ADIKAVI NANNAYA UNIVERSITY

UNIVERSITY COLLEGE OF ENGINEERING

R A J A M A H E N D R A V A R A M

Department of Mechanical Engineering

BTech (MECH)

SYLLABUS &
MODEL QUESTION PAPERS

II, III & IV YEAR
(*For the admitted batch of* 2019-20)

Board of Studies

University College of Engineering

CONTENTS

Branch/Course: Mechanical Engineering
Semester III (Second year) Curriculum

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
		Ext	Int		L	T	P	
BSC-ME301	Probability and Statistics	75	25	100	3	0	0	3
PCC-ME302	Applied Thermodynamics	75	25	100	3	0	0	3
PCC-ME303	Mechanics of Solids	75	25	100	3	0	0	3
PCC-ME304	Metallurgy & Material Science	75	25	100	3	0	0	3
PCC-ME305	Fluid Mechanics & Hydraulic Machinery	75	25	100	3	0	0	3
LC-ME306	Mechanics of Solids Lab	50	50	100	0	0	3	1.5
LC-ME307	Fluid Mechanics & Hydraulic Machinery Lab	50	50	100	0	0	3	1.5
LC-ME308	Material Science Lab	50	50	100	0	0	3	1.5
MC-ME309	Essence of Indian Traditional Knowledge	75	25	100	2	0	0	0
MC-ME310	Skill oriented course	--	50	50	1	0	2	2
Total Credits								21.5

Semester IV(Second year) Curriculum

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
		Ext	Int		L	T	P	
ESC-ME401	Basic Electrical & Electronics Engineering	75	25	100	3	0	0	3
PCC-ME402	Thermal Engineering	75	25	100	3	0	0	3
PCC-ME403	Production Technology	75	25	100	3	0	0	3
PCC-ME404	Machine Drawing	75	25	100	3	0	0	3
HSMC-ME405	Managerial Economics & Financial Analysis	75	25	100	3	0	0	3
LC-ME406	Basic Electrical & Electronics Engineering Lab	75	25	100	0	0	3	1.5
LC-ME407	Thermal Engineering Lab	50	50	100	0	0	3	1.5
LC-ME408	Production Technology Lab	50	50	100	0	0	3	1.5
MC-ME409	Skill oriented course	--	50	50	1	0	2	2
	Total Credits							21.5

Semester V (Third year) Curriculum

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
		Ext	Int		L	T	P	
PCC-ME501	Dynamics of Machinery	75	25	100	3	0	0	3
PCC-ME502	Design of Machine Members-I	75	25	100	3	0	0	3
PCC-ME503	Metal Cutting & Machine Tools	75	25	100	3	0	0	3
PEC-ME504	Professional Elective-I 1.Power plant engineering 2.Automobile Engineering 3. Theory of Elasticity & Plasticity	75	25	100	3	0	0	3
OEC-ME505	Open Elective-I 1.Nano-Technology 2. Robotics 3. Artificial Intelligence & MachineLearning	75	25	100	3	0	0	3
LC-ME506	Dynamics of Machinery Lab	50	50	100	0	0	3	1.5
LC-ME507	Machine Tools Lab	50	50	100	0	0	3	1.5
MC-ME508	Constitution of India	75	25	100	2	0	0	0
MC-ME509	Skill oriented course	--	50	50	1	0	2	2
Summer Internship 2 Months (Mandatory) after second year(to be evaluated during V semester					0	0	0	1.5
	Total Credits							21.5

Semester VI (Third year) Curriculum

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
		Ext	Int		L	T	P	
PCC-ME601	Metrology & Instrumentation	75	25	100	3	0	0	3
PCC-ME602	Heat Transfer	75	25	100	3	0	0	3
PCC-ME603	CAD/CAM	75	25	100	3	0	0	3
PEC-ME604	Professional Elective-II 1. Turbo Machinery Systems 2. Automation in Manufacturing 3. Advanced Materials	75	25	100	3	0	0	3
OEC-ME605	Open Elective-II 1. Industrial Tribology 2. Optimization Techniques 3. Mechatronics	75	25	100	3	0	0	3
LC-ME606	Metrology & Instrumentation Lab	50	50	100	0	0	3	1.5
LC-ME607	Heat Transfer Lab	50	50	100	0	0	3	1.5
LC-ME608	Simulation Lab	50	50	100	0	0	3	1.5
MC-ME609	Skill oriented course	--	50	50	1	0	2	2
	Total Credits							21.5

Semester-VII (Fourth Year)

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
		Ext	Int		L	T	P	
PEC-ME701	Professional Elective-III 1. Finite Element Method 2.Measurements & CNC Machines 3.Advanced Foundry & Welding Technology	75	25	100	3	0	0	3
PEC-ME702	Professional Elective-IV 1. Experimental stress analysis 2. Design for Manufacture 3. Total Quality Control & Management	75	25	100	3	0	0	3
PEC-ME703	Professional Elective-V 1. Unconventional machining processes 2. Production planning & control 3. Mechanical Vibrations	75	25	100	3	0	0	3
OEC-ME704	Open Elective-III 1. Non Destructive Evaluation 2. Additive Manufacturing 3. Concurrent Engineering	75	25	100	3	0	0	3
OEC-ME705	Open Elective-IV 1. Cryogenic Engineering 2. Tool Design 3. Supply Chain Management	75	25	100	3	0	0	3
HSMC-ME706	Industrial Engineering & Management	75	25	100	3	0	0	3
MC-ME707	Skill oriented course	--	50	50	1	0	2	2
Summer Internship 2 Months (Mandatory) after third year(to be evaluated during VII semester					0	0	0	1.5
	Total Credits							21.5

