of the course, the student shall be able to:
CO1 Understand heat flow in gas welding.
CO2 Analyse about bead geometry, hardness and microstructure of MIG,SAW and FCAW welding.
CO3 Understand underwater welding procedure

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 behavior (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

16MMA21CL3- CAD/CAM LAB

L	T	P	CREDIT	SESSIONAL:50 Marks
0	0	4	2	PRACTICAL :50Marks

TOTAL :100 Marks

DURATION OF EXAM. :3 Hrs.

Course Outcomes (CO's): At the end of the course, the student shall be able to:

CO1 Review and train in CAD modeling.
CO2 use parametric CAD software for geometric modeling ofmechanical designs.
CO3 Translate production drawings to 3D CAD models.
CO4 Evaluate a mechanical design and optimize it using CAD, CAE software.
CO5 use 2D / 3D CAD and CAE for use in other courses and research thesis work

SECTION-I

1. Develop a general purpose code to carryout the Rotation of an object about an axis passing throught out points
2. Develop a general purpose code to carryout
   i) an Ortho graphic projection
   ii) Dimetric projection ,given fore shortening factor Fz
   iii) An Isometric projection.
   iv) A Perspective Projection given Zc ,IT
3. Develop 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 o fan 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 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 Open GL 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. (fromagivenlistof10Tutorials)
2. Generative machining interpretation for various tool paths for machining of Curved surfaces.

List of Soft Core –I

16MMA21D1- INDUSTRIAL INSPECTION
16MMA21D2- DESIGN AND METALLURGY OF WELDED
JOINTS 16MMA21D3- FOUNDARY TECHNOLOGY
16MMA21D4- DESIGN, PLANNING AND CONTROL OF PRODUCTION SYSTEMS

16MMA21D1: **INDUSTRIAL INSPECTION**

L T P	Sessional : 50 Marks
4 0 0	Theory : 100 Marks
	Total : 150 Marks
	Duration of Exam : 3 Hrs

Course Outcomes (CO's): At the end of the course, the student shall be able to:
CO1 Understand about the types Gauges.
CO2 Complete understanding about measurement standards.
CO3 Understanding about the gears and threads.
CO4 Understanding surface textures with processes
CO5 Understand tolerances and their positioning with geometry

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

16MMA21D2 **. 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

Course Outcomes (CO's): At the end of the course, the student shall be able to:
CO1 Understand to predict and control of distortion in welded joints.
CO2 Calculate cost estimation of welded joints.
CO3 Understanding the effect of residual stress in welded joints.
CO4 Understanding weld metallurgy: thermal effect of welding on parent metal
CO5 Develop the application of welding automation for enhancing productivity

.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.

16MMA21D3 **FOUNDRY TECHNOLOGY**

L T P	Sessional : 50 Marks
4 0 0	Theory : 100 Marks
	Total : 150 Marks
	Duration of Exam : 3 Hrs.

Course Outcomes (CO'S): At the end of the course, the student shall be able to:
CO1 Design of pattern for a particular component to be manufactured
CO2 Understand the basic composition of various ferrous and non-ferrous metals and their application in casting process
CO3 Choose the appropriate furnace for the production of a particular material
CO4 Design of gating system for a particular component
CO5 Analyse adequate casting method based on quantity, application, mechanical properties and tolerances

UNIT 1
Items (Domestic and Engg.) made by foundry technology. Advantage and limitations of foundry technology and other manufacturing process.
Castability and factors favoring castability. Ferrous and Non ferrous casting metals and alloys and items made of them.
Melting furnaces for cast iron , cast steels, aluminium alloys, brass and bronzes.
Solidification of castings.
UNIT 2
Mold design considerations: Conceptual, functional and production phase. Pattern and core design considerations, traffic rules applications. Examples, case studies.
Gating system elements: objectives,practicalrules,optimal time filling, types of pouring basin, types of gates, types of
risers.
UNIT3
Special casting methods: Gravity die casting, cold chamber die casting, hot chamber die casting, investment casting, centrifugal casting,shell mold casting.continuous casting.
Rough cleaning (Fettling) and surface cleaning of castings.
Casting inspection.
UNIT 4
Repair and salvage of castings. .Heat treatment of castings.Quality control of castings.
Pollution control in foundry. 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

