St. PETER’S UNIVERSITY
St. Peter’s Institute of Higher Education and Research
(Declared under section 3 of UGC Act 1956)
Avadi, Chennai – 600 054.

M.E. (ADVANCED MANUFACTURING TECHNOLOGY) PROGRAMME

(I TO IV SEMESTERS)

REGULATIONS AND SYLLABI

(REGULATIONS – 2013)

(With a retrospective amendment in the credits from the batch of students admitted in 2014-15)
1. **Eligibility:** Candidates who passed (Mechanical / Production / Automobile / Manufacturing) of the university or any other equivalent examination thereto are eligible for admission to two year M.E. (Advanced Manufacturing Technology) programme.

2. **Duration:** Two year comprising 4 semester. Each semester has a minimum 90 working days with a minimum of 5 hours a day and a minimum of 450 hours per semester. Candidates who have completed the duration of the programme of study are permitted to appear for the arrear subjects examinations, if any within two year after the duration of the programme.

3. **Medium:** English is the medium of instruction and examination.

4. **Weightage for internal and end assessment:** The weightage for continuous assessment (CA) and End assessment (EA) is 25:75 unless the ratio is specifically mentioned in the scheme of examinations. The Question Paper is to be set for a maximum of 100 Marks.

5. **Choice Based Credit System:** Choice Based Credit System is followed with one credit equivalent to one hour for a theory paper and two hours for a practical per week in a cycle of 18 weeks (that is, one credit is equal to 18 hours for each theory paper and one credit is equal to 36 hours for a practical in a semester) in the Time Table. The total credit for the programme (4 semesters) is 90.

6. **Scheme of Examinations**

   **I Semester**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
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<tbody>
<tr>
<td>Theory</td>
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</tr>
<tr>
<td>113AMPT01</td>
<td>Probability and statistics</td>
<td>3</td>
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<tr>
<td>113AMPT02</td>
<td>Optimization for Engineering Applications</td>
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<tr>
<td>113AMPT03</td>
<td>Advanced Materials Engineering</td>
<td>3</td>
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<tr>
<td>113AMPT04</td>
<td>Mechatronics in Manufacturing Systems</td>
<td>3</td>
<td>0</td>
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<tr>
<td>113AMPE08</td>
<td>Elective I: Advances in CNC Systems</td>
<td>3</td>
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<tr>
<td>113AMPE10</td>
<td>Elective II: Supply Chain Management</td>
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<tr>
<td>Practical</td>
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<tr>
<td>113AMPP01</td>
<td>CIM and Mechatronics Laboratories</td>
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   **II Semester**

<table>
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<tr>
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<tr>
<td>213AMPT01</td>
<td>Advanced Operations Research</td>
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<td>213AMPT02</td>
<td>Design for Manufacture and Assembly</td>
<td>3</td>
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<td>213AMPT03</td>
<td>Computer Integrated Manufacturing</td>
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<td>213AMPT04</td>
<td>Advanced Metal Joining Processes</td>
<td>3</td>
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<tr>
<td>213AMPP01</td>
<td>Simulation and Welding Laboratory</td>
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### III Semester

<table>
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<tr>
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<tr>
<td>313AMPT01</td>
<td>Rapid Prototyping and Manufacturing</td>
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<td>313AMPT02</td>
<td>Advanced Metal Forming Technology</td>
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<td>313AMPE03</td>
<td><strong>Elective V:</strong> Total Quality System and Engineering</td>
<td>3</td>
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<td>Project</td>
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<td>313AMPP01</td>
<td>Project (Phase I)*</td>
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<td>Viva Voce</td>
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* Candidates who have completed Project work (Phase I) successfully are eligible for Project Work (Phase - II) Examination.

### IV Semester

<table>
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<tr>
<th>Code No.</th>
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### LIST OF ELECTIVES

#### SEMESTER I

**ELECTIVE I**

<table>
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<tr>
<td>113AMPE 05</td>
<td>Design of Advanced Hydraulic and Pneumatic Systems</td>
<td>3</td>
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<td>113AMPE 06</td>
<td>Industrial Robotics and Machine Vision</td>
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<td>113AMPE 07</td>
<td>Manufacturing Information systems</td>
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<td>113AMPE 09</td>
<td>Flexible Competitive Manufacturing System</td>
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**ELECTIVE II**

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<tr>
<td>113AMPE 10</td>
<td>Supply Chain Management</td>
<td>3</td>
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<td>113AMPE 11</td>
<td>Advanced Metrology and Non Destructive Testing</td>
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<td>113AMPE 12</td>
<td>Productivity Management and Re engineering</td>
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<td>Supply chain Information Systems</td>
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#### SEMESTER II

**ELECTIVE III**

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<td>213AMPE 05</td>
<td>Design of cellular Manufacturing system</td>
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<td>213AMPE 07</td>
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<td>213AMPE 09</td>
<td>Information System Analysis and Design</td>
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**ELECTIVE IV**

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<tr>
<td>213AMPE 10</td>
<td>Computer Aided Process Planning</td>
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<tr>
<td>213AMPE 11</td>
<td>Corrosion and Surface Engineering</td>
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<td>213AMPE 12</td>
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<td>213AMPE 14</td>
<td>Plastics and Composite Materials</td>
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#### SEMESTER III

**ELECTIVE V**

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<th>Code No.</th>
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<td>Total Quality System and Engineering</td>
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<td>313AMPE 04</td>
<td>Advances in Foundry Technology</td>
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<td>Finite Element Analysis in Manufacturing Engineering</td>
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<tr>
<td>313AMPE 06</td>
<td>Advanced Agile and Lean Manufacturing Systems</td>
<td>3</td>
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<tr>
<td>313AMPE 07</td>
<td>Advances in Casting and welding</td>
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</table>
7. **Passing Requirements:** The minimum pass mark (raw score) be 50% in End assessment (EA) and 50% in Continuous assessment (CA) and End Assessment (EA) put together. No minimum mark (raw score) in continuous assessment (CA) be prescribed unless it is specifically mentioned in the scheme of Examination.