Semester-VIII (Fourth

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
Project	Project Work							14
	Total Credits							14

Branch/Course: Mechanical Engineering Semester III (Second year) Curriculum

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
		Ext	Int		L	T	P	
BSC-ME301	Probability and Statistics	75	25	100	3	0	0	3
PCC-ME302	Applied Thermodynamics	75	25	100	3	0	0	3
PCC-ME303	Mechanics of Solids	75	25	100	3	0	0	3
PCC-ME304	Metallurgy & Material Science	75	25	100	3	0	0	3
PCC-ME305	Fluid Mechanics & Hydraulic Machinery	75	25	100	3	0	0	3
LC-ME306	Mechanics of Solids Lab	50	50	100	0	0	3	1.5
LC-ME307	Fluid Mechanics & Hydraulic Machinery Lab	50	50	100	0	0	3	1.5
LC-ME308	Material Science Lab	50	50	100	0	0	3	1.5
MC-ME309	Essence of Indian Traditional Knowledge	75	25	100	2	0	0	0
MC-ME310	Skill oriented course	--	50	50	1	0	2	2
Total Credits								21.5

Note: 2 lab Hrs/Week or 1 Theory Hrs/Week for SKILL DEVELOPMENT COURSE

Semester III (Second year) Curriculum

Course Code &Title: BSC-ME301: PROBABILITY AND STATISTICS
Semester & Year of study: III & 2020-2021
Course Index: C301

Course Objectives:
The learning objectives of this course are:

Course Objectives
The ideas of probability and random variables and various discrete and continuous Probability distributions and their properties.
The basic ideas of statistics including measures of correlation and regression
The statistical methods of studying data samples.
The idea of curve fitting, correlation and regression.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C301.1	Formulate and solve problems involving random variables and apply statistical method for analyzing experimental data
C301.2	Correlate the material of one unit to the material of other unit.
C301.3	Resolve the potential misconceptions and hazards in each topic of study.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
II BTech (ME) III Semester (2019-20 AB)
BSC-ME301: PROBABILITY AND STATISTICS

Theory: 3Hrs/week **Credits: 3**
Int Marks: 25 **Ext Marks: 75**

UNIT-I

Probability

Probability spaces, conditional probability, independent events, and Bayes' theorem.
Random variables: Discrete and continuous random variables, Expectation of Random Variables, Variance of random variables

UNIT-II

Probability distributions

Binomial, Poisson, evaluation of statistical parameters for these distributions, Poisson Approximation to the binomial distribution, Continuous random variables and their Properties, distribution functions and density functions, Normal, evaluation of statistical parameters for these distributions.

UNIT-III

Estimation & Tests of Hypotheses

Introduction, Statistical Inference, Classical Methods of Estimation, Estimating the Mean, Standard Error of a Point Estimate, Estimating the Variance, Estimating a Proportional of single mean, Difference between Two Means, between Two Proportions for two Samples Statistical Hypotheses: General Concepts, Testing a Statistical Hypothesis, Tests Concerning a Single Mean, Tests on Two Means, Test on a Single Proportion, Two Samples: Tests on Two Proportions.

UNIT-IV

Applied Statistics

Curve fitting by the method of least squares- fitting of straight lines, second degree Parabolas and more general curves, Correlation and regression - Rank correlation.

Text Books :

1. A Text Book of Probability and Statistics – Dr.ShanazBathul – Vgs.Book Links

Reference Books:

1. J.W Brown and R.V Churchil, Complex variables and Applictions , 7th Ed.,MC-GrawHill,2004
2. Sheldon M Ross, Probability and statistics for Engineers and scientists, academic press
3. Ronald E. Walpole, Raymond H. Myers,Sharon L. Myers,Keying Ye, Probability & Statistics For Engineers & Scientists, 9th Ed. Pearson Publishers.

Course Code &Title: PCC-ME302 APPLIED THERMODYNAMICS
Semester & Year of study: III & 2020-2021
Course Index: C302

Course Objectives:
The learning objectives of this course are:

Course Objectives

To impart the knowledge of the thermodynamic laws and principles so as to enable the student to prepare an energy audit of any mechanical system that exchange heat and work with the surroundings.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C302.1	Be able to have the basic concepts of thermal sciences and their application to in formulating the thermal engineering problems.
C302.2	Have a good understanding of first and second laws of thermodynamics and will be in a position to fully understand the analysis to be taught at the higher levels.
C302.3	Be in a position to check the feasibility of proposed processes and cycles using the ideas of second law of thermodynamics and entropy.

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II BTech (ME) III Semester (2019-20 AB)

PCC-ME302: APPLIED THERMODYNAMICS

Theory: 3Hrs/week **Credits: 3**
Int Marks: 25 **Ext Marks: 75**

UNIT – I

Introduction: Basic Concepts : System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry –Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale – PMM I

UNIT –II

Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation. PMM-I, throttling and free expansion processes – deviations from perfect gas model – Vander waals equation of state – compressibility charts – variable specific heats – gas tables.

UNIT -III

Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

UNIT- IV

Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

Power Cycles : Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericcson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Text Books:

1. Engineering Thermodynamics, by P.K. Nag, Tata McGraw-Hill Publications Company.
2. Applied Thermodynamics-I by R.Yadav, Central Book House.
3. Engineering Thermodynamics by K. Ramakrishna, Anuradha agencies.

References Books:

1. Engineering Thermodynamics by Rathakrishnan, Prentice - Hall India.
2. Engineering Thermodynamics by Y.V.C. Rao.
3. Thermal Engineering by R.K. Rajput, S.Chand& Co.

