SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (AUTONOMOUS)
(Affiliated to JNTUK, Kakinada), (Recognised by AICTE, New Delhi)
Accredited by NAAC with 'A' Grade, All UG Programmes are Accredited by NBA
Recognised as Scientific and Industrial Research Organisation
CHINNA AMIRAM (P.O):: BHIMAVARAM :: W.G.Dt., A.P., INDIA :: PIN: 534 204

ESTD: 1980

SCHEME OF INSTRUCTION & EXAMINATION
(Regulation R17)

IV/IV B.TECH
(With effect from **2017-2018**Admitted Batch onwards**)**
MECHANICAL ENGINEERING
(Accredited by NBA)
I-SEMESTER

Code No.	Name of the Subject	Credits	Lecture Hrs	Tutorial Hrs	Lab Hrs	Contact Hrs/ Week	Internal Marks	External Marks	Total Marks
B17 ME 4101	HeatTransfer	3	3	1	--	4	30	70	100
B17 ME 4102	Computer Aided Manufacturing	3	3	1	--	4	30	70	100
B17 ME 4103	Mechatronics	3	3	1	--	4	30	70	100
# ELE-I	Elective-I	3	3	1	--	4	30	70	100
# ELE-II	Elective-II	3	3	1	--	4	30	70	100
B17 ME 4110	Heat Transfer Lab	2	--	--	3	3	50	50	100
B17 ME 4111	CAD Lab	2	--	--	3	3	50	50	100
Total		**19**	**15**	**5**	**6**	**26**	**250**	**450**	**700**

	Code No.	Course
#ELE-I	B17 ME 4104	Finite Element Analysis
	B17 ME 4105	Automation in Manufacturing
	B17 ME 4106	Quality Control and Assurance
#ELE-II	B17 ME 4107	Project Management
	B17 ME 4108	Tool Design
	B17 ME 4109	Refrigeration & Air Conditioning

Code: B17ME4101

HEATTRANSFER

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

This Course aims to:
1. To make the student calculate the heat transfer phenomena through conduction.
2. To make the student calculate the heat transfer rate in convection.
3. To make the student determine the overall heat transfer coefficient in heat exchangers and boiling and condensation phenomena.
4. To make the student to evaluate the heat transfer by radiation.

Course Outcomes: At the end of the Course, Student will be able to:

S. No	Out Come	Knowledge Level
1	Apply the modes of heat transfer and study the problems involving steady and unsteady state heat conduction in various Cross sections.	K3
2	Formulate and solve the heat transfer coefficients for natural and forced convection for various cross section areas.	K3
3	Design Simple heat exchanger units, acquiring basic knowledge on boiling and condensation heat transfer.	K3
4	Analyze radiation heat transfer between black body and gray body surfaces.	K3

SYLLABUS

UNIT- I

Introduction: Modes and Mechanisms of Heat Transfer – Basic Laws of Heat Transfer – General Applications of Heat Transfer.

Conduction Heat Transfer: Fourier Rate Equation – General Heat Conduction Equation In Cartesian, Cylindrical and Spherical Coordinates, Simplification and Forms of the Field Equation – Steady, Unsteady and Periodic Heat Transfer – Boundary and Initial Conditions.

One Dimensional Steady State Heat Conduction: In Homogeneous Slabs, Hollow Cylinders and Spheres – Overall Heat Transfer Coefficient – Electrical Analogy – Critical Radius/Thickness of Insulation – With Variable Thermal Conductivity.

UNIT -II

Heat Transfer in Extended Surface (Fins) – efficiency, effectiveness and temperature distribution on Long Fin, Fin with Insulated Tip and Short Fin, Application to Errors in Temperature Measurement.

One Dimensional Transient Heat Conduction: In Systems with Negligible Internal Resistance Significance of Biot and Fourier Numbers – Chart Solutions of Transient Conduction Systems – Problems on Semi-infinite Body.

UNIT -III

Convective Heat Transfer: Dimensional Analysis – Buckingham Π Theorem and Its Application for Developing Semi – Empirical Non-Dimensional Correlations for Convective Heat Transfer – Significance of Non-Dimensional Numbers.

Forced Convection:

External Flows: Concepts of Hydrodynamic and Thermal Boundary Layer and Use of Empirical Correlations for Convective Heat Transfer for Flow Over – Flat Plates, Cylinders and Spheres.

Internal Flows: Division of Internal Flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of Empirical Relations for Convective Heat Transfer in Horizontal Pipe Flow, Annular Flow.

Free Convection: Development of Hydrodynamic and Thermal Boundary Layer along a Vertical Plate – Use of Empirical Relations for Convective Heat Transfer on Plates and Cylinders in Horizontal and Vertical Orientation.

UNIT -IV

Heat Transfer with Phase Change: Boiling: Pool Boiling – Regimes, Determination of Heat Transfer Coefficient in Nucleate Boiling, Critical Heat Flux and Film Boiling. Condensation: Film wise and Drop wise Condensation – Nusselt's Theory of Condensation on a Vertical Plate- Film Condensation on Vertical and Horizontal Cylinders Using Empirical Correlations.

Heat Exchangers: Classification of Heat Exchangers – Overall Heat Transfer Coefficient and Fouling Factor –Concepts of LMTD and NTU Methods – Problems using LMTD and NTU Methods.

UNIT -V

Radiative Heat Transfer: Emission Characteristics and Laws of Black-Body Radiation – Irradiation –Total and Monochromatic Quantities– Laws of Planck, Wien, Kirchoff, Lambert, Stefan And Boltzmann – Heat Exchange Between Two Black Bodies – Concepts of Shape Factor – Emissivity – Heat Exchange Between Gray Bodies – Radiation Shields – Electrical Analogy for Radiation Networks.

Text Books:

1. Fundamentals of Engg. Heat and Mass Transfer, R.C.Sachdeva, New Age International Publications, Fifth edition.
2. Heat Transfer, P.K.Nag, TMH Publications, Third edition.

