SCHEME & SYLLABUS

(Choice Based Credit System)

for

M. TECH.

in

CAD/CAM & Robotics

(w.e.f. Session 2017-22)

Program Code: ME-401

DEPARTMENT OF MECHANICAL ENGINEERING

SCHOOL OF ENGINEERING

RIMT UNIVERSITY, MANDI GOBINDGARH, PUNJAB

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SECTION 1

Vision & Mission of the University

VISION

To become one of the most preferred learning places a centre of excellence to promote and nurture future leaders who would facilitate in desired change in the society

MISSION

M1: To impart teaching and learning through cutting edge technologies supported by the world class infrastructure

M2: To empower and transform young minds into capable leaders and responsible citizens of India instilled with high ethical and moral values

SECTION 2

Vision and Mission of the Department

VISION

To contribute to the society through excellence in scientific and technical education and research. To contribute the country by providing globally competent Mechanical Engineers capable of working in an inter-disciplinary environment which foster spirits of innovation, entrepreneurship and leadership. To support industry for growth, being the valuable resource for them, and remain a role model for others in the field of Mechanical Engineering.

MISSION

M1: To provide a high-quality educational experience for undergraduate and graduate students that enables them to become leaders in their chosen professions and to make them globally competitive mechanical engineers.

M2: To create, explore, and develop innovations in engineering and science through undergraduate and graduate research. To develop linkages with world class R&D organizations and educational institutions in India and abroad for excellence in teaching, research and consultancy practices.

SECTION 3

About the Program

Mechanical Engineering Department was established in 2003 with the inception of the institute to produce high quality engineers in the field of Mechanical Engineering. The programme involves application of principles of physics for analysis, design, manufacturing, and maintenance of mechanical systems. It requires a solid understanding of key concepts including Mechanics, Kinematics, Thermodynamics and Energy. Mechanical engineers use these principles and others in the design and analysis of automobiles, aircraft, heating and cooling systems, manufacturing plants, industrial equipment and machinery, medical devices and more.

SECTION 4

Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

PROGRAMME EDUCATION OBJECTIVES (PEOs)

PEO1	To prepare learners with a solid foundation in mathematics, sciences, and technical skills needed to analyze and design in engineering problems.
PEO2	To be able to explore areas of research, application & innovation and make impact in different types of institutional settings such as corporate entities, government bodies, NGOs, inter-government organizations, & start-ups.
PEO3	To prepare learners to apply knowledge, strong reasoning, and quantitative skills to design and implement creative and sustainable solutions.
PEO4	To prepare learners to effectively use modern equipment's & programming tools to solve real life problems that are technically sound, economically feasible and socially acceptable.
PEO5	To prepare learners for successful professional career, to excel in higher studies and or to become entrepreneur.
PEO6	To be able to continuously learn and update one's knowledge, engage in lifelong learning habits and acquire latest knowledge to perform in current work settings.
PEO7	To prepare learners to become responsible citizens by serving the community locally, nationally, and internationally.

PROGRAMME OUTCOMES (POs)

PO 1	Apply the knowledge of mathematics, science, engineering fundamentals, and mechanical engineering to the solution of complex engineering problems.
PO 2	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO 3	Design solutions for complex mechanical engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex mechanical engineering activities with an understanding of the limitations.
PO 6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO 7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1	Apply mechanical engineering and interdisciplinary knowledge for analyzing, designing and manufacturing products to address the needs of the society.
PSO 2	Apply state of the art tools and techniques to conceptualize, design and introduce new products, processes, systems and services.

SECTION 5

Curriculum / Scheme with Examination Grading Scheme

SEMESTER WISE SUMMARY OF THE PROGRAMME: B.TECH. (MECHANICAL ENGINEERING)

S. No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	16	500	16
2.	II	18	500	18
3	III	12	500	26
4	IV	-	100	20
	Total	**46**	**1600**	**80**

EXAMINATION GRADING SCHEME

Marks Percentage Range	Grade	Grade Point	Qualitative Meaning
80-100	O	10	Outstanding
70-79	A^+	9	Excellent
60-69	A	8	Very Good
55-59	B^+	7	Good
50-54	B	6	Above Average
45-49	C	5	Average
40-44	P	4	Fail
0-39	F	0	Fail
ABSENT	AB	0	Fail

Percentage Calculation: CGPA *10

First Semester:

Subject		Contact Hours/Week			Credit	Contact Hrs.	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	Title	L	T	P			Internal	External	Total	
Core Courses										
MTRM101	Research Methodology	4	-	-	4	4	40	60	100	3
MTME121	CAD/CAM	4	-	-	4	4	40	60	100	3
MTME122	Mechatronics	4	-	-	4	4	40	60	100	3
MTME181	Seminar	-	-	-	2	-	100	-	100	-
MTME138	Lab-I	-	-	4	2	4	60	40	100	-
Total		**12**	**-**	**4**	**16**	**16**	**280**	**220**	**500**	**9**

Second Semester:

Subject		Contact Hours/Week			Credit	Contact Hrs.	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	Title	L	T	P			Internal	External	Total	
Core Courses										
MTME123	Computer Aided Process Planning	4	-	-	4	4	40	60	100	3
MTME124	Robotics	4	-	-	4	4	40	60	100	3
MTME125	Optimization Technique	4	-	-	4	4	40	60	100	3
MTME139	Lab- II	-	-	4	2	2	60	40	100	-
Elective Course										
MTME160	Product Life Cycle Management	4	-	-	4	4	40	60	100	3
MTME161	Modeling and Simulation	4	-	-	4	4	40	60	100	3
MTME162	Finite Element Methods	4	-	-	4	4	40	60	100	3
MTME163	Operation Management	4	-	-	4	4	40	60	100	3
Total		16	-	4	18	18	220	280	500	12

Third Semester:

Subject		Contact Hours/Week			Credit	Contact Hrs.	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	Title	L	T	P			Internal	External	Total	
Core Courses										
MTME126	Smart Materials and Applications	4	-	-	4	4	40	60	100	3
MTME107	Manufacturing of Composite Materials	4	-	-	4	4	40	60	100	3
MTME182	Pre Thesis Seminar	-	-	-	4	-	100	-	100	-
MTME183	Project	-	-	-	10	-	60	40	100	-
Elective Course										
MTME164	Rapid Prototyping	4	-	-	4	4	40	60	100	3
MTME165	Product Design and Development	4	-	-	4	4	40	60	100	3
MTME166	Computer Integrated Manufacturing System	4	-	-	4	4	40	60	100	3
MTME167	Industrial Automation	4	-	-	4	4	40	60	100	3
Total		**12**	**-**	**-**	**26**	**12**	**280**	**220**	**500**	**9**

Fourth Semester:

Subject		Contact Hours/Week			Credit	Contact Hrs.	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	Title	L	T	P			Internal	External	Total	
Core Courses										
MTME190	Thesis	-	-	-	20	-	-	100	100	-
Total		-	-	-	20	-	-	100	100	-

SYLLABUS

SEMESTER-I

SUBJECT TITLE: RESEARCH METHODOLOGY
SUBJECT CODE: MTRM-101
SEMESTER: 1
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60

Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of research i.e. meaning, definition, process and research design. The students should be able to understand the data collection methods, questionnaire designing, construction and sampling design & techniques.

S No.	Content	Contact Hrs.
1.	Introduction to Research: Meaning, Definition, Objective and Process Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design. Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal	11 Hrs
2	Sources of Data: Primary and Secondary, Validation of Data Data Collection Methods: Questionnaire Designing, Construction Sampling Design & Techniques – Probability Sampling and Non Probability Sampling Scaling Techniques: Meaning & Types Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability Validity: Content Validity, Criterion Related Validity and Construct Validity	10 Hrs
3	Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA	11 Hrs

4	Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi-Dimensional Scaling Report Writing: Essentials of Report Writing, Report Format Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab orMATLAB Software in Data Analysis	11 Hrs

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	MTRM-101.1	Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling.
CO2	MTRM-101.2	Have basic knowledge on qualitative research techniques
CO3	MTRM-101.3	Have adequate knowledge on measurement & scaling techniques as well as the quantitative data analysis
C04	MTRM-101.4	Have basic awareness of data analysis-and hypothesis testing procedure.

Suggested Readings / Books:

1. Statistics for Management by R.I. Levin and D.S. Rubin, 7thEdn., Pearson Education, New Delhi, 2007.
2. Marketing Research–An Applied Orientation by N.K. Malhotra, 4thEdn., Pearson Education, New Delhi, 2000.
3. Business Research Methods by Donald Cooper, Tata McGraw Hill, New Delhi, 2001.
4. Research Methodology in Social Sciences, Sadhu Singh, Himalaya Publishers, 2007.
5. Research Methodology Methods & Techniques by C.R. Kothari, 2ndEdn., New Age International Publishers, 2008.

SUBJECT TITLE: CAD/CAM
SUBJECT CODE: MTME-121
SEMESTER: 1
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The students will understand the concept of graphic systems and standards and its interfacing for various geometric transformations in design engineering. The students should be able to understand various types of design processes for its transformation into wireframe models. They will also gain knowledge of parametric modeling techniques and different applications in mechanical engineering.

S No.	Content	Contact Hrs.
1.	Introduction: Design process in general and using computers, hardware and software in CAD applications Two Dimensional Transformations: Two dimensional geometric transformations-basic transformations, concatenation, reflection, shear and transformations between coordinate systems.	10 Hrs.
2	Two and Three Dimensional Object representations: Parametric representation of synthetic curves, spline representations, cubic spline interpolation methods, Bezier curves and surfaces, B spline curves and surfaces, conversion between spline representations Representation of Solids: Half spaces, boundary representation (B-rep), sweep representation, constructive solid geometry (CGS), solid manipulations.	11 Hrs.
3	Three Dimensional Geometric Transformations: Tranformations-translation, rotation, scaling, reflections, shears, concatenation transformations Visual Realisation: Basic concepts of visual realization, hidden line removal, hidden surface removal, shading surfaces and solids CAD Standards:	11 Hrs.
4	CAD and CAM integration: Introduction to reverse engineering and rapid prototyping: Practice on available CAD packages, computer programming for geometric modelling of curves, surfaces & solids, projects involving assembly and kinematics analysis of mechanisms, surface modeling in	11 Hrs.

	any available CAD package.	

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-121.1**	Understand the basic concepts OF CAD/CAM contents and tools,
CO2	**MTME-121.2**	Understand the history of CAD/CAM development, CAD/CAM market trends.
CO3	**MTME-121.3**	Understand mathematical representation of solids and geometrical transformations.

Suggested Readings / Books:

1. CAD/CAM by Groover and Zimmer, Prentice Hall, 2005.
2. CAD/CAM: Theory and Practice by I. Zeid, McGraw Hill, 2004.
3. Geometric Modeling by M.E. Mortenson, 2001.

SUBJECT TITLE: MECHATRONICS
SUBJECT CODE: MTME-122
SEMESTER: 1
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of control systems, microprocessor / micro controller based controllers, PC based controllers. The students will be able to understand the electromechanical drives: Relays and solenoids, stepper motors, DC brushed and brushless motors, DC servo motors, AC/DC motors for non-servo motion drives.