16MMA21D4: 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

COURSE OUTCOMES:

Towards the end of the course, the students should be able to:
CO1 Develop life cycle approach to new product development and production system.
CO2 Develop the concept of break-even analysis, line balancing and relate it with practical industrial work.
CO3 Understand and generate MRP-I, MRP-II and ERP models for production and enterprise resource planning.
CO4 Estimating production requirement using various forecasting techniques.
CO5 Understand the criteria for sequencing & accordingly schedule the job on machines

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 - MartandTelsang 5. Operations management- Theory and problems- Joseph Monks

16MMA22C1- 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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Course Outcomes (COs): At the end of the course, the student shall be able to:
CO 1- Expose the students to the Design for Production and for variable loading.
CO 2- Impart in depth knowledge of designing of screws and different types of fasteners.
CO 3- Design bearings, selection of bearings for different aspects & lubricants with their properties.
CO 4- Knowledge of gears, design of different types of gears with consideration of maximum power transmission and gear lubrication.
CO 5- Learn in depth knowledge of flywheels and their design.

Unit 1

Concept Desgin: Brain stormingmethod sandsketching

Unit 2

QualityFunction Development

Material Characteristics Mechanical, thermal and electrical properties.

Unit 3

Design :Design forassembly. Design formanufacturing.

Unit 4

.Production technologies: Metal forming ,casting ,maching, surface treatment, welding, bonding ,fastening ,clinching.

REFERENCEBOOKS:

1. QualityFunction development, L.Cohen.
2. ManfacturingEngg.: Principles forOrganization, D.T. Koenig.
3. Materials ScienceandEngineering: An Introduction,W.D. CallisterJr.
4. Handbook ofAluminum :AlloyProduction and Materials Manfacturing Vol.2,G.E.Totten.
5. CADSoftwareCatia,Dassault system.

16MMA22C2- 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.

Course Outcomes (COs): At the end of the course, the student shall be able to:
CO 1- Expose the students to the Maintenance Management.
CO 2- Impart in depth knowledge of failures types and maintenance.
CO 3- have knowledge of condition monitoring.
CO 4- Knowledge of total productive maintenance.

Unit 1
Maintenance Management
Relevance of maintenance ,maintenance: an over view ,maintenance services ,problems of the plant manager, automation and maintenance ,maintenance objectives and costs, qualityand quality circle in maintence ,Engineeringreliability, 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 maintence

Unit 3
Condition monitoring
NDT concepts ,visual and temperarture monitoring, leakage monitoring,vibration monitoring, lubricant monitoringmethods ,equipments,ferrography,spectroscopy,cracksmonitoring,thicknessmonitoieng,corrosionmonitoing,noise monitoring,sound monitoring, smell monitoring

Unit 4
Total productive maintenance
Development and scope of concept ,tero technology,basic systems of TPM procedure and steps of TPM, productivity circle

Books:

Maintenanceplanningandcontrol-Kelly,A.Buttersworth&Co.1984
MaintenanceandsparepartsManagement–KrishananG,PrenticeHall–1991

16MMA22CL1- CIM LAB

L	T	P	CREDIT	SESSIONAL:50 Marks
0	0	4	2	PRACTICAL :50Marks

TOTAL :100 Marks

DURATION OF EXAM. :3 Hrs.

