SCHEME & SYLLABUS

(Choice Based Credit System)

for

M. TECH.

in

CAD/CAM & Robotics

(w.e.f. Session 2022-23)

Program Code: MEC-301

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	14	500	18
2.	II	18	500	18
3	III	8	400	12
4	IV	-	-	12
	Total	**40**	**1400**	**60**

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

Program Name: M. Tech. CAD/CAM & Robotics
Program Code: MEC-301

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										
MMAT-1108	Research Methodology	3	1	-	4	4	40	60	100	3
MMEC-1101	CAD/CAM	4	-	-	4	4	40	60	100	3
MMEC-1102	Robotics	4	-	-	4	4	40	60	100	3
MMEC-1103	Manufacturing of Composite Materials	4	-	-	4	-	100	-	100	3
MMEC-1171	Optimization Techniques Lab	-	-	2	2	2	50	50	100	-
Total		**15**	**1**	**2**	**18**	**14**	**280**	**220**	**500**	**12**

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										
MMEC-1201	Computer Aided Process Planning	4	-	-	4	4	40	60	100	3
MMEC-1202	Mechatronics	4	-	-	4	4	40	60	100	3
MTME-1271	Lab-II	-	-	2	2	2	50	50	100	-
Elective Course 1 (Any One)										
MMEC-1203	Product Life Cycle Management	4	-	-	4	4	40	60	100	3
MMEC-1204	Finite Element Methods	4	-	-	4	4	40	60	100	3
MMEC-1205	Microprocessor and Microcontroller	4	-	-	4	4	40	60	100	3
Elective Course 2 (Any One)										
MMEC-1206	Industrial Automation	4	-	-	4	4	40	60	100	3
MMEC-1207	Management Information Systems	4	-	-	4	4	40	60	100	3
MMEC-1208	Automatic Control Systems	4	-	-	4	4	40	60	100	3
Total		**16**	**-**	**2**	**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										
MMEC-2301	MOOCs	3	-	-	3	4	40	60	100	3
MMEC-2302	MOOCs	3	-	-	3	4	40	60	100	3
MMEC-2371	Literature Survey	-	-	-	2	-	100	-	100	-
MMEC-2372	Synopsis	-	-	-	4	-	50	50	100	-
Total		**12**	**-**	**-**	**12**	**8**	**230**	**270**	**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										
MMEC-2471	Thesis	-	-	24	12	-	-	-	-	-
Total		**-**	**-**	**24**	**12**	**-**	-	-	-	-

SYLLABUS

SEMESTER-I

SUBJECT TITLE: RESEARCH METHODOLOGY
SUBJECT CODE: MMAT-1108
SEMESTER: 1
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	1	-	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 will 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	**12 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	**13 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	**12 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 or MATLAB Software in Data Analysis	**13 hrs**

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

CO1	MMAT-1108.1	Develop understanding on various kinds of research, objectives of doing

		.research, research process, research designs and sampling.
CO2	MMAT-1108.2	Have basic knowledge on qualitative research techniques
CO3	MMAT-1108.3	Have adequate knowledge on measurement & scaling techniques as well as the quantitative data analysis
C04	MMAT-1108.4	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: MMEC-1101
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.	**12 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.	**13 hrs**
3	Three Dimensional Geometric Transformations: Transformations-translation, rotation, scaling, reflections, shears, concatenation transformations Visual Realization: Basic concepts of visual realization, hidden line removal, hidden surface removal, shading surfaces and solids CAD Standards:	**12 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 any available CAD package.	**13 hrs**

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

CO1	MMEC-1101.1	Understand the basic concepts OF CAD/CAM contents and tools,

CO2	MMEC-1101.2	Understand the history of CAD/CAM development, CAD/CAM market trends.
CO3	MMEC-1101.3	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: ROBOTICS
SUBJECT CODE: MMEC-1102
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 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.	**12 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.	**13 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.	**13 hrs**

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

CO1	MMEC-1102.1	Understand the basic concepts of classification of robots, present status and future trends

CO2	MMEC-1102.2	Understand 2D, 3D transformation
CO3	MMEC-1102.3	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: MANUFACTURING OF COMPOSITE MATERIALS
SUBJECT CODE: MTME-1103
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 composite material, Classification based on matrix and topology, Constituents of composites. The students will be able to understand the industrial application of composite materials: civil constructions of structures/panels, aerospace industries, automobile and other surface transport industries.