Reference Books:

1. Heat Transfer, J. P. Holman, TMH Publications, Special Indian edition.
2. Principles of Heat Transfer, Frank Kreith, R. M. Manglik& M. S. Bohn, Cengage learning publishers, Special edition.
3. Heat and Mass Transfer, D.S.Kumar, S.K.Kataria& Sons Publications, Third edition.
4. Heat and Mass Transfer, Cengel, McGraw Hill Publications, Fifth edition.
5. Heat and mass transfer, R.K. Rajput, S. Chand Publications, Revised edition.

Web Links:

1. https://nptel.ac.in/courses/112101097/
2. http://web.mit.edu/lienhard/www/ahttv212.pdf
3. https://www.grc.nasa.gov/www/k-12/airplane/heat.html

Code: B17ME4102

COMPUTER AIDED MANUFACTURING

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

1. The course is designed to equip the students with the necessary Knowledge of various NC machine tools, Manual part programme and APT language that is essential for an engineering course.
2. Learn about CNC Retrofitting, Group Technology
3. Acquire Knowledge of Computer Aided Process Plan.
4. The course will help learn application of advanced manufacturing techniques of automated manufacturing, material handling, robotics and flexible manufacturing.

Course Outcomes: At the end of the Course, Student will be able to:

S. No	Out Come	Knowledge Level
1	Prepare manual and APT programming for various components by applying the knowledge of numerical control techniques	K3
2	Analyse various computer aided process planning methods and computer aided material handling system	K3
3	Distinguish various automated quality control methods	K3
4	Organize flexible manufacturing system and CIM system	K3

SYLLABUS

UNIT I

Introduction to CNC and CAM, CNC retrofitting, Adoptive control machining, NC part program preparation through computer languages. Group technology: Merits & demerits, Organisation, Classification and Coding systems, Facilities layout.

UNIT II

Computer aided process planning: Introduction to process planning, Methods of process planning, Computer aided process planning, CAPP systems, case studies

UNIT III

Computer aided material handling: Robots: Structure and operation of Robots, robot sensors and applications. Automatic conveyor systems. Automated guided vehicles.

UNIT IV

Computer aided inspection and quality control: Developments and practice, Quality assurance and quality control. Coordinate measuring machine. Non-contact inspection.

UNIT V

FMS &CIMS: Building blocks of Flexible Manufacturing Systems (FMS), Machining systems of FMS, Tool management systems, Advantages of FMS, Computer integrated manufacturing systems (CIMS).

Text Books:

1. Computer Aided Manufacturing, by P.N.Rao, N.K.Tewari&T.K.Kundra, Tata McGraw-Hill publishing company Ltd, New Delhi.
2. Automation, Production Systems and Computer Integrated Manufacturing, by Mikell P.Groover, Prentice-Hall of India Pvt. Ltd.

Reference Book:

1. Computer Integrated Design and Manufacturing, by David D.Bedworth, Mark R.Henderson& Philip M.Wolfe, McGraw-Hill Book Company, Singapore.

Code: B17ME4103

MECHATRONICS

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

1. The course is designed to equip the students with fundamental knowledge on mechatronics system.
2. This course gives some aspects interdisciplinary knowledge required for mechanical engineering students.
3. Acquire knowledge of sensors and actuators.
4. Learn mathematical modeling of physical systems.
5. Learn about practical applications of mechatronic systems.

Course Outcomes: At the end of the Course, Student will be able to:

S. No	Out Come	Knowledge Level
1	Understand various components that constitute a mechatronic system.	K2
2	Develop knowledge of various types of available sensors, and use the sensors apply in a mechatronic system.	K2
3	Identify the required actuation system for the design of mechatronic system	K2
4	Formulate the mathematical model of the simple dynamic systems of mechanical, electrical, and hydraulic & pneumatic domains	K3
5	Develop the closed loop PID control of a given mechatronic system	K3
6	Develop knowledge of microcontroller and programmable logic controller.	K3

SYLLABUS

UNIT-I

Introduction to Mechatronics

Sensors & Transducers: Introduction, performance terminology, Classification of sensors: Potentiometer sensor, strain gauged element, Capacity element, LVDT, Optical Encoders, Tachogenerator and stain gauge load cell, Selection of sensors.

Signal Conditioning: Introduction signal Conditioning-Operational amplifiers: Inverting amplifier, summing amplifier, Integrating amplifier, Difference amplifier, filtering process

UNIT-II

Digital signals: Digital and analog signals - DA and AD converter – Data Acquisition

Digital logic: Digital logic - Logic gates – Application of logic gates

Pneumatic and hydraulic Actuation Systems: Direction control valves –process control valve-cylinders
Mechanical actuation systems

UNIT-III

Electric Actuation System: Switching devices: Mechanical switches, solid state switches – solenoids - DC motors, AC motors, stepper motors
Basic System Models: Modeling of one and two degrees of freedom Mechanical, Electrical, Fluid and thermal systems. Block diagram representations for these systems. Mechanical translational systems, Mechanical rotational systems, Electromechanical coupling

UNIT-IV

System Transfer functions: The Transfer function, Laplace transforms, First order systems, Second order systems, systems in series, systems with feedback loops.
Closed loop controllers: Continuous and discrete processes, control modes, Two step, Proportional, Derivative, Integral, PID controllers

UNIT-V

Microprocessors: Microprocessor systems, Micro controllers, Applications
PLC: Introduction, basic structure, I/P, O/P, processing, programming, ladder diagrams, timers, internal relays and counters, data handling, analogue input and output, selection of PLC.
Case studies of Mechatronic Systems: Pick and place robot, Digital camera, Automotive control

Text Books:

1. Mechatronics Electronic control systems in Mechanical and Electrical Engineering by W. Bolton, Pearson Education, 4th Edition,2011
2. Introduction to Mechatronics – David and Alcaitore Michael B.Histand TMH, 4th Edition, 2006.

Reference Book:

1. Mechatronics System Design by Devdas Shetty and Richard A. Kolk, P.W.S. Publishing Company, 2001

Code: B17ME4104

FINITE ELEMENT ANALYSIS
(Elective-I)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

1. To provide students with a conceptual understanding of the principles of finite element analysis systems, the implementation of these principles, and its connections to CAD.
2. To teach students how to perform structural analysis using finite element methods.