8. **Grading System:** Grading system on a 10 point scale be followed with 1 mark = 0.1 grade point to successful candidates as given below.

**CONVERSION TABLE**
(1 mark = 0.1 Grade point on a 10 point scale)

<table>
<thead>
<tr>
<th>Range of Marks</th>
<th>Grade Point</th>
<th>Letter Grade</th>
<th>Classification</th>
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<tr>
<td>90 to 100</td>
<td>9.0 to 10.0</td>
<td>O</td>
<td>First Class</td>
</tr>
<tr>
<td>80 to 89</td>
<td>8.0 to 8.9</td>
<td>A</td>
<td>First Class</td>
</tr>
<tr>
<td>70 to 79</td>
<td>7.0 to 7.9</td>
<td>B</td>
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<td>60 to 69</td>
<td>6.0 to 6.9</td>
<td>C</td>
<td>First Class</td>
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<td>50 to 59</td>
<td>5.0 to 5.9</td>
<td>D</td>
<td>Second Class</td>
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<tr>
<td>0 to 49</td>
<td>0 to 4.9</td>
<td>F</td>
<td>Reappearance</td>
</tr>
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</table>

**Procedure for Calculation**

\[
\text{Cumulative Grade Point Average (CGPA)} = \frac{\text{sum of Weighted Grade Points}}{\text{Total Credits}} = \frac{\sum (CA+EA)C}{\sum C}
\]

Where Weighted Grade Points in each Course = Grade Points (CA+EA) Multiplied by Credits = (CA+EA)C

**Weighted Cumulative Percentage of marks (WCPM)** = CGPA × 10

9. **Pattern of the Question Paper:** The question paper for End assessment will be set for three hours and for the maximum of 100 marks with following divisions and details.

**Part A:** 10 questions (with equal distribution to all units in the syllabus). Each question carries 2 marks.

**Part B:** 5 questions with either or type (with equal distribution to all units in the syllabus). Each question carries 16 marks. The total marks scored by the candidates will be reduced to the maximum prescribed in the regulations.

10. **Effective Period of Operation for the Arrear Candidates:** Two Year grace period is provided for the candidates to complete the arrear examination, if any.

11. **Syllabus**

Registrar
I Semester

113AMPT01  PROBABILTY AND STATISTICS

Unit I  CALCULAS OF VARIATION
Introduction – Euler’s equation – several dependent variables Lagrange’s equation of Dynamics – Integrals involving derivatives higher that the first – Problem with constrains – Direct methods and eigen value problems.

Unit II  MATRIX THEORY

Unit III  LINEAR PROGRAMMING PROBLEM
Graphical method – simplex method – Big M Technique – Integer programming.

Unit IV  SAMPLING DISTRIBUTIONS AND TESTING OF HYPOTHESIS
Testing of hypothesis-Sampling distributions-Test based on Normal, t-distribution, chi-square and F-distribution-Analysis of Variance-One way and two way classifications.

Unit V  ANALYSIS OF VARIANCE AND TIME SERIES
Design of experiments-Completely Randomized Design-Randomized Block Design-Latin Square Design-2 Factorial Design.
Time series-characteristics and Representation-Moving averages –Exponential Smoothing-Auto Regressive processes.

References
OBJECTIVE:
Optimization is the act of obtaining the best results considering the constraints in any system. This course on optimization gives a in-depth knowledge on various search various search algorithms used for optimizing nonlinear systems. Traditional and non traditional algorithms used for single and multi variable optimization problems are discussed.

OUTCOME:
At the end of this course, students will be familiar with the principles of optimization and the numerous search techniques available to solve engineering problems of various intricacies.

INTRODUCTION

LINEAR PROGRAMMING

ONE DIMENSIONAL NON LINEAR PROGRAMMING
Computer programming on region elimination and gradient search methods.

MULTIVARIABLE UNCONSTRAINED OPTIMIZATION ALGORITHMS
Optimality criteria. – direct search methods – simplex search method, Hooke-Jeeves pattern search, Powell’s conjugate direction method. , Gradient search methods -- Cauchy’s steepest search method, Newton method, conjugate gradient search method, variable metric method (DFP).
Computer programming on direct search method and method and gradient search method.

MULTIVARIABLE CONSTRAINED OPTIMIZATION ALGORITHMS

NON TRADITIONAL OPTIMIZATION ALGORITHMS
Non Traditional Optimization – Multi objective optimization, genetic algorithms and simulated annealing techniques, Meta heuristics search techniques – tabu search ant colony optimization. – Computer programming for these algorithms.

Text book:

References:
AIM:
To impart knowledge on advance concepts of material technology

OBJECTIVES:
To enlight the PG students on elastic, plastic and fractured behaviour of engineering materials.
To train the PG students in selection of metallic and non-metallic materials for the various engineering applications.