S No.	Content	Contact Hrs.
1.	Introduction: Definitions, trends, control systems, microprocessor / micro controller based controllers, PC based controllers, applications: SPM, robot, CNC machine, FMS, CIM. Sensor Technology: Sensor and transducers, terminology, displacement, position, proximity - encoders, velocity - tachogenerators, force - strain gauges, pressure, temperature-thermocouples, RTDs, thermistors, light sensors - photoelectric sensors, IR sensors, sensor selection.	9 Hrs.
2	Electronic Devices and Circuits: Semiconductor devices, diodes and LEDS, zener diodes and voltage regulator, inductive kick, bandwidth, frequency %& response of a measurement system, bipolar transistor circuits, amplifiers. Electromechanical Drives: Relays and solenoids, stepper motors, DC brushed and brushless motors, DC servo motors, AC / DC motors for non-servo motion drives, braking methods, pulse width modulated, Bipolar driver, Mosfet drives, SCR drives, variable frequency drives. Digital Electronics: Digital logic, number systems, logic gates, Boolean algebra, Karnaughrnaps, sequential logic	11 Hrs.
3	Signal Conditioning: Introduction, the operational amplifier, protection, filtering, Wheatstone bridge, digital signals, multiplexers, data acquisition, digital signal processing, pulse-modulation. Precision Mechanical Actuation: Pneumatic actuation systems, electro-pneumatic actuation systems, hydraulic actuation systems, electro-hydraulic actuation systems, mechanical systems, types of motion,	11 Hrs.

	kinematics, inverse kinematics, timing belts, ball screw and nut, linearmotion guides, linear bearings, harmonic transmission, bearings, motor / drive selection	
4	Microprocessors: Control, microcomputerstructure, microcontrollers, digital interfacing, analog interfacing, DAC, ADC, applications. Input / Output Systems: Interfacing, input / output ports, interface requirements, peripheral interface adapters, serial communication interface, direct memory access. Control System: System transfer function, Laplace transformation and its applications, continuous and discrete processes, proportional control, integral control, differential control, PID control, digital controllers, control system performance, controller tuning, adaptive control, frequency response, PLC, PMC, Introduction to fuzzy logic and neural networks.	11 Hrs.

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	MTME-122.1	Understand basic concepts of control systems, microprocessor / micro controller
CO2	MTME-122.2	Able to understand the electromechanical drives
CO3	MTME-122.3	Gain Knowledge of Signal Conditioning and Precision Mechanical Actuation

Suggested Readings / Books:

1. Understanding Electro-Mechanical Engineering - An Introduction to Mechatronics by Kamm, Prentice-Hall of India.
2. Computer Control of Manufacturing system by, Koren, McGraw Hill.
3. Production Systems and CIM byGroover, PHI.
4. Flexible Manufacturing systems by Maleki, Prentice Hall.
5. Feedback Control Systems by BC. Kuo, PHI.

SUBJECT TITLE: SEMINAR
SUBJECT CODE: MTME-181
SEMESTER: 1
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
-	-	2	2

Internal Assessment: 100

Students has to prepare a ppt. along with file for any respective research topic

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME181.1**	Understand the potential of presenting through seminar
CO2	**MTME181.2**	Able to Understand the selection of topic and its presentation
CO3	**MTME181.3**	Understand the use of seminar at different areas and places

SUBJECT TITLE: OPTIMIZATION TECHNIQUE LAB (COMMON TO ALL)
SUBJECT CODE: MTME-138
SEMESTER: 1
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
-	-	2	2

Internal Assessment: 60
End Term Exam: 40
Duration of Exam: 3 Hrs

S No.	Content	Contact Hrs.
1	Introduction to MATLAB and its environment	**2 hrs**
2	Basic MATLAB commands, data types	**2 hrs**
3	Programs for branching statement and loops	**2 hrs**
4	Program for inbuilt and user defined functions	**2 hrs**
5	Program for plots, arrays, input/outputs, etc.	**2 hrs**
6	Dynamics and Vibration using as a single degree vibratory system as a case study	**2 hrs**
7	Implement optimization for reducing an environment impact of mechanical engineering components	**2 hrs**
8	Implement optimization technique to find the optimal cost of structure weight/volume/both	**2 hrs**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-138.1**	Understand the potential of presenting through MATH Lab
CO2	**MTME-138.2**	Dynamics and Vibration using as a single degree vibratory system as a case study
CO3	**MTME-138.3**	Implement optimization technique to find the optimal cost of structure weight/volume/both

SYLLABUS

SEMESTER-II

SUBJECT TITLE: COMPUTER AIDED PROCESS PLANNING
SUBJECT CODE: MTME123
SEMESTER: 2
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of CAPP i.e. principles, scope and information requirement for CAPP. The students will be able to understand computer based process monitoring and control, computer and process interfacing.

S No.	Content	Contact Hrs.
1.	Introduction to CAPP: Principles, scope and information requirement for CAPP, Role of process planning, Manual and experienced based process planning, Advantages of CAPP over conventional process planning, Decision table and decision trees, process capability analysis, Tolerance analysis, Variant process planning, Generative approach, Forward and Backward planning.	**9 Hrs.**
2	Computer Aided Process Planning: Logical design of process planning systems, Implementation considerations, Computer based process monitoring and control, Computer and process interfacing, Totally integrated process planning systems, Process planning for rotational and prismatic parts, Machining of curves and surfaces, Five axis machining, Process planning of freedom surfaces, Development of NC codes, Computer aided design of fixtures, Inspection policies and inspection planning, Expert systems and their use in developing process planning systems.	**11 Hrs.**
3	Retrieval CAPP system: Significance, group technology, structure, relative advantages, implementation, and applications. Selection of manufacturing sequence: Significance, alternative-manufacturing processes, reduction of total set-up cost for a particular sequence, quantitative methods for optimal selection, examples. Generative CAPP system: importance, principle of Generative CAPP system, automation of logical decisions, Knowledge based systems, Inference Engine, implementation, benefits. Determination of machining parameters: Reasons for optimal selection of machining parameters, effect of parameters on production, cost and surface quality, different approaches, advantages of mathematical	**12 Hrs.**

	approach over conventional approach, solving optimization models of machining processes, design and manufacturing tolerances, methods of tolerance allocation, sequential approach, integration of design and manufacturing tolerances.	
4	Generation of tool path: Simulation of machining processes, NC tool path generation, graphical implementation, determination of optimal index positions for executing fixed sequence, quantitative methods. Implementation techniques for CAPP: MIPLAN system, Computer programming languages tbr CAPP, criteria for selecting a CAPP system and benefits of CAPP. Computer integrated planning systems, and Capacity planning system.	**10 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-123.1**	Understand basic concepts of control systems, microprocessor / micro controller
CO2	**MTME-123.2**	Able to understand the electromechanical drives
CO3	**MTME-123.3**	Gain Knowledge of Signal Conditioning and Precision Mechanical Actuation

Suggested Readings / Books:

1. Production Systems and Computer Integrated Manufacturing System, byMikell P Groover, Prentice Hall, 2007.
2. Computer Processing of Remotely Sensed Images: An Introduction, 3rd Edition, by- Mather Paul, Wiley, 2004.
3. Computer Aided Process Control, by- SK Singh, PHI Learning Pvt. Ltd, 2006.
4. Computer Aided Design and Manufacturing by M. Sarcar, K. L. Narayan, PHI Learning Pvt. Ltd, 2005.