Course Outcomes (CO): At the end of the course, the students will be able to:
CO1. Understand the basic features of CNC Machining Centres and CNC Turning Centres
CO2. Understand the part programming of CNC Machining Centres and CNC Turning Centres through live demonstrations of machining examples
CO3. Learn the basics of Automatic Guided Vehicles (AGVs) and Robotics
CO4. Learn about the basic knowledge about Coordinate Measuring Machine (CMM) and Machine Vision System

LISTOFEXPERIMENTS:

1. To studygeneral features ofMachiningCenter.
2. To preparetheCNC part program for machiningaprismaticcomponent on CNC machiningcentre.
3. To studythegeneral features ofaCNC Turningcenter.
4. To preparetheCNC part program formachiningof a Cylindrical Component.
5. Studyand Applications ofRoboticsystem in Automated storage andRetrieval system.
6. Application and Control ofroboticsystem inFlexible manufacturingSystem.
7. To studythegeneral features ofAutomated Guided Vehicle.
8. To studythe general configuration ofCMM and its Application in CIM environment.
9. MachineVision and QualityControl in CIM environment.
10. Studyand Applications ofConveyerSystem in CIM system.
11. Studyand applicationofCIM software

16MMA22CL2 – Diagnostic Maintenance & Monitoring Lab

L	T	P	CREDIT	SESSIONAL:50 Marks
0	0	4	2	PRACTICAL :50Marks

TOTAL :100 Marks

DURATION OF EXAM. :3 Hrs.

List of Experiments.

1. To study the introduction to maintenancetechniques. Preventive and predictive Maintenance
2. To study and perform Non-Destructive Testing techniques , liquid dyepenetrate 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 Industryor Textile Mills or Thermal Powerplant sand Railways.
8. To study the Maintenance planning and control of a large factory, work planning and work control.

Course Outcomes:

At the end of the course students will be able to

CO1 – Practically understand wear analysis through thermograph and Ferrography.

CO2 – practically study the maintenance planning and control of a large factory.

CO3- will be able to perform Non-Destructive Testing techniques.

List of Soft Core –II

16MMA22D1- QUALITY CONTROL TECHNIQUES
16MMA22D2- FINITE ELEMENT METHODS
16MMA22D3- ARTIFICIAL INTELLEGENCE IN MANUFACTURING

16MMA22D1- QUALITYCONTROLTECHNIQUES

L	T	P	CREDIT	
4	0	0	4	

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

Course Outcomes (CO'S): At the end of the course, the student shall be able to:
CO1 Understand about the Concept of Quality control system and process capability study.
CO2 Analyze about process control charts and Errors.
CO3 Understand about the Inspection control methods.
CO4 Understanding about the probability theory, binomial and Poisson distribution .
CO5 Analyze product control, chance and assignable causes of Quality variation

UNIT I

Statistical concepts in Quality Control, variables and attributes, Graphical Representation ,Continuous and Discrete ProbabilityDistributions,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

Theoryof runs, Interpretation of Out of Controlpoints, Probabilitylimits, 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 capabilitystudies.

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 n p chart, varying control limits ,high defectives and low defectives ,CUSU Mor Cumulative sum control chart, Average run length (ARL)Relative efficiencyorsensitivityofcontrol 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 Qualitylevel, Average Outgoing quality (AOQ)curve,AOQL ,quality protection offered by a samplingPlan,

REFERENCEBOOKS

1. Statistical Qualitycontrol byE.L. Grant
2. Qualitycontrol
and Industrial Statistics,byA.J. Duncan
3. Qualitycontrol byDaleH .Beste field
4. Total QualityControl byA. Y .Feigenboum
5. ElementaryS.O.L. by I.W .Burr, M. Dekkar.

16MMA22D2- FINITEELEMENTMETHODS

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

Course Outcomes (CO's): At the end of the course, the student shall be able to:

CO1 Understand the theories of linear system for finite element analysis.

CO2 Understand the theories of non-linear system for finite element analysis.

CO3 Develop the formulation of problem for analysis.

CO4 Analyse non-linear problem solution procedure.

CO5 Understand modeling of system with load, displacement and boundary Conditions

UNIT

I Review ofbasicFEMconcepts:

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

Formulation of Finite Elements : Mathematical interpretation of finite elements , variation formulation ,Development of continuum elements, shape functions ,consistent loads, Iso parametric elements forplanestress, 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, Patched stand in compatibleelement ,p- formulation

Advanced Beam, Plateand Shell elements:

Timoshenko beam theory(shearlocking)

Plateand shell theory Thin plateand Mildin plate(shearand membranelocking)

Mixed formulation forplateand shell

Degenerated shell formulation Dynamicanalysis using FEM Consistent massand lumped mass, masslumping technique

Timeintegration methods: explicit, implicit ,explicit-implicitmethods.