Course Code &Title: PCC-ME303 MECHANICS OF SOLIDS
Semester & Year of study: III & 2020-2021
Course Index: C303

Course Objectives:
The learning objectives of this course are:

Course Objectives

The students completing this course are expected to understand the basic terms like stress, strain, poisons ratio… etc. and different stress induced in beams, thin cylinders, thick cylinders and columns. Further the student shall be able to understand the shear stresses in circular shafts.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C303.1	To gain a fundamental understanding of the concepts of stress and strain by analysis of solids and structures.
C303.2	To study engineering properties of materials, force-deformation, and stress-strain relationship.
C303.3	To learn fundamental principles of equilibrium, compatibility, and force-deformation relationship, and principle of superposition in linear solids and structures.
C303.4	To analyze determinate and indeterminate axial members, torsional members, and beams to determine axial forces, torque, shear forces, and bending moments.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
II BTech (ME) III Semester (2019-20 AB)

PCC-ME303: MECHANICS OF SOLIDS

Theory: 3Hrs/week **Credits: 3**
Int. Marks: 25 **Ext. Marks: 75**

UNIT – I

SIMPLE STRESSES & STRAINS: Elasticity and plasticity – Types of stresses & strains– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses. Principal planes and principal stresses – Concept o f Mohr's circle limited to simple problems only.

UNIT – II

SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

FLEXURAL STRESSES: Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I,T sections – Design of simple beam sections.
SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T sections.

UNIT – IV

THIN CYLINDERS: Thin cylindrical vessels subjected to internal pressure, longitudinal and circumferential stresses & strains, Volumetric strains – changes in dimensions of thin cylinders – Thin spherical shells.
THICKCYLINDERS – Stresses in a thick cylindrical shell, lame's equation – cylinders subjected to inside & outside pressures – stresses in compound thick cylinders.

TEXT BOOKS:

1. Strength of materials by R.K.Bansal ,Laxmi Publications.
2. Strength of materials by Bhavikatti, Lakshmipublications.
3. Strength of materials by RK Rajput, S Chand publications.

REFERENCES: 1.Strength of Materials by S.Timshenko

Course Code &Title: PCC-ME304 METALLURGY & MATERIAL SCIENCE
Semester & Year of study: III & 2020-2021
Course Index: C304

Course Objectives:
The learning objectives of this course are:

Course Objectives

To understand the basic fundamentals of Material science and Physical metallurgy. The basic concepts to be taught will help for the improvement, proper selection and effective utilization of materials which is essential to satisfy the ever increasing demands of the society.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C304.1	To enhance students' ability to understand the science and fundamentals of materials
C304.2	To understand the basic requirements and improve the selection and utilization of materials
C304.3	To understand the regions of stability of phases that occurs in the systems

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II BTech (ME) III Semester (2019-20 AB)

PCC-ME304: METALLURGY & MATERIAL SCIENCE

Theory: 3Hrs/week **Credits: 3**
Int Marks: 25 **Ext Marks: 75**

UNIT – I

Structure of Metals and Constitution of alloys: Bonds in Solids – Metallic bond crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size. Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT –II

Equilibrium Diagrams : Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cus-Sn and Fe-Fe3C.

UNIT –III

Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels. **Heat treatment of Alloys:** Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Harden ability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT – IV

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminums and its alloys, Titanium and its alloys. Introduction to powder metallurgy – Basic Principles.

Ceramic and composite materials: Crystalline ceramics, glasses, cermets, abrasive materials nano-materials – definition, properties and applications.

TEXT BOOKS:

1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill
2. Essential of Materials science and engineering - Donald R.Askeland -Thomson.

REFERENCES:

1. Material Science and Metallurgy – Dr. V.D.kodgire.
2. Materials Science and engineering - Callister &Baalasubrahmanyam
3. Material Science for Engineering students – Fischer – Elsevier Publishers

Course Code &Title: PCC-ME305 FLUID MECHANICS & HYDRAULIC MACHINERY
Semester & Year of study: III & 2020-2021
Course Index: C305

Course Objectives:
The learning objectives of this course are:

Course Objectives

The students completing this course are expected to understand the properties of fluids, its kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations. Further, the student shall be able to understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C305.1	Describe basic working of single and multi-stage centrifugal pumps and blowers.
C305.2	Calculate performance and design of turbines
C305.3	Generate mathematical models of fluid motion including steady, unsteady flow and boundary layer theory.
C305.4	State and visualize fluid kinematics. Predict and design a fluid dynamical system based on in viscid theory.

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II BTech (ME) III Semester (2019-20 AB)

PCC-ME305: FLUID MECHANICS & HYDRAULIC MACHINERY

Theory: 3Hrs/week **Credits: 3**
Int. Marks: 25 **Ext. Marks: 75**

UNIT I

Fluid statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric gauge and vacuum pressure – measurement of pressure. Manometers- Piezometer, U-tube, inverted and differential manometers. Pascal's law, hydrostatic law. Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies.Calculation of metacenter height.Stability analysis and applications.

UNIT II

Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend. Closed conduit flow: Reynolds experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

UNIT III

Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies- specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH. Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

UNIT IV

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube-theory- functions and efficiency. Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitations, surge tank, water hammer.

Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

Text Books:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.
3. Fluid Mechanics and Hydraulic Machines/ RK Bansal/Laxmi Publications (P) Ltd.

Reference Books:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria& Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga& Sharma, Khanna Publishers.

Course Code &Title: LC-ME306 MECHNICS OF SOLIDS LAB
Semester & Year of study: III & 2020-2021
Course Index: C306

Course Objectives:
The learning objectives of this course are:

Course Objectives

To impart practical knowledge on the evaluation of material properties through various destructive testing procedures and their hardness evaluation.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C306.1	To understand evaluation of material properties through various testing procedures.