UNIT I ELASTIC AND PLASTIC BEHAVIOR
Elasticity in metals and polymers Anelastic and visco-elastic behaviour – Mechanism of plastic deformation and non metallic shear strength of perfect and real crystals – Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening.
Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – Deformation of non crystalline materials.

UNIT II FRACTURE BEHAVIOUR

UNIT III SELECTION OF MATERIALS
Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

UNIT IV MODERN METALLIC MATERIALS

UNIT V NON METALLIC MATERIALS
Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TiC, TaC, Al2O3, SiC, Si3N4 CBN and diamond – properties, processing and applications.

REFERENCES:
OBJECTIVE:
To understand the interdisciplinary concepts by focusing application of electronics concepts in Mechanical Engineering and also to know the design of products and processes using Mechatronics system design.

INTRODUCTION
Introduction to Mechatronics - Definition - Mechatronics in Products – Classification of Mechatronics - Measurements Systems - Control Systems - Traditional design and Mechatronics Design.

SENSORS AND TRANSDUCERS

MICROPROCESSOR INTRODUCTION

PLC APPLICATIONS
Programmable Logic Controllers - Introduction - Basic structure - Input/Output processing - Programming - Mnemonics Timers, Internal relays and counters - Data handling - Analog input/output - Selection of PLC.

DESIGN OF MECHATRONICS SYSTEMS
Design and Mechatronics - Designing - Possible design solutions - Case studies of Mechatronics systems.

Text Books

Reference Books
CIM LAB
Computer Aided Drafting – Operating Systems – Wire Frame, Surface and Solid Modeling – Pro E Study –
Measurement of Thread Parameter Using Profile projector - Study of Co-ordinate Measuring Machine - XL
Turn CNC Lathe [ Turning, Facing, drilling and Contouring] –study of feed back milling machine( linear and
circular interpolation)- Manufacturing Simulation Using LEKIN Scheduling Software Package - Mini Project
in LEKIN.

MECHATRONICS LAB (TITLE OF EXPERIMENTS)

FIRST CYCLE
1. Study of Mechatronics system Design
2. Introduction to Lab VIEW
3. Temperature control system using Lab VIEW
4. Design of Vehicle speed indicator using Lab VIEW
5. Vibration measurement system
6. Measurement of stress and Strain analysis using Load cell and Lab VIEW
7. Room temperature Measurement

SECOND CYCLE
1. Resistor simulation
2. Capacitor simulation
3. Simple Servo simulation
4. Data Acquisition using National Instrument’s Data acquisition card
5. Color matching using Lab VIEW
6. Simple pendulum Simulation using Lab VIEW
II Semester

213AMPT01  ADVANCED OPERATIONS RESEARCH

OBJECTIVE
The subject provides knowledge on various types of programming, their analysis, concepts and methods of scheduling as well as introduction to queuing.

UNIT I
Integer Programming: Branch and bound algorithm and cutting plane algorithm. Multi-criterion and goal programming. Stochastic Programming; quantile rules. Two-stage programming; use of fractional programming.

UNIT II
Sequencing and scheduling problems: 2 machine n-job and 3-machines n-job problems with identical machine sequence for all jobs; 2-job n-machine problem with different routings; branch and bound method for solving travelling-salesman problem.

UNIT III
Sensitivity analysis. Parametric programming. Project management: CPM and PERT; probability of project completion; PERT-crashing.

UNIT IV
Replacement problems: block and age replacement policies; dynamic programming approach for maintenance problems; replacement of items with long life.

UNIT V
Transient solution of M/M/1 queue; bulk queues (bulk arrival and bulk service); finite queues; queues in tandem; GI/G/1 queue and its solution; simulation of queues.

References:
DFM APPROACH, SELECTION AND SUBSTITUTION OF MATERIALS IN INDUSTRY: DFM approach, DFM guidelines, standardization, group technology, value engineering, comparison of materials on cost basis, design for assembly, DFA index, Poka-Yoke principle; 6σ concept; design creativity.

TOLERANCE ANALYSIS: Process capability, process capability metrics, Cp, Cpk, cost aspects, feature tolerances, geometric tolerances, surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances, sure fit law, normal law and truncated normal law.

SELECTIVE ASSEMBLY: Interchangeable and selective assembly, deciding the number of groups, Model-I: group tolerances of mating parts equal; Model-II: total and group tolerances of shaft, control of axial play-introducing secondary machining operations, laminated shims, examples.

DATUM SYSTEMS: Degrees of freedom, grouped datum systems-different types, two and three mutually perpendicular grouped datum planes, grouped datum system with spigot and recess, pair and tongue-slot pair, computation of translational of translational and rotational accuracy, geometric analysis and applications.

TRUE POSITION TOLERANCING THEORY: Comparison between co-ordinate and convention method of feature location, tolerancing and true position tolerance, functional gauges, paper layout gauging, compound assembly, examples.

FORM DESIGN OF CASTINGS AND WELDMENTS: Redesign of castings based on parting line considerations, preparation of process drawings for different operations, tolerance worksheets and centrality analysis, examples, design features to facilitate machining, datum features- functional and manufacturing, component design-machining considerations, redesign for manufacture, examples.

LEAN MANUFACTURING: Need for lean concepts, different types of waste, metrics of manufacturing, an overview of value stream mapping- present state map, future state map, evaluation of benefits- Process FMEA, Design FMEA.