Stability, convergenceand consistency

Hyperbolicsystems: structural dynamics and wave propagation

Parabolicsystem : transient the attransfer

Modal solution fornatural frequencies and modeshapes g. Modal Superposition method forstructural dynamics

Non linearanalysis

a. Non linearsolution procedures
b. Newton-Rapson,modified Newton-Rapson and secantmethods
c. Linesearch algorithm
d. Automatictimestep control

UNIT III

Material nonlinearity

a. Rateindependent elastic plasticitywith return-mapping algorithm
b. Isotropicand kinematic chardeningwith Baushingereffect c. Consistenttangent operator
d. Objectiverateand finiterotation elasto plasticity
e. Multiplicativedecomposition and finitedeformation elastoplasticity

Geometricnon linearity

a. Generalized strain and stress
b. Total and Updated L arrangingformulation c. Kirchhoffstress and Cauchystress

Boundarynon linearity

a. Frictionless contact problems
b. Penalty, Lagrangemultiplier, augmented Lagrange multiplier, and perturbed Lagrangemultiple methods
c. Frictional contact problems includingfrictional return mappingalgorithm
d. Rigid-flexiblecontactand flexible-flexiblecontact
e. Multiplicativedecomposition and finitedeformation elasto plasticity

UNIT IV

Geometricnon linearity

a. Generalized strain and stress
b. Total and Updated Lagrangian formulation c. Kirchhoffstress sand Cauchystress

Boundarynon linearity

a. Frictionless contact problems
b. Penalty ,Lagrangemultiplier ,augmented Lagrange multiplier ,and perturbed Lagrangemultiple methods
c. Frictional contact problems includingfrictional return- mappingalgorithm
d. Rigid-flexiblecontact and flexible-flexiblecontact Assignmentsand Tutorial are essential part ofthis course. Various programmingand formulation problems will be assigned through thecourseofstudy. In addition, students arerequired to completeoneprojects related to computer implementation ,application to plasticity, solvingnon linearstructural problem usingcommercial programs

16MMA22D**3- ARTIFICIALINTELLIGENCEINMANUFACTURING**

L	T	P	CREDIT	
4	0	0	4	

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

Course Outcomes: Towards the end of the course, the students should be able to:
CO1 Understand knowledge acquisition and knowledge representation.
CO2 Apply artificial intelligence in manufacturing.
CO3 Understand expert system application.
CO4 Analyze state-of art expert system application.
CO5 Apply theoretical concepts to manufacturing problems

UNIT I

Definition, basic concepts of artificial Intelligence, scope, role and potential of artificial intelligencein manufacturing, Expertsystems,PopularA Iapplication.

UNIT II

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

UNIT III

All 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 ,n planning, learning, natural language processing, neural nets, fuzzy logic ,object oriented programs.

UNIT IV

Case studies, examples of AI, theoretical concepts to manufacturing problems ,CAD, CAPP, schedulingGT,CIM system.
Domains welding, casting, forming, metal cutting, maintenance

M.D UNIVERSITY

SCHEME OF STUDIES AND EXAMINATION

M.TECH 2nd YEAR (MANUFACTURING & AUTOMATION)

SEMESTER 3rd

CBCS Scheme effective from 2017-18

Sl. No	Course No.	Subject	Teaching Schedule				Examination Schedule (Marks)				Duration of Exam (Hours)	No of hours /week
			L	T	P	Total credits	Marks of Class works	Theory	Practical	Total		
1	17MMA23C1	Advanced metrology and calibration	4	0	-	4	50	100	-	150	**3**	**4**
2	17MMA23C2	Manufacturing Automation	4	0	-	4	50	100	-	150	**3**	**4**
3	17MMA23C3	Major Project (Dissertation Stage 1)	-	-	4	4	100	-	-	100		**4**
4	17MMA23CL1	Metrology & Automation Lab	-	-	2	2	50	-	50	100		**2**
5		Open Elective				3						
		TOTAL	**19**									

NOTE:

Examiner will set nine questions in total. Question One will be compulsory and will comprises of 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.