SUBJECT TITLE: ROBOTICS
SUBJECT CODE: MTME124
SEMESTER: 2
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts i.e. classification of robots, present status and future trends, basic components of robotic system. The students will be able to understand 2D, 3D transformation, scaling, rotation, translation, homogeneous coordinates, multiple transformation.

S No.	Content	Contact Hrs.
1.	**Introduction:** History of robots, Classification of robots, Present status and future trends. Basic components of robotic system. Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom. Mechanisms and transmission, End effectors, Grippers-different methods of gripping, Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, Cam type gripper, Magnetic grippers, Vacuum grippers, Air operated grippers; Specifications of robot.	**13 Hrs.**
2	**Drive systems and Sensors** Drive system- hydraulic, pneumatic and electric systems Sensors in robot – Touch sensors, Tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.	**7 Hrs.**
3	**Kinematics and Dynamics of Robots** 2D, 3D Transformation, Scaling, Rotation, Translation, Homogeneous coordinates, multiple transformation, Simple problems. Matrix representation, Forward and Reverse Kinematics Of Three Degree of Freedom, Homogeneious Transformations, Inverse kinematics of Robot, Robot Arm dynamics, D-H representation of robots, Basics of Trajectory Planning.	**12 Hrs.**
4	**Robot Control, Programming and Applications** Robot controls-Point to point control, Continuous path control, Intelligent robot, Control system for robot joint, Control actions, Feedback devices, Encoder, Resolver, LVDT ,Motion Interpolations, Adaptive control. Introduction to Robotic Programming, On-line and off-line programming, programming examples. Robot applications-Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting.	**10 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-124.1**	Understand the basic concepts of classification of robots, present status and future trends
CO2	**MTME-124.2**	Understand 2D, 3D transformation
CO3	**MTME-124.3**	Gain Knowledge of Robot Control, Programming and Applications

Suggested Readings / Books:

1. Industrial Robotics, Technology programming and Applications by Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, AshishDutta, McGraw Hill, 2012.
2. Introduction to Robotics- mechanics and control by Craig. J. J, Addison- Wesley, 1999.
3. Robotics Technology and flexible automation by S.R. Deb, Tata McGraw-Hill Education., 2009.
4. Robotics Engineering an Integrated Approach by Richard D. Klafter, Thomas .A, ChriElewski, Michael Negin, PHI Learning, 2009.

SUBJECT TITLE: OPTIMIZATION TECHNIQUES
SUBJECT CODE: MTME125
SEMESTER: 2
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of meaning of operations research, modeling in operation research, principles of modeling. The students will be able to understand 2D, 3D transformation, scaling, rotation, translation, homogeneous coordinates, multiple transformation.

S No.	Content	Contact Hrs.
1.	Definition of Optimization: Meaning of Operations Research, Modeling in operation research, principles of modeling, Introduction to linear and non-linear programming problems and formulation of problems.	**7 Hrs.**
2	Linear Programming: Characteristics, Assumptions and Applications, Graphical solutions of two variables LP Problem, Linear programming in standard form, Solution of LP by Simplex (including Big M and Two phase methods) and revised Simplex methods, Special cases of LP, Duality and dual Simple method, Sensitivity analysis of LP problems. Network Models: Transportation problem, Transshipment problem, Assignment problem, Traveling-salesman problem, Shortest route problem, Minimal spanning tree problem, Maximum flow problem.	**13 Hrs.**
3	CPM & PERT: Characteristics & uses, drawing of network, removal of redundancy in network. Computation of EOT, LOT, free slack, total slack in CPM and PERT, crashing, resource allocation Dynamic Programming: Deterministic and Probabilistic Dynamic programming Game theory: Two-person, Zero-sum games, Games with mixed strategies, Graphical solution, Solution by linear programming.	**12 Hrs.**
4	Non-linear Programming: Characteristics, Concepts of convexity, maxima and minima of functions of n variables using Lagrange multipliers and Kuhn-Tukker conditions, Quadratic programming , One dimensional search methods, Fibonacci and golden section method, Optimization using gradient methods for unconstrained problems.	**10 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-125.1**	Understand the basic concepts of classification of robots, present status and future trends
CO2	**MTME-125.2**	Understand 2D, 3D transformation
CO3	**MTME-125.3**	Gain Knowledge of Robot Control, Programming and Applications

Suggested Readings / Books:

1. Engineering Optimization Theory and Practice by S.S. Rao, New Age International, 2004.
2. Optimization for Engineering Design by Kalyanmoy Deb, PHI, 2008.
3. Optimization Techniques by J.S Arora, John Wiley, 2001.

SUBJECT TITLE: LAB-II (COMMON TO ALL)
SUBJECT CODE: MTME-139
SEMESTER: 2
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
-	-	2	2

Internal Assessment: 60
End Term Exam: 40
Duration of Exam: 3 Hrs

One lab /field/industrial oriented project /problem will be allocated to each student related to the subjects related to the subjects taught in 1st semester.

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-139.1**	Understand the basic concept of machinability
CO2	**MTME-139.2**	Able to Understand the selection of topic and its presentation
CO3	**MTME-139.3**	Understand the use of seminar at different areas and places

(Departmental Elective-I)
SUBJECT TITLE: PRODUCT LIFE CYCLE MANAGEMENT (Elective-I)
SUBJECT CODE: MTME160
SEMESTER: 2
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of product life cycle management (PLM): definition, PLM lifecycle model. The students will be able to understand the digital manufacturing – PLM, digital manufacturing, benefits manufacturing.