S No.	Content	Contact Hrs.
1.	Introduction: Definition of composite material, Classification based on matrix and topology, Constituents of composites, Interfaces and Interphases, Distribution of constituents, Nano-composites	**12 hrs**
2	Fabrication of Composites: Fabrication of Metal Matrix Composites: Commonly used Matrices, Basic Requirements in Selection of constituents, solidification processing of composites - XD process, Spray processes - Osprey Process, Rapid solidification processing, Dispersion Processes - Stir-casting & Compocasting, Screw extrusion, Liquid metal impregnation technique - Squeeze casting, Pressure infiltration, Lanxide process), Pinciple of molten alloy infiltration, rheological behaviour of meltparticle slurry, Synthesis of In situ Composites; Fabrication of Polymer Matrix Composites - Commonly used Matrices Basic Requirements in selection of Constituents, Moulding method, Low pressure closed moulding, pultrusion, Filament winding, Fabrication of ceramic matrix composites - Various techniques of vapour deposition, Liquid phase method and Hot pressing etc., Fabrication of nano-composites	**13 hrs**
3	Secondary Processing and Joining of Composites: Forging and extrusion of composites – critical issues, dynamic recovery and dynamic recrystallization, mechanical properties; Induction Heating, Fusion Bonding, Ultrasonic welding, Gas tungsten arc welding, Gas metal arc welding, Resistance spot & seam welding, Resistance brazing, Resistance spot joining, Resistant spot brazing, Resistance welding of thermoplastic graphite composite, Weld bonding, Brazing of MMC.	**12 hrs**
4	Industrial Application of Composite Materials: Civil constructions of structures/pannels, Aerospace industries, Automobile and other surface transport industries, Packaging industries, House hold and sports components etc. Fracture & Safety of Composite: Fracture behaviour of composites, Mechanics and Weakest link statistics, Griffith theory of brittle fracture and modification for structural materials, Basic fracture mechanics of composite (Fracture toughness, COD and J-integral approaches, Fatigue crack growth rate), Fracture	**13 hrs**

	Mechanics of brittle matrix fibre composite, Fracture mechanics of metal matrix fibre composite, Experimental evaluation (composite), Elementary reliability analysis.	

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

CO1	MMEC-1103.1	Understand basic concepts of composite material based on matrix and topology,
CO2	MMEC-1103.2	Able to understand the industrial application of composite materials
CO3	MMEC-1103.3	Able to understand distribution of constituents and Nano-composites

Suggested Readings / Books:

1. Composite Materials – Science & Engg. by K.K. Chawla, Springer- Verlag, 2001.
2. Composite Materials: Properties, Non-destructive testing and Repair by Mel M. Schwartz Prentice Hall, 2007.
3. Modern Composite Materials by L.J. Broutman and R.M. Krock Addison-Wesley, 2005.
4. Industrial Materials: Polymers, Ceramics and Composites by David A Colling& Thomas Vasilos, vol. 2, Prentice Hall, 2002

SUBJECT TITLE: OPTIMIZATION TECHNIQUE LAB (COMMON TO ALL)
SUBJECT CODE: MMEC-1171
SEMESTER: 1
CONTACT HOURS/WEEK:

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

Internal Assessment: 50
End Term Exam: 50
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	MMEC-1171.1	Understand the potential of presenting through MATH Lab
CO2	MMEC-1171.2	Dynamics and Vibration using as a single degree vibratory system as a case study
CO3	MMEC-1171.3	Implement optimization technique to find the optimal cost of structure weight/volume/both

SYLLABUS

SEMESTER-II

SUBJECT TITLE: COMPUTER AIDED PROCESS PLANNING
SUBJECT CODE: MMEC-1201
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.	**12 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.	**13 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 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.	**12 hrs**
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	**13 hrs**

	integrated planning systems, and Capacity planning system.	