Course Outcomes:

On the successful completion of the course, students will be able to:

S. No	Out Come	Knowledge Level
1	Understand the fundamental concepts of Finite Element Analysis and Solve the physical problem using functional approximation method.	K3
2	Analyze the 1Dstructural problems by applying the concepts of finite element analysis.	K4
3	Analyze Trusses and Beams by applying the concepts of finite element analysis	K4
4	Analyze 2D structural problems by applying concepts of finite element analysis and apply the principles of Numerical Integration and its application to Finite Element Analysis	K4
5	Analyze Axisymmetric solids by applying the concepts of Finite Element Analysis.	K4

SYLLABUS

UNIT-I

Introduction: stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, The potential energy approach; Rayleigh-Ritz method Finite Element Method: Discretization, Types of elements, band width, node numbering, interpolation functions, local and global coordinates, convergence requirements, Types of boundary conditions, Steps in Finite Element Method,Applications of Finite Element Method .

UNIT-II

One Dimensional Bar Problems: 1-D bar element - shape functions – Stiffness matrix and load vector– assembly of Matrices – Treatment of boundary conditions One dimensional quadratic element – Temperature Effects.

UNIT-III

Trusses: Introduction; Plane trusses; shape functions – Stiffness matrix and load vector– assembly of Matrices – Treatment of boundary conditions; simple problems on trusses.

Analysis of Beams: Beam Element - Shape functions and Element stiffness matrix, load vector for concentrated and Uniformly Distributed Load, simple problems on beams.

UNIT-IV

Two Dimensional Problems: Finite element modeling of two-dimensional Problems - constant strain triangle Element - treatment of boundary conditions 2D four noded iso parametric element, numerical integration, Gaussian Quadrature Approach.

UNIT-V

Axisymmetric Solids Subjected to Axisymmetric Loading: Introduction; Axisymmetric formulation; Finite element modeling - triangular element; Problem modeling and boundary conditions.

Text Book:

1. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, Prentice – Hall.

Reference Books:

1. The Finite Element Method by O.C. Zienkiewicz, Tata McGraw Hill Company Ltd.
2. The Finite Element Methods in Engineering by Rao, S.S.
3. Concepts and Applications of Finite Element Analysis by Cook, R.D.
4. Applied Finite Element Analysis by Segerland, L.J.

Code: B17ME4105

AUTOMATION IN MANUFACTURING
(Elective-I)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

1. To make the students understand the principles of advanced manufacturing procedures by providing the knowledge of various automation strategies used in production systems

Course Outcomes:

After the completion of the course, students are able to

S. No	Out Come	Knowledge Level
1	Understand the basic principles of automation and its components which are implemented in production systems.	K2
2	Identify the importance of material handling and various automatic identification methods used in production systems.	K2
3	Understand the components of manufacturing systems and different production lines implemented in production systems.	K2
4	Understand cellular manufacturing, forming part families, group technology and their involvement in flexible manufacturing systems.	K2
5	Understand various automated inspection methodologies and manufacturing support systems like CAPP, shop floor control, etc.	K2

SYLLABUS

UNIT-I

OVERVIEW OF MANUFACTURING AND AUTOMATION: Production systems, automation in production systems, automation principles and strategies manufacturing operations, production facilities, basic elements of an automated system, levels of automation, hardware components for automation and process control, programmable logic controllers and personal computers.

UNIT-II

MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES: Material handling equipment, analysis storage systems, performance and location strategies, automated storage systems, AS/RS, types, automatic identification methods, barcode technology, RFID

UNIT-III

MANUFACTURING SYSTEMS AND AUTOMATED PRODUCTION LINES: Manufacturing systems-components of a manufacturing system, single station manufacturing cells; manual assembly lines, line balancing algorithms, mixed model assembly lines, alternative assembly systems, automated production lines, applications, analysis of transfer lines.

UNIT-IV

AUTOMATED ASSEMBLY SYSTEMS: Fundamentals, analysis of assembly systems, cellular manufacturing, part families, coding and production flow analysis, group technology and flexible manufacturing systems, quantitative analysis.

UNIT-V

QUALITY CONTROL AND SUPPORT SYSTEMS: Quality in design and manufacturing, inspection principles and strategies, automated inspection, contact vs non-contact, CMM, manufacturing support systems, quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

Text Books:

1. Mikell. P. Groover, automation, production systems and computer integrated manufacturing, 3rd edition, published by Prentice hall,2012.
2. P. Radha krishnan& S. Subramanyam and Raju, CAD /CAM/CIM, 3rd edition new age international publishers-2003

Reference Books:

1. Singh,nanua,system approach to computer integrated design and manufacturing, published by wiley.
2. Tien-chein Chang, Richard a wysk and Hsu-pin Wang, computer aided manufacturing, Pearson publications 2009.
3. R Thomas wright and Michael berkeihiser good heart, manufacturing and automation technology ,willcox publishers.

Code: B17ME4106

QUALITY CONTROL AND ASSURANCE
(Elective-I)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

Students learn

1. The overall objective of the course is to teach the basic principles of Quality management which includes Taguchi's loss function, Deming's philosophy
2. To understand the purpose and function of statistical quality control
3. To understand the difference between attributes and variables
4. To become familiar with basic methods of statistical process control

Course Outcomes: Students will be able to

S. No	Out Come	Knowledge Level
1	Apply the fundamentals in interpreting the concepts like Quality Costs, Deming's philosophy, Taguchi's loss function and Six Sigma	K3
2	Construct and analyse control charts for Variables and Attributes for the purpose of improving the process	K3
3	Analyse different processes for their Process Capability Acquire knowledge of Laplace transform, partial differentiation and their applications	K3
4	Design different sampling plans for the purpose of inspection.	K3

SYLLABUS

UNIT-I

Quality control in Perspective: Introduction to quality, quality assurance, quality control; quality of design, quality of conformance and quality of performance; quality characteristics – variables and attributes, growth of quality control, Statistical quality control, Taguchi's loss function, examples of off-line and on-line quality control techniques, quality costs, Deming's philosophy, introduction to six sigma concept.