S No.	Content	Contact Hrs.
1.	Introduction to Product Life Cycle Management(PLM): Definition, PLM Lifecycle model, Threads of PLM, Need for PLM, Opportunities and benefits of PLM, Views, Components and Phases of PLM, PLM feasibility study, PLM visioning. PLM Concepts, Processes and Workflow: Characteristics of PLM, Environment driving PLM,PLM Elements, Drivers of PLM, Conceptualization, Design, Development, Validation, Production, Support of PLM.	**7 Hrs.**
2	Product Data Management (PDM) Process and Workflow: PDM systems and importance, reason for implementing a PDM system, financial justification of PDM implementation. Versioning, check-in and checkout, views, Metadata, Lifecycle, and workflow. Applied problems and solution on PDM processes and workflow. Collaborative Product Development: Engineering vaulting, product reuse, smart parts, engineering change management, Bill of materials and process consistency, Digital mock-up and prototype development, design for environment, virtual testing and validation, marketing collateral.	**15 Hrs.**
3	Tools of Communication for collaborative work: Creation of 3DXML and CAD drawing using CAD software. Creation of an animation for assembly instructions on 3D via composer, creation of an acrobat 3D document. Applied problems and solutions on tools of communication for collaborative work. Knowledge and optimization of design products: Know how, best practices, parameterization of design, Applied problems and Solution on optimization of products using power copy, publication, parameters, formula, rule, check, design table, configuration, reaction.	**10 Hrs.**

4	Digital Manufacturing – PLM: Digital manufacturing, benefits manufacturing, manufacturing the first-one, Ramp up, virtual learning curve, manufacturing the rest, production planning. Developing a PLM strategy and conducting a PLM assessment: Strategy, Impact of strategy, implementing a PLM strategy, PLM initiatives to support corporate objectives. Infrastructure assessment, assessment of current systems and applications.	**10 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME160.1**	Understand basic concepts of product life cycle management (PLM): definition.
CO2	**MTME160.2**	Understand PLM lifecycle model
CO3	**MTME160.3**	Understand the digital manufacturing – PLM, digital manufacturing, benefits manufacturing.

Suggested Readings / Books:

1. Product Life cycle Management by S. John, Springer, 2011.
2. Product Life cycle Management (Volume: 3) The Executive Summary by S. John, Springer, 2011.

(Departmental Elective-I)

SUBJECT TITLE: MODELING AND SIMULATION
SUBJECT CODE: MTME161
SEMESTER: 2
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of use and scope of mathematical modeling, principles of model formulation, role and importance of steady-state and dynamic simulation. The students will be able to understand the modeling of specific systems: constant and variable holdup CSTRs under isothermal and non-isothermal conditions.

S No.	Content	Contact Hrs.
1.	Introduction: Use and scope of mathematical modeling, Principles of model formulation, Role and importance of steady-state and dynamic simulation, Classification of models, Model building, Modeling difficulties, Degree-of-freedom analysis, Selection of design variables, Review of numerical techniques, Model simulation.	**7 Hrs.**
2	Fundamental Laws: Equations of continuity, energy, momentum, and state, Transport properties, Equilibrium and chemical kinetics, Review of thermodynamic correlations for the estimation of physical properties like phase equilibrium, bubble and dew points	**10 Hrs.**
3	Modeling of Specific Systems: Constant and variable holdup CSTRs under isothermal and non-isothermal conditions, Stability analysis, Gas phase pressurized CSTR, Two phase CSTR, Non-isothermal PFR, Batch and semi-batch reactors, Heat conduction in a bar, Laminar flow of Newtonian liquid in a pipe, Gravity flow tank, Single component vaporizer, Multi-component flash drum, Absorption column, Ideal binary distillation column and no ideal multi-component distillation column, Batch distillation with holdup etc.	**15 Hrs.**
4	Simulation: Simulation of the models, Sequential modular approach, Equation oriented approach, Partitioning and tearing, Introduction and use of process simulation software (Aspen Plus/ Aspen Hysys) for flow sheet simulation.	**10 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME161.1**	Understand basic concepts of use and scope of mathematical modeling, principles of model formulation

CO2	**MTME161.2**	Understand role and importance of steady-state and dynamic simulation.
CO3	**MTME161.3**	Understand the modeling of specific systems: constant and variable holdup CSTRs under isothermal and non-isothermal conditions.

Suggested Readings / Books:

1. Process Modeling, Simulation, and Control for Chemical Engineering by W.L. Luyben, McGraw-Hill, 1998.
2. Process Plant Simulation by B.V. Babu, Oxford University Press, 2004.
3. Process Modeling, Longman Sc& Tech., M.M. Denn, 1987

(Departmental Elective-I)

SUBJECT TITLE: FINITE ELEMENT METHODS
SUBJECT CODE: MTME162
SEMESTER: 2
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of the finite element method, comparison with finite difference method. The students will be able to understand the finite element analysis of 2-D problems: Finite element modeling of single variable problems, triangular and rectangular elements

S No.	Content	Contact Hrs.
1.	Introduction: Historical background, basic concept of the finite element method, comparison with finite difference method.	**7 Hrs.**
2	Variation Methods: Calculus of variation, Rayleigh-Ritz and Galerkin methods; Finite Element Analysis of 1-D problems: Formulation by different approaches (direct, potential energy and Galerkin); Derivation of elemental equations and their assembly, solution and its post processing, Applications in heat transfer, fluid mechanics and solid mechanics: bending of beams analysis of truss and frame.	**15 Hrs.**
3	Finite Element Analysis of 2-D problems: Finite element modelling of single variable problems, triangular and rectangular elements; Applications in heat transfer, fluid mechanics and solid mechanics; Axi-symmetric and 3D bodies.	**10 Hrs.**
4	Numerical Considerations: numerical integration, error analysis, meshes refinement. Plane stress and plane strain problems; Bending of plates; Eigen value and time dependent problems.	**10 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-162.1**	Understand the basic concepts of finite element method,
CO2	**MTME-162.2**	Understand the difference between finite element and finite difference methods.
CO3	**MTME-162.3**	Understand some programming aspects: mesh generation, mesh refinement, numerical integration etc.