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

CO1	MMEC-1103.1	Understand basic concepts of control systems, microprocessor / micro controller
CO2	MMEC-1103.2	Able to understand the electromechanical drives
CO3	MMEC-1103.3	Gain Knowledge of Signal Conditioning and Precision Mechanical Actuation

Suggested Readings / Books:

1. Production Systems and Computer Integrated Manufacturing System, by Mikell 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: MECHATRONICS
SUBJECT CODE: MMEC-1201
SEMESTER: 1ST
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 beendesigned to cover the basic concepts ofcontrol 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.	**12 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	**13 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, kinematics, inverse kinematics, timing belts, ball screw and nut, linearmotion guides, linear bearings, harmonic transmission, bearings, motor / drive selection	**12 hrs**
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.	**13 hrs**

	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.	

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

CO1	MMEC-1201.1	Understand basic concepts of an Electronics devices
CO2	MMEC-1201.2	Able to understand the working of semiconductor
CO3	MMEC-1201.3	Gain Knowledge of Signal Conditioning and micrprocessor

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 by Groover, PHI.
4. Flexible Manufacturing systems by Maleki, Prentice Hall.
5. Feedback Control Systems by BC. Kuo, PHI.

SUBJECT TITLE: LAB-II (COMMON TO ALL)
SUBJECT CODE: MMEC-1271
SEMESTER: 1st
CONTACT HOURS/WEEK:

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

Internal Assessment: 50
End Term Exam: 50
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	**MMEC-1271.1**	Understand the basic concept of machinability
CO2	**MMEC-1271.2**	Able to Understand the selection of topic and its presentation
CO3	**MMEC-1271.3**	Understand the use of seminar at different areas and places

(Departmental Elective-I)

SUBJECT TITLE: PRODUCT LIFE CYCLE MANAGEMENT
SUBJECT CODE: MMEC-1203
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.	**12 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.	**13 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.	**12 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	**13 hrs**

	corporate objectives. Infrastructure assessment, assessment of current systems and applications.	

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

CO1	**MMEC-1203.1**	Understand basic concepts of product life cycle management (PLM): definition.
CO2	**MMEC-1203.2**	Understand PLM lifecycle model
CO3	**MMEC-1203.3**	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: FINITE ELEMENT METHODS
SUBJECT CODE: MMEC-1204
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	**MMEC-1204.1**	Understand the basic concepts of finite element method,
CO2	**MMEC-1204.2**	Understand the difference between finite element and finite difference methods.
CO3	**MMEC-1204.3**	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: MICROPROCESSOR AND MICROCONTROLLER
SUBJECT CODE: MMEC-1205
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 Architecture of 8086 microprocessor and to learn the design aspects of I/O and Memory Interfacing circuits.

S No.	Content	Contact Hrs.
1.	Unit I: Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.	**12 hrs**
2	Unit II: 8086 signals – Basic configurations – System bus timing – System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors. Unit III: Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.	**13 hrs**
3	Unit IV: Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.	**12 hrs**
4	Unit V: Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors	**13 hrs**

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

CO1	**MMEC-1205.1**	Understand and execute programs based on 8086 microprocessor.

CO2	**MMEC-1205.2**	Design Memory Interfacing circuits.
CO3	**MMEC-1205.3**	Design and implement 8051 microcontroller based systems.