TEXT BOOK:

REFERENCES:
OBJECTIVE:
This course will enable the student
• To gain knowledge on how computers are integrated at various levels of planning and manufacturing.
• To understand the flexible manufacturing system and to handle the product data and various software used for manufacturing

INTRODUCTION
Meaning and origin of CIM- the changing manufacturing and management scene - External communication - islands of automation and software-dedicated and open systems-manufacturing automation protocol - product related activities of a company- marketing engineering - production planning - plant operations - physical distribution- business and financial management

GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING
Process planning - role of process planning in CAD/CAM integration - approaches to computer aided process planning - variant approach and generative approaches – CAPP and CMPP process planning systems.

SHOP FLOOR CONTROL AND INTRODUCTION OF FMS
Shop floor control-phases -factory data collection system -automatic identification methods-Bar code technology-automated data collection system. FMS-components of FMS - types -FMS workstation - material handling and storage systems- FMS layout -computer control systems-application and benefits.

CIM IMPLEMENTATION AND DATA COMMUNICATION
CIM and company strategy - system modeling tools -IDEF models - activity cycle diagram CIM open system architecture (CIMOSA)- manufacturing enterprise wheel-CIM architecture- Product data management-CIM implementation software.
Communication fundamentals- local area networks -topology -LAN implementations - network management and installations.

OPEN SYSTEM AND DATABASE FOR CIM
Open systems - open system inter connection - manufacturing automations protocol and technical office protocol (MAP /TOP)

TEXT BOOK

REFERENCES
Objective:
- To provide knowledge about the principle and applications of latest welding processes
- To acquire essential significance of thermal effects of welding and subsequent remedial measures to reduce residual stresses and distortion in weldments.
- To gain knowledge about the Weldability of different commercially available materials, their corresponding weld joints design and automation of welding processes.

This subject deals with the recent welding processes and the Weldability of ferrous and non-ferrous metals and alloys. The effects of heat flow in welding and the resulting residual stresses and distortion have been emphasized. Good welding design principles and welding automation have been detailed.

1. SPECIAL WELDING PROCESSES
Electron beam welding, laser beam welding, ultrasonic welding, explosion welding, electro slag and electro gas welding, cold pressure welding, Friction Stir welding, diffusion bonding and adhesive bonding.

2. HEAT EFFECTS OF WELDING
Metallurgical effects of heat flow in welding- TTT curve- continuous cooling transformation diagrams- development of residual stress, methods of relieving or controlling welding residual stresses, types and control of distortion, pre-heat and post welding heat treatment.

3. WELDABILITY OF FERROUS AND NON-FERROUS ALLOYS

4. WELDING DESIGN
Typical joints for different welding processes, principles of welding joint design and location of joint within the member, evolving good weld design, welding symbol- Blue print reading, welding design for static and fatigue loading, fracture toughness.

5. AUTOMATION IN WELDING
Welding sequence and classification of processes, manual and semi-automatic, automatic, automated welding- adaptive controls- remote welding, robotic welding- selecting welding system, gravity welding and fire cracker welding, under water welding- wet and dry.

TEXT BOOKS:

REFERENCES:
Introduction to simulation languages- Simulation procedure-simulation of manufacturing systems-use of simulation software’s - PROMODEL, ARENA, Flex sim, Pre Actor, CATIA, Simul8, Advanced Generic Schedule Simulator -. Evaluation of model and validation.
III Semester

313AMPT01 RAPID PROTOTYPING AND MANUFACTURING

Objective:
- This module is focused to provide a detailed knowledge on advanced manufacturing techniques, the Rapid Prototyping and Rapid Manufacturing Process.
- Focused to aid in understanding the need, types, application, method of operation and the future of Rapid Prototyping system in industrial application.
- This also aids in innovative thinking and develop business case studies in RP / RM techniques.

INTRODUCTION

VIRTUAL PROTOTYPING, MATERIALS SELECTION & PROCEDURE FOR PROTOTYPING

TYPES OF RAPID PROTOTYPING PROCESS

APPLICATIONS OF RAPID PROTOTYPING

RAPID MANUFACTURING

TEXT BOOKS
1. Cooper, G.K (2001), Rapid Prototyping Technology Selection and Application, Marcel Dekker Inc, USA.
3. Liou, W.F (2008), Rapid Prototyping and Engineering Applications, A toolbox for prototype development, CRC Press, Taylor & Francis Group LLC, USA

FURTHER READING
1. International Journal of Advanced Manufacturing Technology
2. Rapid Prototyping Journal
3. The RPD Magazine
4. The tct Magazine
5. Wohlers Report
6. www.rapitech.co.in/rpdmagazine
OBJECTIVE
To give first level introduction to various metal forming technologies and to study forging, rolling, drawing and other unconventional forming techniques in detail.

INTRODUCTION
Stress and strain - Three dimensional stress pattern - True stress and true strain - Principal stresses - Yield criteria - Von Mises criterion - Tresca's criterion - Von Mises Yield for plane strain problems - Coulomb function and sticking friction.

FORGING
Forging - Forging in plane strain - Forging of circular disc - Effect of friction - Forging equipment - defects in forged products - Causes & Remedies.

ROLLING AND EXTRUSION
Rolling and extrusion - Rolling of sheet and strip in plane strain conditions - Effect of friction - maximum draft, rolling load, torque and H.P - roll deflection - defect in rolled products - causes and remedies - forward and backward extrusion - Approximate extrusion loads - tube extrusion .

DRAWING

UNCONVENTIONAL FORMING METHODS

References:

Web Reference:
1. www.kkai.com/matproc.html
OBJECTIVE:
To provide a first-level introduction to hydraulics and pneumatics to under-graduate students of mechanical engineering and also to provide the basic knowledge on various hydraulic and pneumatic circuits used in industries.