UNIT-II

Control charts for Variables: Shewart's norm bowl, X and R charts, X and σ charts, Statistical control of processes, group control chart, X chart with linear trend, warning limits

UNIT-III

Control charts for Attributes: Defect and defective, fraction defective and percent defective, p-chart, 100p -chart, np-chart, c-chart, u-chart, ku-chart, demerit control charts

UNIT-IV

Process capability analysis: Determination of process capability, PCR, Design specifications and tolerances, PCR for nominal the better type, smaller the better type and larger the better type product specifications; Tolerances for sub-assemblies, setting tolerances for intermediate steps in production

UNIT-V

Acceptance sampling plans: Single, double, multiple and sequential sampling plans, OC curve, rectifying inspection, AOQ, AOQL, ASN and ATI, Use of Dodge Romig Tables, Design of single and sequential sampling plans.

Text Books:

1. Statistical Quality Control by E.L.Grant and Leavenworth, McGraw Hill
2. Quality control and application by Bertrand.L.Hansen and P.M.Ghare, PHI

Reference Books:

1. Introduction to Statistical Quality Control by D.C.Montgomery, Wiley
2. Principles of Quality control by Jerry Banks, John Wiley.
3. Quality control hand book by Juran, McGraw Hill.

Code: B17ME4107

PROJECT MANAGEMENT
(Elective-II)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

1. To make the students understand the importance of Project Management across all avenues of work.
2. To teach students various project planning and scheduling tools and how to estimate the cost of the projects.
3. To make the students understand the sources of risks in projects and teach them how to manage the risks through various tools and methods.
4. To teach students how to control the project, evaluate a project, communicate it to others, and terminate it.
5. To make the students understand the roles and responsibilities within and outside the team, and how to manage the stress in projects.

Course Outcomes:

At the end of the Course, Student will be able to:

S. No	Out Come	Knowledge Level
1	Understand that PM skills are critical to most careers and they can be applied at most businesses and professions.	K2
2	Acquire thorough knowledge on various analytical tools required during different stages of project life cycle.	K2
3	Will be able to apply various tools and techniques for planning and scheduling the projects and can estimate the cost of the project.	K3
4	Learn how to be proactive to the risks and be able to manage them that occur during the progressive stages of the projects.	K2
5	Learn the ways of controlling the projects and all possible practical situations that lead to different changes during the course of project execution.	K2
6	Possess full knowledge on how to evaluate the projects, terminate the projects and finally how to close the contract.	K3
7	Be an effective team member or project manager and knows how to manage the stress.	K2
8	Finally, students will acquire all the key skills to become effective project managers across various industries.	K2

SYLLABUS

UNIT I: Overview of Project Management: Characteristics of projects, Need and evolution of project management, Definition and Objectives of project management, Project management: the person, the team, the system; The Project Life Cycle, Stages and different forms of Project Management.

UNIT II: Project Planning and Scheduling: Work breakdown structure, Gantt charts, Network diagrams, Scheduling with resource constraints, CPM and PERT, Fundamentals of cost estimates and budgets, Cost estimating process.

UNIT III: Project Risk Management: Risk concepts, Risk identification: Sources of risks and identification techniques, Risk Assessment, Risk response planning, Risk analysis methods.

UNIT IV: Project Control, Evaluation, Communication, and Termination: Project control process, Project control emphasis, Controlling changes, Project evaluation, Project communication management – meetings and reports, Terminating the project, Closure of contract, Project extensions.

UNIT V: Roles, Authority, and Teams in Project Management: Project manager's role and responsibility, Authority in project management, Roles inside and outside the project team, Teams in project management and team building approach, Emotional stress and stress management.

Text Books:

1. John M Nicholas, Project Management for Business and Technology: Principles and Practice, Prentice Hall of India, 2002.
2. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, PH Inc.
3. Lock, Gower, Project Management Handbook.
4. S. Choudhury, Project Scheduling and Monitoring in Practice.
5. P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd.

Reference Books:

1. Larson, E.W. and Gray, C.F. (2018), Project management the managerial process, Seventh Edition, McGraw-Hill
2. Harvey Maylor (2007), Project management, Third Edition, Pearson Education.
3. N. J. Smith (Ed), Project Management, Blackwell Publishing, 2002.
4. Robert K. Wysocki, Robert Back Jr. and David B. Crane, Effective Project Management, John Wiley, 2002.

5. Jack R Meredith and Samuel J Mantel, Project Management: A Managerial Approach, John Wiley, 4th Edition, 2000.

Code: B17ME4108

TOOL DESIGN
(Elective-II)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

1. To apply the principles of locating and clamping systems.
2. Apply the design of different tools and components, such as jigs and fixtures, press tools for sheet metal working, molds for plastic injection molding, and die casting.
3. Use of limit gauges and tolerances

Course Outcomes: At the end of the Course, Student will be able to:

S. No	Out Come	Knowledge Level
1	Explain about locating and clamping devices	K2
2	Practice with jigs and fixtures	K2
3	Use press and press tools and design different types of dies	K2
4	Illustrate Die casting Dies and Injection Moulds	K2
5	Determine gauges and gauge design	K3

SYLLABUS

UNIT-I

Locating and Clamping Devices: Principles of Jigs and Fixtures design-Locating principles-Locating elements-Standard parts-Clamping devices-Mechanical actuation-Pneumatic & hydraulic actuation-Analysis of clamping forces-Tolerance and error analysis.

UNIT-II

Jigs & Fixtures: Drill Bushes-Different types of Jigs-Plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs- Automatic drill jigs-Rack & Pinion Operated, Air operated Jigs Components. General principles of lathe, milling and broaching fixtures-Grinding, Drilling and shaping fixtures, Assembly, Inspection and Welding fixtures-Modular fixtures. Design and development of Jigs and fixtures for simple components.

UNIT-III

Press Tools: Press working terminology-Presses and Press accessories-Computation of capacities and tonnage requirements-Design and development of various types of cutting, forming and drawing dies. **Bending dies** – Introduction, bend allowance, spring back, edge bending die design. **Drawing dies** – Single action, double action and triple action dies, factors affecting drawing, drawing die design.

UNIT-IV

Die Casting Dies: Basic Terminology, Types of Dies: Single cavity, multicavity dies, combination dies, unit dies, Pressure Die casting Process, Requirements, Technique of filling Die Cavity, Pressure Die casting machines, advantages and disadvantages of Pressure die Casting Process, defects in die casting. **Injection Moulding:** Basic Terminology, Injection moulding machine and its elements, general configuration of a mould. 2 plate and 3 plate mould. Introduction to compression, transfer, blow moulding, extrusion, forming and calendaring.