OPEN ELECTIVE

A candidate has to select this paper from the pool of open electives provided by the University.

M.D UNIVERSITY

SCHEME OF STUDIES AND EXAMINATION

M.TECH 2nd YEAR (MANUFACTURING & AUTOMATION)

SEMESTER 4th

CBCS Scheme effective from 2017-18

Sl. No	Course No.	Subject	Teaching Schedule				Examination Schedule (Marks)				No of Credits
			L	T	P	Total	Marks of Class works	Theory	Practical	Total	
1.	17MMA24C1	Major Project (Dissertation Stage 2)	-	-	-	-	250	-	500	750	**20**
		TOTAL	**-**	**-**	**-**	**-**	**250**	**-**	**500**	**750**	

NOTE:

1. **Students have to publish a research paper in a journal / conference of the research work done in the semester.**

17MMA23C1-ADVANCEDMETEROLOGY&CALIBRATION

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

Course Outcomes (CO): At the end of the course, the students will be able to:

CO1. Understand the basic features of measuring instruments like sine bar, callipers and depth gauge etc.

CO2. Learn the basics of metrology and measurement.

CO3. Learn about the basic knowledge of calibration of instruments.

UNIT–I

Fundamentaldeviationand itscalculations,effectoftoleranceonthefits,effectsof electroplating onthefitsand itssolution, shaft basisand holebasissystemand its applications,Go,No-Gogaugesdesign,toleranceposition andtoleranceforboltandnut. GeometricalTolerances.

Surfaceerrorsi.e.form,macroandmicroerrors,reasonsfor theseerrors.

Surface texture parameters, amplitude,spacing and hybrid,bearing ratio/ ABBOTT-Fire stonecurve,AverageSlope

UNIT– II

Measuringinstrumentforflatness& surfacefinishes,instrumentforgeometrical tolerances, profile projector, co-ordinate measuring machine,lasermicrometer, various grades ofslipgaugesandpingauges,autocollimeters,various types ofmicrometer

UNIT– III

Introductiontocalibration,calibrationofmechanicalmeasuringinstruments,micrometers depth-micrometer,verniercaliper,toolmakermicroscope,pin gauge,surfaceplate,dial gauges,opticalflats,slipgauges.

UNIT– IV

Calculationof uncertainty,bothAtype&Btype,formicrometers,vernierCalipersand co-ordinatemeasuringMachine

TextBooks:

1. EngineeringMetrologyAndInstrumentationbyR.K.Rajput
2. ISI–Standard919andISI-Standard4218.
3. GeometricalTolerancesIs:800(Part-I)–1985ISO1101–1983
4. EngineeringTolerancesbyH.G.Conwat

17MMA23CL1 – Metrology& Automation lab

L	T	P	CREDIT	SESSIONAL:50 Marks
0	0	2	2	THEORY :50 Marks
				TOTAL :100 Marks
				DURATION OF EXAM. :3 Hrs.

Course Outcomes (CO's): At the end of the course, the student shall be able to:

CO1 Understand the various practical demonstrations of automation of mechanical equipments.

CO2 To utilize the theories for designing feeder system

CO3 Selection of equipments and practical demonstration.

CO4 Operation of variety of software .

CO5 Computer programming on CNC machine

1.MeasurementsusingOpticalProjector/ToolmakerMicroscope.

2.MeasurementofalignmentusingAutocollimator/Rollerset

3.Measurementofcuttingtoolforcesusing
a)LathetoolDynamometer

b)DrilltoolDynamometer.

4.MeasurementsofSurfaceroughness,UsingTallySurf/MechanicalComparator

5. StudyandapplicationsofHydaulicsoftware.

6. StudyandapplicationsofPneumaticsoftware.

7. StudyandapplicationsofRoboticsoftware.

8. StudyandapplicationsofPLCsoftware.

9. Todesignanautomatedpartfeeder.

17MMA23C2-MANUFACTURING AUTOMATION

L	T	P	CREDIT
0	0	0	4

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

Course Outcomes:

At the end of the course the student will be able to

CO1 know various techniques of automatic material handling in a manufacturing organization.