INTRODUCTION

HYDRAULIC MOTORS AND PUMPS
Oil hydraulic systems-Hydraulic Power Generators-Selection and specification of pumps, pumps, pump characteristics.

ACTUATORS AND CONTROL UNITS
Hydraulic actuators-Linear and Rotary Actuators- selection, specification and characteristics. Control and regulation elements-Pressure, direction and flow control valves-relief valves, non return and safety valves-actuation systems.

HYDRAULIC CIRCUITS

PNEUMATICS – BASICS AND CIRCUITS

COMBINED CIRCUITS

References :

Web References:
1. www.pneumatics.com
2. www.fluidpower.com.tw
INDUSTRIAL ROBOTICS AND MACHINE VISION

ROBOTICS AND ITS COMPONENTS

KINEMATICS OF ROBOT
Introduction, Matrix Representation, Homogeneous transformation, forward and inverse Kinematics, Inverse Kinematics Programming, Degeneracy, dexterity, velocity and static forces, velocity transformation force control systems, Basics of Trajectory planning.

ROBOT END EFFECTORS

MACHINE VISION
Introduction – Image processing Vs image analysis, image Acquisition, digital Images – Sampling and Quantization – Image definition, levels of Computation.

FEATURE EXTRACTION

TEXT BOOK

REFERENCES
OBJECTIVES
The students will learn the production planning and control system, the databases required to handle records and their maintenance, various methods of collecting data from the shop floor in order to analyze and improve the performance of the manufacturing system. They also understand the importance of information system along with scheduling techniques for customer requirement. They are also exposed to different case studies.

INTRODUCTION
This subject has been introduced to the students with an idea to impart to the students the knowledge on various manufacturing activities such as Materials Requirement Planning and Manufacturing Resources Planning so that they get to know about the role of information and communication in product manufacture besides understanding the importance of data, database and database management system. They also learn about the various techniques used to collect data from the shop floor in a way to analyze the performance of manufacturing system. They are also introduced to the concept of Part Based Manufacturing Information System that is widely used in modern manufacturing industries.

PRODUCTION MANAGEMENT SYSTEM
Introduction - the evolution of order policies from MRP to MRP II, the role of production organization control.

DATABASE
Database-Terminologies-Entities & Attributes - Data Models, Schema & Subschema-Data Independence-ER Diagram - Trends in Database.

DATABASE MANAGEMENT SYSTEMS AND MODELS

MANUFACTURING SHOP FLOOR CONTROL SYSTEM

MANUFACTURING INFORMATION SYSTEM
Information system for manufacturing- Parts Oriented Production Information System-Concepts and structure-Computerized Production Scheduling, Online Production Control System, Computer Based Production Management System-Case Study

REFERENCES:

Web reference:
1.www.ist.psu.edu
OBJECTIVE:
This Course will enable the student
- To learn the elements involved in CNC Machines and Mechanism for converting program of instructions to mechanical action
- To generate program using various techniques and study of special type CNC machines

INTRODUCTION

CNC SYSTEM

PROGRAMMING OF CNC MACHINES
Various programming techniques – APT – Programming for various machines in ISO and FANUC – CAM packages for CNC Machines such as Uni graphics, LDEAS, Pro-Engineer, CATIA, ESPIRIT, MASTERCAM, etc.,

TOOLING FOR CNC MACHINES

SPECIAL TYPES OF CNC MACHINES

REFERENCES:
OBJECTIVE
This Course will enable the student
• To Gather the information about Flexible manufacturing system concept in detail
• To learn the recent trends in Scheduling and Simulation

INTRODUCTION
Manufacturing in a competitive environment - Automation of manufacturing process - numerical control - material handling and movement - industrial robots - Sensor technology - flexible, fixturing - Design for assembly, disassembly and services.

GROUP TECHNOLOGY AND CELL DESIGN
Group technology - Part families - classification and coding - Production flow analysis - Machine cell design - Benefits

FLEXIBLE MANUFACTURING SYSTEM AND APPLICATIONS

SOFTWARE INTEGRATION WITH FMS

LEAN MANUFACTURING

References:
UNIT I

UNIT II
Supply Chain Management - The new paradigm, the modular company, the network relations, supply process - Procurement process - Distribution management.

UNIT III

UNIT IV
Supply Chain Activity Systems - Structuring the SC, SC and new products, functional roles in SC, SC design framework, collaborative product commerce (CPC)

UNIT V
SCM Organization and Information System - The management task, logistics organization, the logistics information systems - Topology of SC application - MRP, ERP, Warehouse management system, product data management - cases.

REFERENCES:
OBJECTIVE
To give introduction to the various measuring instruments which are most commonly used in industries and to study advancements in measuring methods and non destructive testing methods.

INTRODUCTION

STATISTICAL QUALITY CONTROL
Statistical Quality Control - Data presentation - Statistical measures and tools - Process capability - Confidence and tolerance limits - Control charts for variables and for fraction defectives - Theory of probability - Sampling - ABC standard - reliability and life testing.

BASIC NDT TESTS
Liquid penetrants and magnetic particle tests - characteristics of liquid penetrants - different washable systems - Developers - applications - method of production of magnetic fields - Principles of operation of magnetic particle test - applications -Advantages and limitations.

RADIOGRAPY
Radiography - Sources of ray - x-ray production - properties of d and x rays - film characteristics – exposure charts-contrasts-operational characteristics of x ray equipment - applications.