UNIT-V

Design of Limit Gauges: Elements, types and application of limit gauges, Gauge materials, their selection, Taylor's principles of gauge design, Types and methods to provide gauge tolerances. Design steps and design of plug & ring / snap gauge for given dimension and application.

Text Books:

1. Donaldson. C, Tool Design, Tata McGraw-Hill, 1986
2. "ASTME Handbook of Fixture Design ".Prentice Hall of India Pvt. Ltd.
3. Basu, Mukherjee, Mishra, Fundamentals of Tool Engg. Design, Oxford & IBH Publishing, N. Delhi

References:

1. A. K. Goroshkin, " Jigs and Fixtures Handbook ", Mir Publishers, Moscow, 1983.
2. "Die Design Handbook ", Ivana Suchy, McGraw Hill Book Co., 2005.
3. Injection Moulding Design, RGW Pye, john.1998
4. Production technology, HMT,Tata McGraw Hill.
5. P. Eugene Ostergaard, "Basic Die Making" - Mc Graw Hill Book, 1963.

Code: B17ME4109

REFRIGERATION & AIR CONDITIONING
(Elective-II)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

1. Understand the principles of refrigeration and air craft refrigeration systems.
2. Have the complete knowledge of the Vapour Compression Refrigeration System and its performance.
3. Understand the working of Vapour Absorption refrigeration system.
4. Understand the working of Steam Jet Refrigeration system.
5. Understand the principles and processes of psychrometry.
6. Develop the knowledge of students in selecting the right equipment for a particular application of Air- conditioning.

Course Outcomes: At the end of the Course, Student will be able to:

S. No	Out Come	Knowledge Level
1	Illustrate the fundamental principles and applications of refrigeration and air conditioning system.	K2
2	Analyze cooling capacity and performance of refrigeration systems	K3
3	Examine the properties, applications and environmental issues of differentrefrigerants	K3
4	Analyze the air conditioning processes using principles of Psychrometry	K3

SYLLABUS

UNIT I: Introduction to Refrigeration: Necessity of refrigeration and air conditioning, applications, unit of refrigeration. Carnot cycle, Bell Coleman cycle, Open and Dense air systems, Actual air refrigeration system –numerical problems. Refrigeration needs of air craft‘s, methods of air refrigeration systems.

UNIT II: Vapour Compression Refrigeration System - Basic Cycles- Working principle and Essential components of the plant – COP – Representation of cycle on T-S and P-h charts- Effect of sub cooling and super heating - cycle analysis. Actual cycle, Influence of various parameters on system performance -numerical Problems. Refrigerants- Classifications- Desirable properties.

UNIT III: Vapour Absorption Refrigeration (VAR) System – Description and Working of NH3 – Water System and Li Br – Water (Two Shell & Four Shell) System – Calculation of Max COP, Principle of Operation of Three Fluid Absorption System.

Steam Jet Refrigeration System: Working Principle and Basic Components – Nonconventional refrigeration methods: Principle and operation (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

UNIT IV: Psychrometry: Psychrometric properties and relations- Psychrometric chart- Psychrometric processes- Human comfort and comfort chart- Effective temperature and factors governing effective temperature.

UNIT V: Air Conditioning: Summer, Winter and year round air conditioning- Different types of Air conditioning load - By pass factor, RSHP, GSHF- Fresh air quantity- Cooling coils and Dehumidity- Air washers.

Text Books:

1. A Course in Refrigeration and Air Conditioning, S. C Arora &Domkundwar, Dhanpatrai Publications
2. Refrigeration and Air conditioning, by R. S. Khurmi and J. K. Gupta, S Chand publications.

References:

1. Refrigeration and Air conditioning, by Jordan R.C. and Priester G.B.
2. Principles of Refrigeration, by Dossat.
3. Refrigeration and Air-conditioning, by W.P.Stoecky.
4. Refrigeration and Air Conditioning, CP Arora, TMH, 15th edition 2013.

Code: B17ME4110

HEAT TRANSFER LAB

Lab : 3 Periods	**Int. Marks : 50**
Exam : 3 Hrs.	**Ext. Marks : 50**
	Credits : 2

Course Objectives:

1. This course is designed to introduce a basic study, the phenomena of heat and mass transfer, and to provide useful information concerning the performance and design of particular systems and processes.
2. A knowledge-based design problem requiring the formulations of solid conduction and fluid convection and the technique of numerical computation.
3. Examine the basic concepts of heat transfer models - thermal gradients, conduction, convection, and radiation.
4. To help the student develop skills that would apply to lifelong learning.

Course Outcomes:

Upon successful completion of this course, the student will be able to

S. No	Out Come	Knowledge Level
1	Conduct experiments on conduction, convection and radiation of heat;collect data, perform analysis and interpret results to draw valid conclusions through standard test procedures	K3
2	Determine thermal properties and performance of heat exchanger	K3

LIST OF EXPERIMENTS

1. Determination of Heat Transfer through Lagged Pipe.
2. Measurement of Thermal Conductivity for a given Asbestos Insulating powder.
3. Determination of Thermal Conductivity for a Given Copper Metal Rod.
4. Determination of Heat Transfer through Pin-Fin.
5. Experimentation on Transient Heat Conduction.
6. Determination of Heat Transfer through Forced Convection.
7. Determination of Heat Transfer through Natural Convection.
8. Determination of overall heat transfer coefficient for Parallel and Counter Flow Heat Exchanger.
9. Emissivity Measurement.
10. Measurement of Stefan Boltzmann constant.
11. Determination of Heat Transfer through Drop Wise and Film Wise Condensation.
12. Determination of Two phase heat Transfer.
13. Determination of Overall Heat Transfer Co-Efficient for Composite Wall.

14. Study of Refrigeration Test Rig.
15. Study of Air Conditioning Test Rig.

Reference Books:

1. Heat Transfer, by J.P.Holman, Int. Student edition, McGraw Hill book company.
2. Analysis of Heat transfer, by Eckert and Drake, Int.Student edition, McGraw Hill Kogakusha Ltd.
3. Heat and Mass Transfer by R.K. Rajput, S. Chand & Co.
4. Heat and mass transfer by Sachdeva.
5. Heat and mass transfer by Kothandaramanna, New Age International.