Suggested Readings / Books:

1. Yu-Cheng Liu, Glenn A.Gibson, ―Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design‖, Second Edition, Prentice Hall of India, 2007. (UNIT I- III)
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, ―The 8051 Microcontroller and Embedded Systems: Using Assembly and C‖, Second Edition, Pearson education, 2011. (UNIT IV-V)

(Departmental Elective-II)

SUBJECT TITLE: INDUSTRIAL AUTOMATION
SUBJECT CODE: MMEC-1206
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 computer based control i.e. implementing control system using computer or microprocessor. The students will be able to understand advanced functions of PLC i.e. analog input and output functions, analog input and output modules, analog signal processing in PLC.

S No.	Content	Contact Hrs.
1.	Computer based control: Implementing control system using computer or microprocessor; computer based controller: hardware configuration and software requirements. Distributed control system: Meaning and necessity of distributed control; hardware components of DCS; DCS software. Introduction programmable logic controller (PLC): What is PLC? PLC versus microprocessor/microcontroller/computer, advantages and disadvantages of PLC, architecture and physical forms of PLC	**12 hrs**
2	Basic PLC functions: Registers: holding, input and output registers; Timers and timer functions; counters and counter functions Intermediate PLC functions: Arithmetic functions: addition, subtraction, multiplication, division and other arithmetic functions; Number comparison and conversion. Data handling functions of PLC: Skip function and applications; master control relay function and applications; jump with non-return and return; data table, register and other move functions. Bit functions of PLC: Digital bit functions and applications; sequencer functions and applications.	**13 hrs**
3	Advanced functions of PLC: Analog input and output functions, analog input and output modules, analog signal processing in PLC; PID control function, network communication function. PLC programming: PLC programming languages, ladder programming, mnemonic programming and high level language programming.	**12 hrs**
4	SCADA: Supervisory control versus distributed control; Layout and parts of SCADA system, detailed block schematic of SCADA system; Functions of SCADA system: data acquisition, monitoring, control, data collection and storage, data processing and calculation, report generation; MTU: functions, single and dual computer configurations of MTU; RTU: functions, architecture	**13 hrs**

	/ layout; MTU-RTU communication and RTU-field device communication.	

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

CO1	**MMEC-1206.1**	Understand the basic concepts of computer based control i.e. Implementing control system using computer or microprocessor.
CO2	**MMEC-1206.2**	Understand advanced functions of PLC
CO3	**MMEC-1206.3**	Understand analog input and output functions, analog input and output modules, analog signal processing in PLC

Suggested Readings / Books:

1. Process Control Instrumentation Technology, C.D. Johnson, Prentice Hall, 2000.
2. Programmable Logic Controllers, J.W. Webb, R.A. Reis, Prentice Hall, 2004.
3. Programmable Logic Controllers, J.R. Hackworth and F.D. Hackworth, Pearson Edition, 2008.
4. Supervisory Control and Data Acquisition (SCADA), S.A. Boyer, International Society of Automation, 2001.

(Departmental Elective-II)

SUBJECT TITLE: MANAGEMENT INFORMATION SYSTEMS
SUBJECT CODE: MMEC-1207
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:
Information Systems (IS) enables new approaches to improve efficiency and efficacy of business models. This course will equip the students with understanding of role, advantages and components of an Information System. The objective of the course is to help students integrate their learning from functional areas, decision making process in an organization and role of Information Systems to have a vintage point in this competitive world.

S No.	Content	Contact Hrs.
1.	Unit I: Basic Concepts of Information System Role of data and information, Organization structures, Business Process, Systems Approach and introduction to Information Systems.	**12 hrs**
2	Unit II: Types of IS Resources and components of Information System, integration and automation of business functions and developing business models. Role and advantages of Transaction Processing System, Management Information System, Expert Systems and Artificial Intelligence, Executive Support Systems and Strategic Information Systems. Unit III: Architecture & Design of IS Architecture, development and maintenance of Information System.	**13 hrs**
3	Unit IV: Decision Making Process Programmed and Non- Programmed decisions, Decision Support Systems, Models and approaches to DSS Unit V: Introduction to Enterprise Management technologies Business Process Reengineering, Total Quality Management and Enterprise Management System viz. ERP, SCM, CRM and Ecommerce.	**20 hrs**
4	Unit VI: Introduction to SAD System Analysis and Design. Models and Approaches of Systems Development.	**5 hrs**