ULTRASONIC TESTING METHODS
Ultrasonic and acoustic emission techniques - Production of ultrasonic waves - different types of waves - general characteristics of waves - pulse echo method -A, B, C scans -Principles of acoustics emission technique - Advantage and limitations - Instrumentation - applications.

References:

Web References:
1. www.metrologytooling.com
2. www.sisndt.com
3. www.iuk'tu-harburg.de
Objective: To study the productivity concepts, models, organisational transformation and reengineering concepts, tools and implementation. To enable the students to understand the concepts of productivity and reengineering and to make them apply these in the industries.

INTRODUCTION
Introduction - Productivity concepts - Macro and Micro factors of productivity, Productivity benefit model, productivity cycle.

PRODUCTIVITY MEASURES
Productivity Models - Productivity measurement at International, National and Organizational level, Total Productivity models. Productivity management in manufacturing and service sector. Productivity evaluation models, Productivity improvement models and techniques.

ORGANIZATIONAL TRANSFORMATION AND REENGINEERING
Organizational Transformation - Principles of organizational transformation and re-engineering, fundamentals of process re-engineering, preparing the workforce for transformation and re-engineering, methodology, guidelines, DSMCQ and PMP model.

PROCESS IMPROVEMENT
Re-engineering - Process Improvement Models, PMI models, Edosomwan model, Moen and Nolan strategy for process improvement, LMICIP model, NPRDC model.

TOOLS AND TECHNIQUES
Re-engineering Tools and implementation - Analytical and process tools and techniques - Information and communication technology - Enabling role of IT, RE opportunities, process redesign - cases. Software methods in BPR - specification of BP, case study - Order, processing, user interfaces, maintainability and reusability.

References:
OBJECTIVE:
- To provide visibility about the role played by information system in supply chain enhancement.
- To provide a detailed knowledge about e-business and e-commerce application in real World supply chains.
- This subject is focused to develop knowledge & role of databases in SCM, along with the knowledge on future projected SC Information system.

INTRODUCTION

E-BUSINESS

E-COMMERCE

APPLICATION OF E-COMMERCE

ADVANCED SUPPLY CHAIN INFORMATION SYSTEMS

REFERENCE BOOKS:
OBJECTIVE
This Course will enable the student
• To Learn Various approaches involved in Cellular Manufacturing system.
• To Study about Machine Cell Layout and its performance in detail.

INTRODUCTION
Introduction-Introduction of Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.

CELLULAR MANUFACTURING SYSTEM DESIGN AND APPROACH

MACHINE CELL LAYOUT
Implementation of GT/CMS - Inter and Intra cell layout, cost and non-cost based models, establishing a team approach, Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS.

PERFORMANCE MEASUREMENT

COMPARITIVE STUDIES
Economics of GT/CMS - Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS -cases.

References:
OBJECTIVE
To study about the various machining techniques used in industries and to give first level introduction to micro machining techniques

INTRODUCTION
Concepts of accuracy - Introduction - Concepts of accuracy of machine tools - spindle and displacements accuracies - Accuracy of numerical control systems - Errors due to numerical interpolation - displacement measurement system and velocity lags.

DIMENSIONING AND TOLERANCING
Geometric dimensioning and tolerancing - Tolerance zone conversions - Surfaces, features of size, datum features - datum, oddly configured and curved surfaces as datum features, equalizing datum - datum features of size representation - form controls, orientation controls - logical approach to tolerance.

NANOTECHNOLOGY – AN INTRODUCTION
Fundamentals of nanotechnology and measuring - Processing system of nanometer accuracies - mechanism of metal processing - nano physical processing of atomic-bit-units nano chemical and electrochemical atomic-bit processing. IN processing in-situ measurement position of processing point - post process and on-machine measurement of dimensional feature and surface - Mechanical and optional measuring system.

POSITIONING SYSTEMS

MANUFACTURING METHODS

References:
**Objective:** To study the reliability concepts, failure data analysis, reliability prediction and management and the concepts of total productive maintenance. To enable the students to understand the concepts of reliability and total productive maintenance and to make them apply these in the industries.

**INTRODUCTION**
Introduction - Reliability function - MTBF - MTTF - morality curve - availability - Maintainability.

**DISTRIBUTIVE FUNCTIONS**
Failure Data Analysis - Repair time distributions - exponential, normal, log normal, gamma, and Weibull - reliability data requirements - Graphical evaluation.

**RELIABILITY PREDICTION**

**RELIABILITY MANAGEMENT**
Reliability Management - Reliability demonstration testing - Reliability growth testing - Duane curve - Risk assessment - FMEA, Fault tree.

**TOTAL PRODUCTIVE MAINTENANCE**

**References:**
OBJECTIVE:
This course is intended to teach the students about E manufacturing concepts (ie) use of IT in the manufacturing sector and advanced manufacturing systems like Lean manufacturing, Agile manufacturing etc.

INTRODUCTION

MANUFACTURING STRATEGY

LEAN MANUFACTURING

AGILE MANUFACTURING

E-MANUFACTURING

References:
OBJECTIVE: To study the computer based information system, management information systems, system development, quality, Knowledge based system and decision support system. To enable the students to understand the concepts of information systems and enable them to apply these practically in the industries.