Suggested Readings / Books:

1. Finite Element Procedures in Engineering Analysis by K.J. Bathe, Prentice-Hall, Englewood Cliffs, NJ, 1982.
2. Introduction to the Finite Element Method by J.N. Reddy, McGraw-Hill', New York, 1993.
3. Finite Element Analysis by C.S. Krishnamoorthy, Tata McGraw Hill, 2001
4. Finite Element Methods by Chandupatla, Pearson Publication, 2004.

(Departmental Elective-I)
SUBJECT TITLE: OPERATION MANAGEMENT (Elective-I)
SUBJECT CODE: MTME163
SEMESTER: 2ND
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of operations managements which helps the students to enhance their skills.

S No.	Content	Contact Hrs.
1.	Introduction: Basic concepts of operations and production management, Types of manufacturing systems and their characteristics, scope of operations management.	7 Hrs.
2	Product and Process Design: System planning and design, long-range planning, product and process design and technological considerations, MACRO and MICRO process design. Demand Forecasting: Role of demand forecasting in operations decisions; various demand patterns, qualitative and quantitative techniques of demand forecasting, introduction to standard software used in demand forecasting.	12 Hrs.
3	Production Planning and Scheduling: Aggregate production planning, operation scheduling, various scheduling criteria, lot sizing, job shop control; Mutli-stage manufacturing systems, their scheduling and management, capacity planning, introduction to standard software used for Production Planning and Scheduling. Materials Planning: Details of material requirement planning (MRP), manufacturing resource planning (MRP-II) and enterprisewide resource planning (ERP) with their various techniques, JIT and JIT-II concepts.	13 Hrs.
4	Facilities Planning: Plant design, types and considerations in the plant location, plant layout types, design, evaluation, principles and types of material flow, optimum plant layout.	10 Hrs.

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-163.1**	Understand the basic concepts of production, productivity and function of management
CO2	**MTME-163.2**	To gain knowledge of hierarchy, principles and dimensions of planning function of organizations

CO3	**MTME-163.3**	Determine the various theories and approaches related to Industrial Engineering

Suggested Readings / Books:

1. Modern Production/Operations Management by Buffa, E. S. and Sarin, R. K, John Wiley & Sons, 2000.
2. Production Operations Management by Adam, E., Jr. and Ebert, R. E., Pearson Education, 2006.
3. Operations Management: Policy, Practice, and Performance Improvement by Brown, S., Blackmon, K., Cousins, P. and Maylor H., Butterworth-Heinemann, 2009.
4. Operations Management by Dervitsiotis, K. N., McGraw Hill, 2003.
5. Production and Operations Management by Starr M. K.,Thomson Business Information., 2002.

SYLLABUS

SEMESTER-III

SUBJECT TITLE: SMART MATERIALS AND APPLICATIONS
SUBJECT CODE: MTME126
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of smart materials and their application for sensing and actuation, mechatronics aspects. The students will be able to understand shape memory alloys (SMA), electro-active polymers (EAPs) and magnetostrictive materials.

S No.	Content	Contact Hrs.
1.	Introduction: Smart materials and their application for sensing and actuation, Mechatronics aspects. Piezoelectric materials: Piezoelectricity and piezoelectric materials, Constitutive equations of piezoelectric materials, Piezoelectric actuator types, Control of piezoelectric actuators, Applications of piezoelectric actuators for precise positioning and scanning.	**13 Hrs.**
2	Shape memory alloys (SMA): Properties of shape memory alloys, Shape memory effects, Pseudo-elasticity in SMA, Design of shape memory actuator, selection of materials, Smart actuation and control, Applications of SMA in precision equipments for automobiles, trains and medical devices. Electro-active polymers (EAPs): Ionic polymer metal composites (IPMC), Conductive polymers, Carbon nanotubes, Dielectric elastomers, Design & control issues for EAP actuators, Applications of EAP for biomemetic, tactile display and medical devices.	**15 Hrs.**
3	Magnetostrictive materials: Basics of magnetic properties of materials, magnetostriction: constitutive equations, types of magnetostrictive materials, Design & control of magnetostrictive actuators, Applications of magnetostrictive materials for active vibration control.	**15 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME126.1**	Understand basic concepts of smart materials and their application
CO2	**MTME126.2**	Understand shape memory alloys (SMA), electro-active polymers (EAPs)
CO3	**MTME126.3**	Gain knowledge of magnetostatic materials

Suggested Readings / Books:

1. Emerging Actuator Technologies- a Micromechatronics Approach by Jose L. Pons, John Wiley & Sons Ltd, 2005.
2. Smart Material Systems: Model Development by Ralph Smith, SIAM, Society for Industrial and Applied Mathematics, 2005.
3. Dielectric Elastomers as Electromechanical Transducersby F. Carpi, D. De Rossi, R. Kornbluh, R. Pelrine, P. Sommer-Larsen, Elsevier, Hungry, 2008.
4. Electroactive Polymer (EAP) Actuators as Artificial Muscles Reality, Potential and Challenges by Y. B. Cohen, SPIE press, USA, 2004.

SUBJECT TITLE: MANUFACTURING OF COMOSITE MATERIALS
SUBJECT CODE: MTME127
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of composites, function of the matrix and reinforcement in composites, matrices, thermosets and thermoplastic, fiber reinforcement. The students will be able to understand the metal matrix and reinforcement, manufacturing processes for metal matrix composites: dispersion hardended and particle composite.