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Code: B17ME4111

CAD LAB

Lab : 3 Periods	**Int. Marks : 50**
Exam : 3 Hrs.	**Ext. Marks : 50**
	Credits : 2

Course Objectives:

1. To impart the fundamental knowledge on using various modelling and analysis tools forEngineering Simulation
2. To know various fields of engineering where these tools can be effectively used to improve the output of a product.
3. To impart knowledge on how these tools are used in Industries by solving some real time problems using these tools.

Course Outcomes:

S. No	Out Come	Knowledge Level
1	Apply various commands in CAD software for modelling 2D &3D objects.	K3
2	Analyze various structural components using CAD software.	K4

SYLLABUS

- **DRAFTING:** Development of part drawings for various components in the form of orthographic and isometric representation of dimensioning and tolerances, scanning and plotting.
- **PART MODELING:** Generation of various 3D models through protrusion, revolve, shell sweep. Creation of various features. study of parent child relation. feature based and boolean based modelling surface and assembly modelling. study of various standard translators. design simple components.
- Determination of deflection and stresses in 2D and 3D trusses and beams.
- Determination of deflectionsand principal and Von-mises stresses in planestress, plane strain and Axisymmetric components.
- Determination of deformation and stresses in 3D structures.
- Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.

Reference Books:

1. Solid Works Reference Guide.
2. CAD/CAM Theory and Practice by Ibrahim Zeid.
3. CAD/CAM Principles and Applications by P.N. Rao, Tata McGraw Hill Publishing Company Ltd.
4. CAD/CAM Computer Aided Design and Manufacturing by Mikell P. Groover and Emory W. Zimmer, Jr.

SCHEME OF INSTRUCTION & EXAMINATION

(Regulation R17)

IV/IV B.TECH

(With effect from **2017-2018**Admitted Batch onwards**)**

MECHANICAL ENGINEERING

II-SEMESTER

Code No.	Name of the Subject	Credits	Lecture Hrs	Tutorial Hrs	Lab Hrs	Contact Hrs/ Week	Internal Marks	External Marks	Total Marks
B17 ME 4201	Production Planning & Control	3	3	1	--	4	30	70	100
# ELE-III	Elective-III	3	3	1	--	4	30	70	100
B17 ME 4205	CAM Lab	2	--	--	3	3	50	50	100
B17 ME 4206	Seminar	2	--	--	--	--	50	--	50
B17 ME 4207	Project Work	10	--	--	3	3	60	140	200
Total		**20**	**6**	**2**	**6**	**14**	**220**	**330**	**550**

	Code No.	Course
# ELE-III	B17 ME 4202	Power Plant Engineering
	B17 ME 4203	Automobile Engineering and Hybrid Vehicles
	B17 ME 4204	Additive Manufacturing

Code: B17ME4201

PRODUCTION PLANNING AND CONTROL

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

1. To understand the problems and opportunities faced by the operations manager in manufacturing and service organizations.
2. To develop an ability to apply PPC concepts in a various area like marketing, accounting, finance, engineering, personnel management, logistics, etc.
3. To integrate operations concepts with other functional areas of business.
4. To understand the PPC function in both manufacturing and service organizations.
5. To examine several classic Operations Management planning topics including production planning and inventory control.
6. To learn several important contemporary topics relevant to business managers of all functional disciplines, including quality management, lean concepts, and sustainability.

Course Outcomes: At the end of the Course, Student will be able to:

S. No	Out Come	Knowledge Level
1	Judge which type production is required for different specific real-world situations and can apply various qualitative/quantitative methods for forecasting the future demand.	K3
2	Analyze different inventory systems for minimizing the total costs and maximizing the profit.	K3
3	Determine the most economical process of doing a work and prepare the route sheets for establishing how and where the work will be done.	K3
4	Analyze the sequence of performing jobs scheduled through different machines in order to measure the effectiveness of the system and can also administer the priority rules for dispatching jobs.	K3

SYLLABUS

UNIT I

Introduction: Definition – Objectives of production Planning and Control – Functions of production planning and control – Types of production – Organization of production planning and control department.

UNIT II

Forecasting: Importance – Types of forecasting– Forecasting techniques – qualitative methods and quantitative methods.

UNIT III

Inventory management: Functions of inventories – relevant inventory costs – EOQ model – Inventory control systems: Fixer order quantity system and Periodic review system - ABC analysis -VED analysis- Material Requirement Planning, Bill of material, MRP II - Master Production Scheduling.

UNIT IV

Aggregate planning: Chase planning, Expediting, controlling aspects.
Routing: Definition – Routing procedure –Route sheets — Factors affecting routing, procedure – Difference with loading

UNIT V

Scheduling: Policies – Types of scheduling - Forward and Backward Scheduling – Gantt Charts – Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – Job shop Scheduling – 2 jobs and n machines – Line of Balance.
Dispatching: Activities of dispatcher – Dispatching procedure – follow up – priorit y rules for dispatching jobs - Applications of computer in production planning and control.

Text Books:

1. Elements of Production Planning and Control / Samuel Eilon.
2. Modern Production/ operation managements / Baffa & Rakesh Sarin

Reference Books:

1. Operations Management – S.N. Chary.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
3. Production Control A Quantitative Approach / John E. Biegel.
4. *Operations Management / Joseph Monks.*

Code: B17ME4202

POWER PLANT ENGINEERING
(Elective-III)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

The course is aimed at providing knowledge of power generation through different prime movers viz steam, ICGT, Hydro, nuclear and hybrid systems along with their economics and environmental considerations.

Course Outcomes:

At the end of the Course, Student will be able to:

S. No	Out Come	Knowledge Level
1	Describe with a layout, the working of steam power plant with fuel handling and ash handling systems	K2
2	Determine the performance of Diesel engine and gas turbine power plants.	K3
3	Analyze various hydroelectric power plant and nuclear power plant along with their economics and their impact on environment.	K3
4	Calculate load factor, capacity and utilization factor and cost of power generated by power plants.	K3

SYLLABUS

UNIT I: Introduction to the sources of energy – resources and development of power in India.