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II BTech (ME) III Semester (2019-20 AB)
LC-ME306: MECHNICS OF SOLIDS LAB

Lab: 3Hrs/week **Credits: 1.5**
Int Marks: 50 **Ext Marks: 50**

List of Experiments:

MECHNICS OF SOLIDS LAB:

1. Direct tension test (UTM)
2. Bending test on a) Simple supported b) Cantilever beam
3. Torsion test
4. Hardness test Brinells hardness test
5. Hardness test Rockwell hardness test
6. Test on springs (Tension ,Compression test)
7. Compression test on cube (UTM)
8. Impact test (Izod test, charpy test)
9. Punch shear test (UTM)
10. To find out the hardness of various treated and untreated steels

Course Code &Title: LC-ME307 MATERIAL SCIENCE LAB
Semester & Year of study: III & 2020-2021
Course Index: C307

Course Objectives:
The learning objectives of this course are:

Course Objectives

To impart practical exposure on the microstructures of various materials.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C307.1	To understand, Preparation and study of various materials and their micro structures.

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II BTech (ME) III Semester (2019-20 AB)
LC-ME307: MATERIAL SCIENCE LAB

Lab: 3Hrs/week **Credits: 1.5**
Int Marks: 50 **Ext Marks: 50**

List of Experiments:

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Harden ability of steels by Jominy End Quench Test.

Course Code &Title: LC-ME308 FLUID MECHANICS & HYDRAULIC MACHINERY LAB
Semester & Year of study: III & 2020-2021
Course Index: C308

Course Objectives:
The learning objectives of this course are:

Course Objectives

To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C308.1	Calculate the coefficient of discharge for Orifice meter and Venturimeter.
C308.2	Predict performance characteristics of centrifugal pump and submergible pump.
C308.3	Predict performance characteristics of turbines

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
II BTech (ME) III Semester (2019-20 AB)

LC-CS308: FLUID MECHANICS & HYDRAULIC MACHINERY LAB

Lab: 3Hrs/week **Credits: 1.5**
Int Marks: 50 **Ext Marks: 50**

List of Experiments:

1. Impact of jets on Vanes.
2. Performance Test on Pelt on Wheel.
3. Performance Test on FrancisTurbine.
4. Performance Test on KaplanTurbine.
5. Performance Test on Single Stage CentrifugalPump.
6. Performance Test on Multi Stage CentrifugalPump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in apipeline.
12. Turbine flow meter.

Course Code &Title: MC-ME309 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE **Semester & Year of study: III & 2020-2021** **Course Index: C309**	
Course Objectives: The learning objectives of this course are:	
Course Objectives	
Learn about Introduction to traditional knowledge, Indigenous Knowledge	
Learn about Protection of traditional knowledge, The Biological Diversity Act 2002 and Rules 2004, the protection of TK bill, 2016. Geographical indicators act 2003	
Learn about Traditional knowledge and intellectual property, global legal FORA	
Learn about Traditional knowledge in different sectors	
Course Outcomes: By the end of the course, the student will be	
Course Index	**Course Outcomes**
C309.1	Understand about Introduction to traditional knowledge, Indigenous Knowledge
C309.2	Understand about Protection of traditional knowledge, The Biological Diversity Act 2002 and Rules 2004, the protection of TK bill, 2016. Geographical indicators act 2003
C309.3	Understand about Traditional knowledge and intellectual property, global legal FOR A
C309.4	Understand about Traditional knowledge in different sectors

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
II BTech (ME) III Semester (2019-20 AB)
MC-ME309: ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Theory : 3 Hrs/week **Credits : 0**
Int Marks : 25 **Ext Marks : 75**

UNIT I

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge.

UNIT II

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.
The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.

UNIT III

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT IV

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

Text Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.

Reference Books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2

IV (Second year) Curriculum

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
		Ext	Int		L	T	P	
ESC-ME401	Basic Electrical & Electronics Engineering	75	25	100	3	0	0	3
PCC-ME402	Thermal Engineering	75	25	100	3	0	0	3
PCC-ME403	Production Technology	75	25	100	3	0	0	3
PCC-ME404	Machine Drawing	75	25	100	3	0	0	3
HSMC-ME405	Managerial Economics & Financial Analysis	75	25	100	3	0	0	3
LC-ME406	Basic Electrical & Electronics Engineering Lab	75	25	100	0	0	3	1.5
LC-ME407	Thermal Engineering Lab	50	50	100	0	0	3	1.5
LC-ME408	Production Technology Lab	50	50	100	0	0	3	1.5
MC-ME409	Skill oriented course	--	50	50	1	0	2	2
	Total Credits							21.5

Course Code &Title: ESC- ME401BASIC ELECTRICAL & ELECTRONICS ENGINEERING
Semester & Year of study: IV & 2020-2021
Course Index: C401

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C401.1	To learn the basic principles of electrical law's and analysis of networks.
C401.2	To understand the principle of operation and construction details of transformer
C401.3	To understand the principle of operation and construction details of DC machines.
C401.4	To understand the principle of operation and construction details of alternator and 3-Phase induction motor.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C401.1	Understand to analyse the various electrical networks.
C401.2	Understand to analyse the performance of transformer.
C401.3	Understand the operation of DC generator, DC Motor, 3-point starter and Speed control methods.
C401.4	Understand to explain the operation of 3-phase alternator and 3-phase induction motors.