COMPUTER BASED INFORMATION SYSTEM

MANAGEMENT INFORMATION
Management information system – concepts – Design and implementation of MIS – Information system for decision making, types levels of decision making – MIS as a technique for making a programmed decisions – Decision – Assisting information systems – Conceptual Systems Design – Detailed System design

SYSTEM ANALYSIS AND DESIGN
Overview of system Development – System Analysis – System Design-completing the system development process - the traditional system life cycle – stages and limitations of life cycle approach – case study

QUALITY
Quality, Success and Services-traditional tool and methodologies for quality assurances- new approaches to quality – information system failure causes- the concept of implementation – controlling risk factor.

KNOWLEDGE BASED SYSTEMS

REFERENCES:

WEB REFERENCES:
1. www.dis.uniroma1.it
Elective IV

213AMPE10 COMPUTER AIDED PROCESS PLANNING

Objective: To study the Process Planning concepts, Part Design Representation, Process engineering and planning and Computer Aided Process Planning Systems, Integrated Process Planning Systems. To enable the students to understand the concepts of Computer Aided Process Planning and to make them apply these in the industries.

INTRODUCTION
Introduction - The Place of Process Planning in the manufacturing cycle - Process Planning and Production Planning - Process Planning and Concurrent Engineering, CAPP, Group Technology

GROUP TECHNOLOGY

PROCESS PLANNING

COMPUTER AIDED PROCESS PLANNING

PROCESS PLAN SYSTEMS

References:

Web reference:
OBJECTIVE
The subject provides knowledge on various types of corrosion, their kinetics, testing and methods of protection as well as introduction to tribology.

UNIT I INTRODUCTION
Introduction tribology, surface degradation, wear and corrosion, types of wear, adhesive, abrasive, oxidative, corrosive, erosive and fretting wear, roles of friction and lubrication-, expressions for corrosion rate. emf and galvanic series - merits and demerits -Pourbaix diagram for iron, magnesium and aluminium. Forms of corrosion - Uniform, pitting, intergranular, stress corrosion. corrosion fatigue. dezincification. erosion corrosion, crevice corrosion - Cause and remedial measures - Pilling Bedworth ratio - High temperature oxidation.

UNIT II KINETICS OF CORROSION
Exchange current density, polarization - concentration, activation and resistance, Tafel equation; passivity, electrochemical behaviour of active/passive metals, Flade potential, theories of passivity, Effect of oxidising agents

UNIT III CORROSION IN INDUSTRIAL PRACTICE
Atmospheric, pitting, dealloying, stress corrosion cracking, intergranular corrosion, corrosion fatigue, fretting corrosion and high temperature oxidation; causes and remedial measures, Corrosion failure – Inspection and analysis of corrosion damage

UNIT IV TESTING
Purpose of corrosion testing - Classification - Susceptibility tests for intergranular corrosion- Stress corrosion test.salt spray test humidity and porosity tests, accelerated weathering tests. ASTM standards for corrosion testing and tests for assessment of wear

UNIT V PROTECTION METHODS
Electroless plating and Anodising - Cathodic protection, metallic, organic and inorganic coatings, corrosion inhibitors - principles and practice - inhibitors for acidic neutral and other media. Special surfacing processes - CVD and PVD processes, sputter coating. Laser and ion implantation. Arc spray. plasma spray. Flame spray. HVOF.

TEXT BOOKS

REFERENCES
OBJECTIVE:
Sub assemblies, main assemblies, equipments, machines etc are manufactured by assembling different components together to perform a particular objective. These components are manufactured by different manufacturing methods like fabrication, machining, grinding and finishing etc. Every Mechanical Engineer should know about the Tool Engineering and Design. By keeping this in mind this syllabus is framed.

1. MECHANISM OF CHIP FORMATION AND TYPES OF CHIPS
Mechanism of chip formation, Types of chip, techniques for the study of chip form formation, chip tool interface, built-up edge, chip breakers etc - problems.

2. FORCES IN METAL CUTTING

3. THERMAL ASPECTS OF METAL CUTTING
Heat in metal cutting, Flow of heat, Methods of tool temperature measurement, significance of cutting tool temperature. Cutting fluids - Types and selection – evaluation of heat flow in both the tool and work piece.

4. CUTTING TOOL MATERIAL AND TOOL WEAR

5. THERMAL ANALYSIS WITH CFD SOFTWARE
Introduction to CFD - various tools and techniques in CFD – various features of CFD – Applications of CFD – Comparisons of CFD with ANSYS and NISA – CFD in thermal analysis of metal cutting.

6. JIGS & FIXTURES

7. PRESS TOOLS & ECONOMIC ASPECTS OF TOOLING
Dies, punches, types of presses, clearances, types of dies, strip layout, calculation of press capacity, center of pressure. Design consideration for die elements. Economics of tooling – Tool selection and tool replacement with respect to small tools.

TEXT BOOKS:

REFERENCES:
2. ELBS "Principles of jig and Tool design: Published by English Universities Michigan,1969.
Objectives:
To import knowledge about different types of plastics and composites and their fabrication methods.
To acquire details about the effects machining and joining parameters on its quality
To gain knowledge about the different types of reinforcements and its corresponding fabrication methods of composites.

INTRODUCTION

PLASTICS PROCESS

COMPOSITE MATERIALS

POLYMER MATRIX COMPOSITES
Processing of Polymer Matrix Composites – Open Mould Processes, Bag Moulding, Compression Moulding With BMS and SMS - Filament winding – Pultrusion - Centrifugal Casting – Injection Moulding – Application of PMC`s

METAL MATRIX COMPOSITES

REFERENCE:
Elective V (Semester III)

313AMPE03 TOTAL QUALITY SYSTEM AND ENGINEERING

Objective: To study the concepts of TQM, SQC and Acceptance sampling. To enable the students to apply these in the industries.