CO2 understand the concept and interfacing of various pneumatic, hydraulic and software for automation of mechanical products /system.

CO3 understand control strategies, modeling and simulation in a manufacturing system.

UNIT-1

Introduction: AutomationinProductionSystem,Principles andStrategiesofAutomation,Basic Elements ofan AutomatedSystem,AdvancedAutomationFunctions,Levels ofAutomations,introductiontoautomationproductivity.

Materialhandlingsystems: OverviewofMaterialHandling Systems-Rotary feeders, oscillatingforce feeder, vibratory feeder,elevatortypeandCentrifugaltypefeeders,Principles andDesignConsideration, MaterialTransportSystems, StorageSystems.

UNIT-2

AutomatedManufacturingSystems: Components, ClassificationandOverviewof ManufacturingSystems, Manufacturing Cells,GT and CellularManufacturing, FMS, FMS andits Planning and Implementation, Flow lines &TransferMechanisms, FundamentalsandAnalysisof TransferLines,productdesignforautomaticassembly.

ControlTechnologies inAutomation: Industrial Control Systems,ProcessIndustriesVersesDiscrete-Manufacturing Industries,ContinuousVerses DiscreteControl, Computer Process and its Forms. Sensors,Actuators andother ControlSystemComponents.

UNIT-3

Evaluation of automatic production: product manufacturabiiity, orientation devices- active and passive devices,partsorientationandescapement.

Pneumaticandhydrauliccomponentsandcircuits:

Booleanalgebra,pneumaticsensorsandamplifiers,jetdestructiondevices,logicdevices,schimittrig geringdevices, developingpneumaticcircuitsforautomatic diecasting machine.

UNIT-4

Modelingand Simulationfor manufacturing Plant Automation: Introduction/needforsystemModeling,Building MathematicalModelofamanufacturingPlant,ModernTools-Artificialneuralnetworksinmanufacturingautomation,AIin manufacturing,Fuzzydecisionandcontrol, robotsand applicationofrobotsforautomation.

REFERENCEBOOKS:

1. Handbookofdesign,manufacturing and Automation:R.C. Dorf,JohnWileyandSons.

2. Automation,ProductionSystemsandComputerIntegrated Manufacturing,M.P.Groover,PearsonEducation.

3. IndustrialAutomation:W.P.David,JohnWileyandSons.

4. ComputerBasedIndustrialControl,KrishnaKant,EEE-PHI

5. AnIntroduction toAutomatedProcess Planning Systems, Tiess ChiuChang&RichardA.Wysk

6. ManufacturingassemblyHandbook:-BrunoLotter

7. AnatomyofAutomation,AmberG.H&P.S.Amber,PrenticeHall.

8. PerformanceModelingofAutomatedManufacturingSystems, Viswanandham,PHI.

9. AutomaticprocesscontrolsystemandHardware-R.P.

Hunter,PrenticeHall.

17MMA23C3 MAJOR PROJECT

(DISSERTATION STAGE-1)

Marks Credits -4

L	T	P	
-		4	Sessional Exam : 100

A candidate has to prepare a report covering identification of research topic, literature review, planning of research scheme and systematic documentation. The marks will be given on the basis of a report prepared and presentation given by the candidate covering the above said contents, contents of the presentation, communication and presentation skills.

COURSE OUTCOMES:

By the end of this course every student is expected to be able to

CO1 understand the process of research.

CO2 do literature survey to identify a research problem.

CO3 communicate and discuss research ideas.

CO4 plan and write dissertation synopsis.

17MMA24C1 DISSERTATION-II (IV sem)

COURSE OUTCOMES:

By the end of this course every student is expected to be able to

CO1 handle research problems and use modern research tools/methods.

CO2 analyse and review the existing literature on a research problem.

CO3 design and conduct experiments.

CO4 write dissertation and technical reports.

CO5 publish research papers.