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

CO1	**MMEC-1207.1**	Understand the basic concepts of MIS
CO2	**MMEC-1207.2**	Understand advanced functions MIS
CO3	**MMEC-1207.3**	Understand the concept of decision making

Suggested Readings / Books:

1. Management Information System, W.S Jawadekar, Tata Mc Graw Hill Publication.
2. Management Information System, David Kroenke, Tata Mc Graw Hill Publication.
3. MIS: Management Perspective, D.P. Goyal, Macmillan Business Books
4. MIS and Corporate Communications, Raj K. Wadwha, Jimmy Dawar, P. Bhaskara Rao, Kanishka Publishers.
5. MIS: Managing the digital firm, Kenneth C. Landon, Jane P. Landon, Pearson Education

(Departmental Elective-II)

SUBJECT TITLE: AUTOMATIC CONTROL SYSTEMS
SUBJECT CODE: MMEC-1208
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:
Be able to model and/or write equations of motion for electrical and mechanical components and systems – these are some of the basic backbone elements of control engineering. (a, e, i, k) (2) Be able to study system responses and characteristics subject to various types of inputs, such as step, ramp, impulse and sinusoidal, and analyze the characteristics by manual calculations and/or with Matlab. (a, b, e, i, k)

S No.	Content	Contact Hrs.
1.	Mathematical modeling of dynamic systems, transfer functions and block diagrams. State-space representations and local linearization of nonlinear systems. Transient and steady-state analysis, stability criteria and state-feedback control. The root-locus method and frequency response method for control systems analysis and design. Design of PID controllers and compensation networks. Controllability and observability for linear time-invariant systems. Computer simulations using Matlab.	**50 hrs**

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

CO1	**MMEC-1207.1**	Understand the basic concepts of dynamics systems
CO2	**MMEC-1207.2**	Understand the steady state conditions
CO3	**MMEC-1207.3**	Understand the concept of controllability and observability for linear time-invariant systems

Suggested Readings / Books:

1. Control System Engineering 7th Edition by Norman S. Nise. Wiley. ISBN

SYLLABUS

SEMESTER-III

SUBJECT TITLE: MOOCs
SUBJECT CODE: MMEC-2301
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	-	-	3

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

The students have to register for a MOOC course and thereafter enroll for examination. The marks for the same will be added in the semester marks card.

SUBJECT TITLE: MOOCs
SUBJECT CODE: MMEC-2302
SEMESTER: 3
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	-	-	3

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

The students have to register for a MOOC course and thereafter enroll for examination. The marks for the same will be added in the semester marks card.

SUBJECT TITLE: LITERATURE SURVEY
SUBJECT CODE: MMEC-2371
SEMESTER: 3
CONTACT HOURS/WEEK:

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

Internal Assessment: 100

The students have to undergo a research work by finding some appropriate literature review. The report file along with presentation will be submitted or presented to the Department.

SUBJECT TITLE: SYNOPSIS
SUBJECT CODE: MMEC-2372
SEMESTER: 3
CONTACT HOURS/WEEK:

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

Internal Assessment: 50
End Term Exam: 50

The students have to undergo a research proposal based upon the literature review. The report file along with presentation will be submitted or presented to the Department.

SYLLABUS

SEMESTER-IV

SUBJECT TITLE: THESIS
SUBJECT CODE: MMEC-2471

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
-	-	-	12

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	MMEC-2471.1	Understand the potential of doing the research
CO2	MMEC-2471.2	Able to Understand the selection of topic and its presentation
CO3	MMEC-2471.3	To effectively use the different tools, report writing and present in schematically way the research area selected