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ESC-ME401: BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Theory: 3Hrs/week **Credits: 3**
Int Marks: 25 **Ext Marks: 75**

UNIT-1

Review of DC Circuits:

DC circuits, Ohm's Law, Kirchhoff's laws, solution of star-delta circuits, Steady State Solution of DC Circuits, Simple problems using ohm's law, Joule's law of electric heating, relationship between various energy units, charging and discharging of capacitor, series-parallel magnetic circuits, fringing effect, comparison between electric and magnetic circuit, Concept of induced emfs, series-parallel connection of inductors, rise and decay of current in inductive circuit.

UNIT-2

Single-Phase AC Circuits :

Introduction to AC Circuits, Waveforms and RMS Value, Power and Power factor, Generation of alternating emf , instantaneous, peak, average values and related other terms, vector representation of AC quantities, Steady state analysis of R, L, C series and parallel circuits, power triangle, resonance in series and parallel circuits. **Three-Phase AC Circuits:** Generation of three-phase emf, star connection, delta connection, relationship between line and phase quantities, power measurement in three-phase circuit, variation in wattmeter reading with power factor.

UNIT - 3

Energy Band Theory of Solids: Intrinsic and Extrinsic Semiconductors Doping, Doping Materials, Carrier Mobility, Conductivity, Diffusion and continuity equation, Hall – Effect and its Application. **Semiconductor Diodes:** Band structure of PN Junction, Quantitative Theory of PN Diode, Volt – Amp. Characteristics, Temperature Dependence, Transition and Diffusion Capacitance of PN Junction, Zener and Avalanche Breakdowns, **Diode Rectifiers:** Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Ripple Factor and Regulation Characteristics

UNIT - 4

Bipolar Junction Transistor: NPN and PNP junction Transistor, Characteristics of Current Flow across the Base Regions, Minority and Majority Carrier Profiles, CB, CE and CC Configurations and their Input and Output Characteristics. Comparison of CE, CB and CC Configurations. Junction Biasing for Saturation, Cutoff and Active Region, and Parameters and the relation between them. as an Amplifier, h – parameter model, **JFET:** JFET and its characteristics, Pinch off Voltage, Drain Saturation Current, JFET biasing, Small signal models of FET.

Text Books*:*

1. Basic Electrical Technology B.L. Thereja, A. K . Thereja
2. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias, McGraw Hill.
3. Electronic Devices and Circuits, Nashalky.

References*:*

1. Electronic Devices and Circuits 2nd Edition, B. V. Rao and K. Raja Rajeswari, Pearson Education

Course Code &Title: PCC-ME402 THERMAL ENGINEERING
Semester & Year of study: IV & 2020-2021
Course Index: C402

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C402.1	To familiarize the student with the various engine systems along with their function and necessity. To make the student learn and understand the reasons and affects of various losses that occurs in the actual engine operation.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C402.1	Classify various types of I.C. Engines and Cycles of operation.
C402.2	Express the effect of various operating variables on engine performance
C402.3	Discuss fuel metering and fuel supply systems for different types of engines
C402.4	Distinguish normal and abnormal combustion phenomena in SI and CI engines

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PCC-ME402: THERMAL ENGINEERING

Theory: 3Hrs/ Week **Credits: 3**
Int Marks: 25 **Ext Marks: 75**

UNIT – I

Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blowdown-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

I.C. ENGINES : Classification - Working principles, Valve and Port Timing Diagrams, - Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication, principle of wankle engine, principles of supercharging and turbo charging**.**

UNIT – II

Combustion in S.I. Engines : Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Types of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.

Combustion in C.I. Engines : Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

UNIT – III

Measurement, Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

UNIT IV

COMPRESSORS – Classification –positive displacement and roto dynamic machinery – Power producing and power absorbing machines, fan, blower and compressor – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating: Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, undercooling, saving of work, minimum work condition for two stage compression.

Text Books:

1. I.C. Engines / V. Ganesan- TMH 2. Heat engines, Vasandani & Kumar publications Thermal

References:

1. Thermal Engineering / RK Rajput/ Lakshmi Publications
2. IC Engines – M.L.Mathur &R.P.Sharma – Dhanpath Rai & Sons.
3. I.C.Engines–AppliedThermosciences–C.R.Ferguson&A.T.Kirkpatrick-2ndEdition-Wiley Publ
4. I.C. Engines - J.B.Heywood /McGrawHIll.
4. Thermal Engineering – R.S.Khurmi & J.S.Gupta- S.chand Publ
5. Thermal Engineering / PL Ballaney, Khanna Publishers

Course Code &Title: PCC-ME403 PRODUCTION TECHNOLOGY
Semester & Year of study: IV & 2020-2021
Course Index: C403

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C403.1	To impart basic knowledge and understanding about the primary manufacturing processes such as casting, joining, bulk forming, sheet metal forming and powder metallurgy and their relevance in current manufacturing industry; To introduce Processing methods of plastics.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C403.1	Design patterns, Gating, runner and riser systems
C403.2	Select a suitable casting process based on the component
C403.3	Learn various arc and solid state welding processes and select a suitable process based on the application and requirements
C403.4	Understand various bulk deformation processes
	Understand various sheet metal forming and processing of plastics

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PCC-ME403: PRODUCTION TECHNOLOGY

Theory: 3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks: 75**

UNIT – I

CASTING: Steps involved in making a casting – Advantage of casting and its applications. – Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems

Methods of melting and types of furnaces, Solidification of castings, Solidification of pure metals and alloys, short & long freezing range alloys. Risers – Types, function and design, casting design considerations, Basic principles and applications of Centrifugal casting, Die casting and Investment casting.