S No.	Content	Contact Hrs.
1.	Introduction to Composites, Function of the Matrix and Reinforcement in Composites, Matrices: Thermosets and Thermoplastic, Fiber Reinforcement. Properties of Composites, Composites testing, Composites design: Laminate theory, Rule of mixtures, symmetry and balance	**7 Hrs.**
2	Thermoset Composite manufacturing: Lay-up processes, Spray up process, Thermoset Composite manufacturing: Fiber placement process, Thermoset Composite manufacturing: Resin transfer moulding. Thermoset Composite manufacturing: Vaccum assisted resin transfer moulding, Thermoset Composite manufacturing: Compression molding process, Thermoset composites manufacturing: Filament winding, Thermoplastic Composite manufacturing: Sheet moulding, Thermoplastic Composite manufacturing: Injection moulding, sheet moulding, Calendaring, Thermoplastic Composite manufacturing: Extrusion, Blow molding, rotational molding, Thermoforming	**15 Hrs.**
3	Metal Matrix Composites: Metal matrix and reinforcement, Manufacturing processes for Metal Matrix Composites: Dispersion hardended and particle composite, Manufacturing processes for Metal matrix composites: Layer composites and infiltration method.	**10 Hrs.**
4	Ceramic matrix composites: Hot isostatic processing, Non – destructive testing of Composites, Manufacturing process selection: Cost, performance, size shape, rate of production. Steps for process selection	**10 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-107.1**	Understand basic concepts of composite material based on matrix and topology,

CO2	**MTME-107.2**	Able to understand the industrial application of composite materials
CO3	**MTME-107.3**	Able to understand distribution of constituents and Nano-composites

Suggested Readings / Books:

1. Composites manufacturing: materials, product, and process engineering by S. Mazumdar, CRC press, 2001.
2. Composite materials and processing by M. Balasubramanian, CRC press, 2013.
3. Manufacturing processes for advanced composites by F.C Campbell, Elsevier, 2003.

SUBJECT TITLE: PRE-THESIS SEMINAR
SUBJECT CODE: MTME182
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
-	-	-	4

Internal Assessment: 100

Students should present the research topic which should be carried out in final thesis

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-182.1**	Understand the potential of presenting through seminar
CO2	**MTME-182.2**	Able to Understand the selection of topic and its presentation
CO3	**MTME-182.3**	To effectively use of seminar for selecting the research area

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SUBJECT TITLE: PROJECT
SUBJECT CODE: MTME183
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
-	-	-	10

Internal Assessment: 60
External Assessment: 40

Students should make a project and thereafter submit the file along with ppt.

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-183.1**	Understand the method of concept learning through practical skills
CO2	**MTME-183.2**	Able to Understand the potential of practical demonstration
CO3	**MTME-183.3**	To effectively use the practical skills for project management

(Departmental Elective-II)

SUBJECT TITLE: RAPID PROTOTYPING
SUBJECT CODE: MTME164
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts ofrapid prototyping: classification of manufacturing processes. The students will be able to understand the materials selections and product prototyping: geometrical modeling techniques, wireframe modeling, surface modeling and solid modeling.

S No.	Content	Contact Hrs.
1.	Introduction to Rapid Prototyping: Classification of Manufacturing Processes, Introduction to Rapid Prototyping, Rapid Prototyping and its Impact, Engineering design process, Product development, Product Prototyping and Product Development, Need of Product Prototyping, Prototype Planning and Management, Product and Prototype Cost Estimation, Prototype Design Methods and tools.	**9 Hrs.**
2	Materials Selections and Product Prototyping: Geometrical Modelling Techniques, Wireframe Modelling, Surface Modelling and solid modelling, Prototyping Materials, Modelling of Material Properties, Modelling and Design of Materials and Structures. Rapid Prototyping Processes: Rapid Prototyping Overview, Rapid Prototyping Procedure, Liquid-Based RP Processes, Solid-Based RP Processes, Powder-Based RP Processes. Direct	**12 Hrs.**
3	Digital Prototyping and Manufacturing: Solid Models and Prototype Representation, Reverse Engineering for Digital Representation, Prototyping and Manufacturing Using CNC Machining, Fully Automated Digital Prototyping and Manufacturing. Direct Methods for Rapid Tool Production: Classification of Direct Rapid Tool Methods, Direct ACESTM Injection Moulds, Laminated Object Manufactured (LaM) Tools, DTM Rapid Tool, Sand Form, EOS Direct Tool Process, Direct Metal Tooling using 3Dp. applications of Rapid Prototyping: Functional Models, Pattern for Investment and Vacuum Casting, Medical Model, and Art Models, Engineering Analysis Models	**13 Hrs.**
4	Indirect Methods for Rapid Tool Production: Metal Deposition Tools, RTV Tools, Epoxy Tools, Ceramic Tools, Cast Metal Tools, Investment Casting, Fusible Metallic Core, Sand Casting, Keltool Process	**8 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-164.1**	Understand the basic concepts of rapid manufacturing: customization and mass customization
CO2	**MTME-164.2**	Understand the classification of rapid manufacturing processes
CO3	**MTME-164.3**	Understand 3D printing, direct metal deposition/3D welding, laser/electron beam melting based technologies

Suggested Readings / Books:

1. Rapid prototyping and engineering applications by Frank W. Liou, CRC press publications, 2010.
2. Rapid manufacturing by DT Pham & SS Dimov, Springer, 2004.
3. Product design by Kevin otto&, kristin wood, Pearson publication, 2007.

(Departmental Elective-II)

SUBJECT TITLE: PRODUCT DESIGN AND DEVELOPMENT
SUBJECT CODE: MTME165
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of product design in industry, principal requirements of good product design, factors and considerations affecting product design. The students will be able to understand the value engineering, concept, advantage and applications, value, types of values, analysis of function.