STEAM POWER PLANT: Plant layout, working of different circuits, fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, and ash-handling systems. Combustion: properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT II: INTERNAL COMBUSTION AND GAS TURBINE POWER PLANTS:

DIESEL POWER PLANT: Plant layout with auxiliaries – fuel supply system, air starting equipment, super charging.

GAS TURBINE PLANT: Introduction – classification - construction – layout with auxiliaries, combined cycle power plants and comparison.

UNIT III: HYDRO ELECTRIC POWER PLANT: Water power – hydrological cycle / flow measurement – drainage area characteristics – hydrographs – storage and pondage –classification of dams and spill ways. HYDRO PROJECTS AND PLANT: Classification – typical layouts – plant auxiliaries – plant operation pumped storage plants.

UNIT IV: NUCLEAR POWER STATION: Nuclear fuel – breeding and fertile materials – nuclear reactor– reactor operation. TYPES OF REACTORS: Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor, homogeneous reactor, gas cooled reactor, radiation hazards and shielding – radioactive waste disposal.

UNIT V: POWER PLANT ECONOMICS AND ENVIRONMENTAL CONSIDERATIONS: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, load curves, load duration curve, definitions of connected load, maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – methods of pollution control.

Text Books:

1. A course in Power Plant Engineering /Arora and Domkundwar/Dhanpatrai& Co.
2. Power Plant Engineering /P.C.Sharma / S.K.Kataria Pub

Reference Books:

1. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
2. Power station Engineering – ElWakil / McGrawHill.
3. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers

Code: B17ME4203

AUTOMOBILE ENGINEERING AND HYBRID VEHICLES

(Elective-III)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

Course Objectives:

1. To make students familiar with the constructional details of chassis and body
2. To understand about various steering systems, steering linkages, Transmission system, steering gear boxes and power steering
3. To study the different components in the drive line and types of final drive
4. To introduce students to the rear axles and types of suspension systems.
5. To introduce students to braking systems, wheels and tyres and provides the information on various aspects of vehicle maintenance.
6. To understand upcoming technology of hybrid electric vehicles.

Course Outcomes:

Upon successful completion of this course the student should be able to:

S. No	Out Come	Knowledge Level
1	Apply and understand all sub systems of an Automobile such as various types of suspension systems and the concepts of brakes, electrical and electronic ignition systems	K3
2	Analyze different types of engines, their cooling systems and various types of catalytic converters to control Exhaust emissions	K3
3	Analyze various types and working principles of clutch, gearbox, drive shaft and final drive systems and hybrid vehicles.	K3
4	Analyze, troubleshoot, servicing and maintenance of automobile vehicles and also create an idea on future challenges in the field of automobile.	K3

SYLLABUS

UNIT-I

Introduction to Automobile, Automobile Layout, Chassis and body, Power unit- types of automobile engines, engine parts, Classification: ‘In-line’ and ‘V’ type, Multi-Valve Engines, Super Charging/Turbo charging, Air filters, Fuel Systems: Petrol Engines: Carbureted and MPFI, Ignition systems: Conventional and Electronic, Diesel Engines: Conventional, CRDI and Dual fuel Engines, Engine Cooling and Lubrication.

UNIT-II

Clutches: principle, Types: cone clutch, single plate clutch, diaphragm clutch, multi plate clutch, centrifugal clutches and fluid coupling.

Gearbox: Construction and Working Principle, Selector Mechanism, Types: Sliding mesh, Constant mesh, Synchromesh, and Epicyclical, Overdrive, Automatic Gearbox-CVT, Torque converter.

Drive shaft and Final Drive: Drive Shaft, Types of Propeller shafts, Final drive and Differential, Power transmission: Front, Rear and Four wheel drive.

UNIT-III

Suspension System: Leaf springs coil springs, torsion bar, shock absorber, Independent suspension system.

Steering System: Steering geometry: camber, caster, Kingpin angle, Toe-in, and Toe-out. Steering Mechanism and its Elements: Steering gear box and its types, Steering gear ratio, Power-Steering

Wheels: Disc and Drum type, **Tires:** Tire Construction, Tube and Tubeless Tires, Radial Tires, Tire specification, Tire rotation and Tire Maintenance.

UNIT-IV

Braking System: Necessity, Parking and Power Brakes, Parts and Working Principle of Mechanical, Air and. Hydraulic Brakes: Master and Wheel cylinder, Properties of Brake Fluids, Brake Diagnostics and Service: Brake Bleeding, Anti-lock Braking System.

Air pollution and their control: EGR and Catalytic Converters, EURO/Bharat Stage Norms, Mufflers.

Electricaland Electronic system: Starting System, Ignition system, battery, ECU/ ECM.

UNIT-V

Hybrid Vehicles: History and Introduction of Hybrid Vehicles, Components in hybrid vehicles, Classification of hybridtopologies- Drivetrain structure, Degree of hybridization, Nature of the power source,Advantages and Disadvantages, Applications.

Trouble shooting and Maintenance: Engine and Vehicle Troubles: Diagnostic Information,Symptom descriptions and their Causes and Remedies, Maintenance - Periodic, Preventive and Break down.

Text Books:

1. Automotive Mechanics (10/e) - William H. Crouse and Donald L. Anglin, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-059054-0.
2. Automobile Engineering – KK Jain/ RB Asthana, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-044529-X.
3. Internal Combustion Engines and Air Pollution- E.F. Obert, Harper & Row International Publishers Inc., ISBN: 0-06-350561-4.
4. Electric and Hybrid Vehicles, Tom Denton, Taylor & Francis,2018.

Reference Books:

1. Automotive Mechanics – S. Srinivasan, Tata McGraw-Hill Publishing company Limited, ISBN: 0-07-044941-6.
2. Internal Combustion Engines – Heywood, John, B. McGraw-Hill Publications Limited.
3. Automotive Engines- S Srinivasan, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-040265-5.
4. Hybrid Vehicles and the future of personal transportation, Allen Fuhs, CRC Press,2011.