PRINCIPLES OF TQM
Introduction - Principles of Quality Management - Pioneers of TQM - Quality costs - Quality system Customer Orientation - Benchmarking - Re-engineering - concurrent engineering

LEADERSHIP AND QUALITY AUDITING
Practices of TQM - leadership - organizational structure - Team building - Information systems and documentation - Quality Auditing - ISO 9000 - QS 9000

TQM TECHNIQUES

STATISTICAL QUALITY CONTROL
Statistical Quality control - Methods and Philosophy of Statistical process control - Control Charts for variables and Attributes - Cumulative sum and exponentially weighted moving average control charts - Other SPC Techniques - Process Capability Analysis - Six sigma accuracy.

SAMPLING
Acceptance sampling - Acceptance sampling problem - Single sampling Plans for attributes - double, multiple and sequential sampling, Military standards - The Dodge - Roming sampling plans.

References:

Web references:
2. www.mcb.co.uk/tam.htm
OBJECTIVES:

- To know about the casting metallurgy and design aspects of moulding, gating and riser.
- To learn about the special casting processes and foundry mechanization.
- To understand about the computer applications in foundry technology.

INTRODUCTION

Basics of casting techniques – Various aspects of advances in foundry technology – Scope of the study

Casting metallurgy & design - Solidification of pure metals and alloys - Fluidity - Shrinkage in cast metals - Absorption of gases - Degassing methods - Progressive solidification - Directional solidification - Hot spot & Junction - Design for moulding - Design for core support.

Principle of gating and riser - Improvement of yield efficiency - Simple problems in gating and risers for steels and cast irons

Special casting processes - Shell moulding, investment casting, Carbon - Dioxide moulding, Centrifugal casting, Die casting, Continuous casting, Squeeze casting, Vacuum casting, Full mould processes, Semi-Solid metal casting, Thixocasting and Rheocasting process, Compo casting.


Computer aided design and castings – Computer aided pattern making and use of rapid prototyping technology in foundry, Feeder design and solidification analysis, Gating design and mould filling analysis, Rapid tooling fabrication, Implementing rapid casting development technologies, Case study from industry.

References:
OBJECTIVE:
The objective is to equip students with fundamentals of finite element principles so as to enable them to understand the behaviour of various finite elements and to be able to select appropriate elements to solve physical and engineering problems with emphasis on structural and thermal engineering applications.

UNIT I INTRODUCTION

UNIT II ONE DIMENSIONAL ANALYSIS
Steps in FEA – Discretization, function – derivation of element characteristics matrix, shape function, assembly and imposition of boundary conditions – solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

UNIT III SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS

UNIT IV ANALYSIS OF PRODUCTION PROCESSES:

UNIT V COMPUTER IMPLEMENTATION
Pre Processing, Mesh generation, elements connectivity, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages such as ANSYS and DEFORM – Development of code for one dimensional analysis and validation.

TEXT BOOKS:

REFERENCES:
OBJECTIVE
Nowadays, almost all Industries are struggling in their business due to economy crisis. In this situation, they can go for a rapid change i.e. agility in their products to achieve and fulfill their customers demand. Simultaneously, the internal costs / wastages are to be minimized and or eliminated. This syllabus gives an excellent idea about the agility to meet the customer requirements, elimination of internal wastages and achieve the customer satisfaction. This syllabus is framed based on the above factors.

1. INTRODUCTION TO AGILE MANUFACTURING
Meaning and definition agility – concepts of agility – Agile manufacturing system – agile relationship models – products, services and enrichment of each customer – enrichment chain – moving from one time product to providing customer enrichment.

2. AGILE BUSINESS STRATEGIES

3. INTRODUCTION TO LEAN MANUFACTURING SYSTEM
Meaning and definition of lean – Basic concepts of lean – elements of lean – functional areas of lean – Lean techniques – procedure to implement lean in manufacturing industries - prerequisites of becoming lean in manufacturing system – education and training.

4. LEAN MANUFACTURING PRACTICES & IMPLEMENTATION

5. AGILE AND LEAN SOFTWARE
Introduction to agile and lean simulation / scheduling software – Minitab / Flexsim / Tuppas / QAD / Preactor – features, concepts, tools, and techniques – Applications, Advantages, and limitations – real time problems and solutions.

TEXT BOOKS

REFERENCE BOOKS
OBJECTIVES:
To provide knowledge about solidification of metals and corresponding design principles of casting.
To import principles and applications of latest casting processes.
To gain knowledge about thermal effects of welding, Weldability of ferrous and non-ferrous metals, residual stresses in weldments, good weld joint design principles and latest welding processes.
To acquire latest knowledge about automation in casting and welding.

UNIT I
Casting metallurgy and design-Heat transfer between metal and mould-Solidification of pure metals and alloys-Shrinkage in cast metals-Progressive and directional solidification-Principles of gating and riser-Degasification of the melt-Design considerations in casting- Casting defects, Designing for directional solidification and minimum defects.

UNIT-II
Special casting process-Shell Moulding, precision investment casting, CO2, Moulding, centrifugal casting, Die casting and continuous casting.

UNIT-III

UNIT-IV

UNIT-V
Recent advances in casting and welding-Layout of mechanized foundry-sand reclamation-Material handling in foundry-Pollution control in Foundry-Recent trends in casting-Computer Aided design of Castings, Low pressure die casting, Squeeze casting, full mould casting process. Automation in welding-Welding robots-Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

References:

Registrar