S No.	Content	Contact Hrs.
1.	Importance of product design in industry, Principal requirements of good product design. Factors and considerations affecting product design. Ergonomic factor in product design, Product design methodology and techniques, Basic elements and concepts of visual design	**20 Hrs.**
2	Materials, forms, function and color relationships. Product graphics, product development and testing, Packaging materials their characteristics and applications, Packaging design considerations	**13 Hrs.**
3	Value engineering, concept, advantage and applications, Value, types of values, Analysis of function, using and evaluating functions, Value engineering techniques. Value control	**10 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-165.1**	Understand the basic concepts of principal requirements of good product design.
CO2	**MTME-165.2**	Understand the factors and considerations affecting product design
CO3	**MTME-165.3**	Understand value engineering, concept, advantage and applications

Suggested Readings / Books:

1.Product Design & Development by K.T. Ulrich, Steven D Eppinger, Tata McGrawhill New Delhi, 2001.
2. The Mechanical Design Process byDavid G Ullman, McGrawhillInc., 1992.
3. Product Design Fundamentals and Methods by N.J.M. Roozenberg, J. Ekels, N.F.M Roozenberg, John Willey & Sons, 1995

4. Product Design: “Techniques in Reverse Engineering and new Product Development by Kevin Otto & Kristin Wood,Pearson Education, 2004.

(Departmental Elective-II)

SUBJECT TITLE: COMPUTER INTEGRATED MANUFACTURING SYSTEM
SUBJECT CODE: MTME166
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of product life cycle management. need of CAD/CAM integration through computers, benefits of integration, types of production systems and their automation. The students will be able to understand the computer aided production planning and control: computer aided shop floor control.

S No.	Content	Contact Hrs.
1.	Introduction: Introduction to Product life cycle management. Need of CAD/CAM integration through computers, Benefits of integration, Types of production systems and their automation, CAD/CAM integration. Concept of FMS and CIMS, DNC based factory management and control, Integrated CAD/CAM system and shared database.	**10 Hrs.**
2	Elements of a General CIM System: Types of CIM systems, CAD-CAM link for CIMS, Benefits of CAM, FMS and CIMS, Automated material handling systems, equipment and their functions. Integration of Robots in CIMS, automated guided vehicle navigation system, Automatic Storage and Retrieval Systems (AS/RS), Carousel storage system, design of automatic material handling system, KWO analysis, work-part transfer mechanisms.	**12 Hrs.**
3	Group Technology: Concept and terminology, Part family formation, Classification and coding systems for components, Group technology machine cells.	**9 Hrs.**
4.	Computer Aided Production Planning and Control: Computer aided shop floor control, Computer aided inspection & quality control, Shop floor data collection systems, Sensors used in Automation, Tool management system, Automatic identification systems, Barcode system. CIM Database and Database Management Systems: Types, Management information system, Manufacturing data preparation.	**11 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-166.1**	Understand the basic concepts OF CAD/CAM contents and tools,

CO2	**MTME-166.2**	Understand the history of CAD/CAM development, CAD/CAM market trends.
CO3	**MTME-166.3**	Understand mathematical representation of solids and geometrical transformations.

Suggested Readings / Books:

1. CAD/ CAM by M.P. Groover and E.W. Zimmers, Dorling Kingsley, 2008.
2. Automation, Production Systems and Computer Integrated Manufacturing by M.P. Groover, Pearson Education Asia, 2009.
3. Principles of Computer Integrated Manufacturing by K.S. Vajpayee, Prentice Hall, 2006.
4. Computer Integrated Manufacturing by P.N. Rao, N.K. Tewari and T.K. Kundra, McGraw Hill, 1998.

(Departmental Elective-II)

SUBJECT TITLE: INDUSTRIAL AUTOMATION
SUBJECT CODE: MTME167
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Course Objectives:
The course has been designed to cover the basic concepts of automation in production system, principles and strategies of automation, basic elements of an automated system. The students will be able to understand the control technologies in automation: industrial control systems, process industries versus discrete-manufacturing industries.

S No.	Content	Contact Hrs.
1.	Introduction: Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Flow lines & Transfer Mechanisms, Fundamentals of Transfer Lines. (SLE: Analysis of Transfer Lines).	**9 Hrs.**
2	Material handling and Identification Technologies: Overview of Material Handling Systems, Principles and Design Consideration, Material Transport Systems, Storage Systems, Overview of Automatic Identification Methods. Automated Manufacturing Systems: Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation. Quality Control Systems: Traditional and Modern Quality Control Methods, SPC Tools, Inspection Principles and Practices, Inspection Technologies.	**13 Hrs.**
3	Control Technologies in Automation: Industrial Control Systems, Process Industries Versus Discrete-Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms. Computer Based Industrial Control: Introduction & Automatic Process Control, Building Blocks of Automation Systems: LAN, Analog & Digital I/O Modules, SCADA Systems& RTU. Distributed Control System: Functional Requirements, Configurations & some popular Distributed Control Systems.	**12 Hrs.**
4.	Modeling and Simulation for Plant Automation: Introduction, need for system Modeling, Building Mathematical Model of a Plant, Modern Tools & Future Perspective. Industrial Control Applications: Cement, Thermal, Water Treatment & Steel Plants.	**8 Hrs.**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-167.1**	Understand the basic concepts basic concepts of computer based control i.e. Implementing control system using computer or microprocessor.
CO2	**MTME-167.2**	Understand advanced functions of PLC
CO3	**MTME-167.3**	Understand analog input and output functions, analog input and output modules, analog signal processing in PLC

Suggested Readings / Books:

1. Automation, Production Systems and Computer Integrated Manufacturing byM.P.Groover, Pearson Education.5th edition, 2009.
2. Computer Based Industrial Control by Krishna Kant, EEE-PHI,2nd edition,2010
3. An Introduction to Automated Process Planning Systems by Tiess Chiu Chang & Richard A. Wysk
4. Performance Modeling of Automated Manufacturing Systems by Viswanandham, PHI, 1st edition,2009.

SYLLABUS

SEMESTER-IV

SUBJECT TITLE: DISSERTATION
SUBJECT CODE: MTME-190

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	-	-	4

Students should do the research thesis and submit a report file to the department. The ppt. is compulsory for the same.

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**MTME-190.1**	Understand the potential of doing the research
CO2	**MTME-190.2**	Able to Understand the selection of topic and its presentation
CO3	**MTME-190.3**	To effectively use the different tools, report writing and present in schematically way the research area selected