UNIT – II

Formability of metals: Cold and hot working; Rolling; Types; Roll size; Stretch forming, metal spinning, embossing and coining; Peening; Sheet metal forming operations; Presses; Die design.

UNIT – III

Forging materials: Forging processes; Forging techniques; Forging presses; Forging pressure distribution and forging force; Automation of forging; Swaging; Drawing; Extrusion; High energy rate forming.

UNIT – IV

Weld ability: Welding metallurgy; Principles and processes of arc welding (SMAW, GTAW, GMAW, FCAW, PAW, SAW); Welding equipment; Weld positioners and fixtures; Oxyacetylene welding; Flame cutting; Brazing and soldering; Principle of resistance welding; Types of resistance welds; Seam welding; Projection welding; Resistance butt welding; Solid state welding; Weld inspection and testing.

Text Books:

1. Manufacturing Processes for Engineering Materials - Kalpakjain S and Steven R Schmid- Pearson Publ , 5th Edn.
2. Manufacturing Technology -Vol I- P.N. Rao- TMH

References:

1. Manufacturing Science – A.Ghosh & A.K.Malik – East West Press Pvt. Ltd
2. Process and materials of manufacture- Lindberg- PHI
3. Production Technology- R.K. Jain- Khanna
4. Production Technology-P C Sharma-S. Chand

Course Code &Title: ESC-ME404 MACHINE DRAWING
Semester & Year of study: IV & 2020-2021
Course Index: C404

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C404.1	The student will acquire knowledge of fastening arrangements such as welding, riveting the different styles of attachment for shaft. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C404.1	To develop the technical skills necessary to generate an engineering drawing and an engineering assembly using a modern CAD system.
C404.2	To introduce the elements of engineering communications; including graphical representation of Machines end its elements.
C404.3	To model simple assembly drawings and prepare detailed part drawings with geometric dimensioning and tolerance

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II BTech (ME) IV Semester (2019-20 AB)

ESC-ME404: MACHINE DRAWING

Theory: 3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

SYLLABUS:

Part-A

Screw threads and Screw Fastenings using standard Empirical formulae. Riveted joints,

Keys, Cotter-joints, Pin-joints.

Shaft couplings: Box and split muff couplings, Flanged, Flexible, Universal and Oldham couplings, Shaft bearings, Brackets and Hangers, Pipe joints.

Orthogonal views and Sectional views of machine parts.

Part-B

Assembly drawing of various engine components and machine tool components.

Text Books:

1. Machine Drawing, by N.D.Bhatt, Charotal Publishing House.
2. Engineering Drawing, by A.C.Parkinson, Wheeler Publishing.

Reference:

1. Machine Drawing by K.L Narayan, P. Kannaiah and K. Venkata Reddy, New Age.

Course Code &Title: HSMC-ME405 MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS
Semester & Year of study: IV & 2020-2021
Course Index: C405

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C405.1	The Learning objectives of this paper is to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting, Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
C405.2	To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
C405.3	To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation. Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital budgeting proposals.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C405.1	The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product and the knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
C405.2	One is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
C405.3	The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis and to evaluate various investment project proposals with the help of capital budgeting techniques for decision making

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HSMC-ME405: MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS

Theory: 3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

UNIT I

Introduction to Managerial Economics: Definition, Nature and Scope of Managerial Economics– Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting (survey methods, statistical methods, expert opinion method, test marketing, controlled experiments, judgmental approach to demand forecasting)

UNIT II

Theory of Production and Cost Analysis: Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts, Opportunity cost, Fixed vs. Variable costs, Explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems)- Managerial Significance and limitations of BEA.

UNIT III

Markets structures and Pricing Strategies: Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly. Objectives and Policies of Pricing- Methods of Pricing:
Business and New Economic Environment: Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post-liberalization scenario.

UNIT IV

Financial Accounting: Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts. Financial Analysis through ratios: Computation, Analysis and Interpretation of Liquidity Ratios. (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), Capital structure Ratios (Debt-Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

TEXT BOOKS:

1. Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.
2. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2007.

REFERENCES:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
2. Suma Damodaran, Managerial Economics, Oxford University Press.
3. Lipsey & Chrystel, Economics, Oxford University Press.

Course Code &Title: LC-ME406 BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB
Semester & Year of study: IV & 2020-2021
Course Index: C406

Course Objectives:
The learning objectives of this course are:

Course Objectives
To learn network theorems to analyze the electrical network.
To learn determine first order RC/RL networks of periodic non- sinusoidal waveforms.
To learn RLC circuits and understand resonant frequency and Q-factor.
To learn describe the performance of dc shunt machine.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C406.1	Able to apply network theorems to analyze the electrical network.
C406.2	Able to determine first order RC/RL networks of periodic non- sinusoidal waveforms.
C406.3	Able to analyse RLC circuits and understand resonant frequency and Q-factor.
C406.4	Able to describe the performance of dc shunt machine.
C406.4	Able to investigate the performance of 1-phase transformer.

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LC-ME406: BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB

Lab : 3 Hrs/week **Credits : 1.5**
Int Marks : 50 **Ext Marks : 50**

Section A: Electrical Engineering:

1. Swinburne's test on D.C. Shunt machine (predetermination of efficiency of a given D.C.shunt machine working as motor and generator).
2. OC and SC tests on single phase transformer (predetermination of efficiency and regulation at given power factors).
3. Brake test on 3-phase Induction motor (determination of performancecharacteristics)
4. Regulation of alternator by Synchronous impedance method.
5. Speed control of D.C. Shunt motor by a) Armature Voltage control b) Field flux control method
6. Brake test on D.C. Shunt Motor.