B17ME4204

ADDITIVE MANUFACTURING
(Elective-III)

Theory	**: 3 Periods**	**Sessionals**	**: 30**
Tutorial	**: 1 Period**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 4**

Course Objectives:

1. The course is designed to develop fundamental knowledge on rapid prototyping.
2. Acquire knowledge of digital and virtual prototyping.
3. Learn certain aspects of three-dimensional printing.
4. Study the Liquid based, solid based, and powder based rapid prototyping techniques
5. Learn tools used for rapid prototyping.

Course Outcomes:

At the end of the Course, Student will be able to:

S. No	Out Come	Knowledge Level
1	Understand the significance of rapid prototyping and its practical usage.	K2
2	Use Stereo Lithography System models files for rapid prototyping.	K2
3	Understand various Liquid based and Solid based rapid prototyping methods	K2
4	Understand the concept of additive manufacturing.	K2
5	Develop the CAD models for rapid prototyping.	K3
6	Use the tools of rapid prototyping	K2

SYLLABUS

UNIT I: Introduction:
Need - Development of RP systems-, – RP process chain - Impact of Rapid Prototyping and Tooling on Product Development – History of RP systems and their classification- Benefits Applications – Digital prototyping - Virtual prototyping

Stereo Lithography System:
Principle, Process parameter, Process details, Data preparation, Data files and machine details & Applications. Stereo lithography Apparatus

UNIT II: Liquid Based And Solid Based Rapid Prototyping Systems:
Fused deposition Modeling, Laminated object manufacturing, three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations and applications.

UNIT III: Powder Based Rapid Prototyping Systems:
Selective Laser Sintering, Direct Metal Laser Sintering, Three Dimensional Printing, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam Melting: Processes, materials, products, advantages, applications and limitations.

UNIT IV: Reverse Engineering And Cad Modeling:
Basic concept- Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – geometric modeling techniques: Wire frame, surface and solid modeling – data formats – Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation

UNIT V: Rapid Tooling:
Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect – Fabrication processes, Applications

Text Books:

1. Rapid prototyping: Principles and applications, second edition, Chua C.K., Leong K.F., and Lim C.S., World Scientific Publishers, 2003.
2. Rapid Tooling: Technologies and Industrial Applications, Peter D.Hilton, Hilton/Jacobs, Paul F.Jacobs, CRC press, 2000.

Reference Books:

1. Rapid prototyping, Andreas Gebhardt, Hanser Gardener Publications, 2003.
2. Rapid Prototyping and Engineering applications: A tool box for prototype development, LiouW.Liou, Frank W.Liou, CRC Press, 2007.
3. Rapid Prototyping: Theory and practice, Ali K. Kamrani, Emad Abouel Nasr, Springer, 2006.
4. Paul F.Jacobs – "Stereo lithography and other RP & M Technologies", SME, NY 2011

Code: B17ME4205

CAM LAB

Lab : 3 Periods	**Int. Marks : 50**
Exam : 3 Hrs.	**Ext. Marks : 50**
	Credits : 2

Course Objectives:

1. The course is designed to equip the students with the necessary Knowledge to send part programmed to CNC machine and being able to machine parts.
2. Motivation of the students towards the good position in automated and software industries as a design engineer

Course Outcomes: At the end of the Course, Student will be able to:

S. No	Out Come	Knowledge Level
1	Demonstrate the CAM Software's XL MILL and XL TURN	K2
2	Create manual part programming for CNC Turning and milling using G-Codes and M-Codes	K3

LIST OF EXPERIMENTS

MANUAL PART PROGRAMMING (Using G and M Codes) in CNC lathe:

1) Part programming for Facing and Step Turning.
2) Part programming using for Threading and Grooving.
3) Part Programming for Drilling and Boring

MANUAL PART PROGRAMMING (using G and M codes) in CNC Milling:

1) Part programming for Linear and Circular interpolation and Contour motions.
2) Part programming For Drilling Cycle, Mirroring.
3) Part Programming for Pocket Operations (Circular and Rectangular)
4) Part Programming for Rotation and Scaling

Reference Books:

1. Computer Aided Manufacturing, by P.N.Rao, N.K.Tewari&T.K.Kundra, Tata McGraw-Hill publishing company Ltd, New Delhi.
2. Automation, Production Systems and Computer Integrated Manufacturing, by Mikell P.Groover, Prentice-Hall of India Pvt. Ltd.

Code: B17 ME 4206

SEMINAR

Lecture	**: --**	**Int.Marks**	**: 50**
Tutorial	**: --**	**Ext. Marks**	**: --**
Exam	**: --**	**Credits**	**: 2**

For the seminar, each student has to be evaluated based on the presentation of any latest topic with report of 10-15 pages and a PPT of minimum 10 slides. The student shall collect the information on a specialized topic and prepare a technical report, showing his understanding over the topic, and submit to the department, which shall be evaluated by the Departmental committee consisting of Head of the department, seminar supervisor and a senior faculty member.

NOTE: Minimum of 50 % of marks is required to pass in seminar. If a student fails to get those minimum marks he/she has to again present the same topic within 2 weeks from the date of earlier presentation.

Code: B17 ME 4207

PROJECT WORK

Lab	**: 3 Hrs.**	**Int.Marks**	**: 60**
Tutorial	**: --**	**Ext. Marks**	**: 140**
Exam	**: --**	**Credits**	**: 10**

Course Outcomes: At the end of the Project Work students will be able to

S.No	Out Come	Knowledge Level
1	Identify a current problem through literature/field/case studies	K3
2	Identify the background objectives and methodology for solving the same.	K3
3	Design a technology/ process for solving the problem.	K6
4	Develop a technology/ process for solving the problem.	K6
5	Evaluate that technology/ process at the laboratory level.	K5

Format for Preparation of Project Thesis for B. Tech:

1. Arrangement Of Contents: The sequence in which the project report material should be arranged and bound should be as follows:

1. Cover Page & Title Page
2. Bonafide Certificate
3. Abstract.
4. Table of Contents
5. List of Tables
6. List of Figures
7. List of Symbols, Abbreviations and Nomenclature
8. Chapters
9. Appendices
10. References

*The table and figures shall be introduced in the appropriate places.

Note:

Out of a total of 200 marks for the project work, 60 marks shall be for Internal Evaluation and 140 marks for the end semester examination. The end semester examination (VivaVoce) shall be conducted by the committee. The committee consists of an external examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project and evaluated by an internal committee.