Section B: Electronics Engineering:

1. Draw the VI Characteristics of PN Diode
2. Draw the characteristics of Zener Diode
3. Halfwave Rectifier with and Without Filter
4. Fullwave Rectifier with and Without Filter
5. Draw the VI characteristics of CE, CB, CC Configurations
6. Draw the Drain characteristics of JFET

Course Code &Title: LC-ME407 THERMAL ENGINEERING LAB
Semester & Year of study: IV & 2020-2021
Course Index: C407

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C407.1	To provide hands on experience in operating various types of internal combustion engines and understands their functioning and performance

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C407.1	To understand the performance test on variable compression ratio engines and reciprocating air compressor unit.

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LC-ME407: THERMAL ENGINEERING LAB

Lab: 3 Hrs /Week **Credits: 1.5**
Int Marks: 50 **Ext Marks: 50**

List of Experiments:

1. I.C. Engines valve / port timing diagrams.
2. Testing of Fuels – Viscosity, flash point/fire point, carbon residue, calorific value.
3. I.C. Engines performance test and Exhaust emission measurements (4 -stroke diesel engine)
4. I.C. Engines performance test and Exhaust emission measurements (2-stroke petrol engine)
5. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine.
6. Determination of FP by retardation and motoring test on IC engine.
7. I.C. Engines heat balance at different loads and show the heat distribution curve.
8. Economical speed test of an IC engine.
9. Performance test on variable compression ratio engines.
10. Performance test on reciprocating air compressor unit.
11. Dis-assembly / assembly of different parts of two wheelers. 3 wheelers & 4 wheelers. Tractor & Heavy duty engines covering 2-stroke and 4 stroke, SI and CI engines.
12. Study of boilers, mountings and accessories.

COURSE CODE &TITLE: LC-ME408 PRODUCTION TECHNOLOGY LAB
SEMESTER & YEAR OF STUDY: IV & 2020-2021
COURSE INDEX: C408

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C408.1	Design and manufacture of simple patterns
C408.2	Sand testing
C408.3	Arc welding, gas welding and resistance welding equipment for the fabrication of welded joints
C408.4	Pipe bending and injection molding equipment

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C408.1	To apply some of the manufactures process directly in the industry for preparation of complicated jobs.
C408.2	At the end of the lab learn preparation of various jobs using various manufacturing process
C408.3	The student will be trained to implement similar features in preparation of jobs can be extended to implement in the preparation of complicated jobs

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II BTech (ME) IV Semester (2019-20 AB)
LC-ME408: PRODUCTION TECHNOLOGY LAB

Lab: 3 Hrs/Week **Credits: 1.5**
Int Marks: 50 **Ext Marks: 50**

List of Experiments

1. Metal Casting
2. Pattern design and making.
3. Mould preparation, Melting and Casting
4. Welding
5. Gas welding
6. Manual metal arc welding - Lap & Butt Joints
7. Metal Forming and Powder Metallurgy
8. Blanking & Piercing operations and study of simple, compound and progressive dies.
9. Basic powder compaction and sintering
10. Processing of Plastics
11. Injection Moulding
12. Blow Moulding

Semester V (Third year) Curriculum

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
		Ext	Int		L	T	P	
PCC-ME501	Dynamics of Machinery	75	25	100	3	0	0	3
PCC-ME502	Design of Machine Members-I	75	25	100	3	0	0	3
PCC-ME503	Metal Cutting & Machine Tools	75	25	100	3	0	0	3
PEC-ME504	Professional Elective-I 1. Power plant engineering 2. Automobile Engineering 3. Theory of Elasticity & Plasticity	75	25	100	3	0	0	3
OEC-ME505	Open Elective-I 1.Nano-Technology 2. Robotics 3. Artificial Intelligence & Machine Learning	75	25	100	3	0	0	3
LC-ME506	Dynamics of Machinery Lab	50	50	100	0	0	3	1.5
LC-ME507	Machine Tools Lab	50	50	100	0	0	3	1.5
MC-ME508	Constitution of India	75	25	100	2	0	0	0
MC-ME509	Skill oriented course	--	50	50	1	0	2	2
Summer Internship 2 Months (Mandatory) after second year(to be evaluated during V semester					0	0	0	1.5
	Total Credits							21.5

COURSE CODE &TITLE: PCC-ME501 DYNAMICS OF MACHINERY
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C501

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C501.1	To equip the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations.
C501.2	Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.
C501.3	Develop understanding of vibrations and its significance on engineering design
C501.4	Develop understanding of dynamic balancing, flywheel analysis, gyroscopic forces and moments

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C501.1	Analyze stabilization of sea vehicles, aircrafts and automobile vehicles
C501.2	Compute frictional losses, torque transmission of mechanical systems.
C501.3	Analyze dynamic force analysis of slider crank mechanism and design of flywheel.
C501.4	Understand how to determine the natural frequencies of continuous systems starting from the general equation of displacement
C501.5	Understand balancing of reciprocating and rotary masses.

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III BTech (ME) V Semester (2019-20 AB)

PCC-ME501: DYNAMICS OF MACHINERY

Theory:3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

UNIT – I

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles suchas motor car, motor cycle, aero planes and ships, static and dynamic force analysis of planar mechanisms, (Demonstration of models in video show).

FRICTION: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, friction circle and friction axis: lubricated surfaces, boundary friction, film lubrication.

UNIT – II

CLUTCHES: Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission.

UNIT – III

TURNING MOMENT DIAGRAMS: Dynamic force analysis of slider crank mechanism, inertia torque, angular velocity and acceleration of connecting rod, crank effort and turning moment diagrams – fluctuation of energy – fly wheels and their design.

GOVERNERS: Watt, porter and proell governors, spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms and hunting.

UNIT – IV

BALANCING: Balancing of rotating masses single and multiple – single and different planes use analytical and graphical methods. Primary, secondary, and higher balancing of reciprocating masses. analytical and graphical methods, unbalanced forces and couples – examination of "V" multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

Text Books :

1. Theory of Machines / S.S Rattan/ Mc. Graw Hill
2. Mechanism and machine theory /Ashok G. Ambedkar/PHI Publications.

References :

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
2. Theory of Machines / Shigley / MGH
3. Theory of Machines / Thomas Bevan / CBS Publishers
4. Theory of machines / Khurmi/S.Chand.

COURSE CODE &TITLE: PCC-ME502 DESIGN OF MACHINE MEMBERS-I
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C502

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C502.1	This course gives the insight of slider and roller bearings and the life prediction.
C502.2	Learn to design I.C engine parts
C502.3	Design the mechanical systems for power transmission elements such as gears, belts, ropes, chains, keys and levers.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C502.1	The student will able to select the suitable bearing based on the application of the loads and predict the life of the bearing
C502.2	Design power transmission elements such as gears, belts, chains, pulleys, ropes, levers and power screws.
C502.3	Design of IC Engines parts.

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III BTech (ME) V Semester (2019-20 AB)
PCC-ME502: DESIGN OF MACHINE MEMBERS-I

Theory:3Hrs/ Week **Credits :3**
Int Marks: 25 **Ext Marks :75**

UNIT – I

Bearings: Classification of bearings- applications, types of journal bearings – lubrication – bearing modulus – full and partial bearings – clearance ratio – heat dissipation of bearings, bearing materials – journal bearing design – ball and roller bearings – static loading of ball & roller bearings, bearing life.

UNIT – II

Engine Parts: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – cranks and crank shafts, strength and proportions of over hung and center cranks – crank pins, crank shafts.

Pistons, forces acting on piston – construction design and proportions of piston, cylinder, cylinder liners,

UNIT – III

Design of curved beams: introduction, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and t-section, design of crane hooks, c –clamps.

Power Transmissions Systems, Pulleys: Transmission of power by belt and rope drives, transmission efficiencies, belts – flat and v types – ropes - pulleys for belt and rope drives, materials, chain drives

Design Of Power Screws: Design of screw, square ACME, buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

UNIT – IV

Spur & Helical Gear Drives: Spur gears- helical gears – load concentration factor – dynamic load factor, surface compressive strength – bending strength – design analysis of spur gears

– estimation of centre distance, module and face width, check for plastic deformation, check for dynamic and wear considerations.

Machine Tool Elements: Levers and brackets: design of levers – hand levers-foot lever – cranked lever – lever of a lever loaded safety valve- rocker arm straight – angular- design of a crank pin – brackets- hangers- wall boxes.

Wire Ropes: Construction, Designation, Stresses in wire ropes, rope sheaves and drums.

*Note: Design data book is permitted for examination

Text Books:

1. Machine Design/V.Bandari/TMH Publishers
2. Machine Design/ NC Pandya & CS Shaw/ Charotar publishers
3. Design data book.

References:

1. Machine Design: An integrated Approach / R.L. Norton / Pearson Education
2. Mech. Engg. Design / JE Shigley/Tata McGraw Hill education.
3.Design of machine elements- spots/Pearson Publications
4. Machine Design-Norton/Pearson Publications

COURSE CODE &TITLE: PCC-ME503 METAL CUTTING & MACHINE TOOLS
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C503

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C503.1	The course provides students with fundamental knowledge and principles in material removal processes.
C503.2	In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, Computer Numerical Control etc
C503.3	To demonstrate the fundamentals of machining processes and machine tools.
C503.4	To develop knowledge and importance of metal cutting parameters.
C503.5	To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
C503.6	To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C503.1	Apply cutting mechanics to metal machining based on cutting force and power consumption.
C503.2	Operate lathe, milling machines, drill press, grinding machines, etc.
C503.3	Select cutting tool materials and tool geometries for different metals.
C503.4	Select appropriate machining processes and conditions for different metals.
C503.5	Learn machine tool structures and machining economics
C503.6	Write simple CNC programs and conduct CNC machining

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
III BTech (ME) V Semester (2019-20 AB)

PCC-ME503: METAL CUTTING & MACHINE TOOLS

Theory: 3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

UNIT – I

FUNDAMENTAL OF MACHINING:

Elementary treatment of metal cutting theory – element of cutting process – geometry of single point cutting tool, tool angles, chip formation and types of chips – built up edge and its effects, chip breakers, mechanics of orthogonal cutting –Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, tool wear, machinability, economics of machining, coolants, tool materials and properties.

UNIT – II

LATHE MACHINES:

Engine lathe – principle of working, specification of lathe – types of lathe – work holders tool holders – box tools taper turning, thread turning – for lathes and attachments, constructional features of speed gear box and feed gear box. Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – single spindle and multi-spindle automatic lathes – tool layout and cam design for automats.

UNIT – III

SHAPING, SLOTTING AND PLANNING MACHINES: Principles of working – principal parts – specifications, operations performed, machining time calculations.

DRILLING & BORING MACHINES: Principles of working, specifications, types, operations performed – tool holding devices – t
wist drill – Boring Machines – fine Boring Machines – jig boring machine, deep hole Drilling Machine.

MILLING MACHINES: Principles of working – specifications – classification of Milling Machines – principal features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters, geometry of milling cutters – methods of indexing, accessories to milling machines.

UNIT –IV

FINISHING PROCESSES: Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations, comparison to grinding.

JIGS & FIXTURES: Principles of design of jigs and fixtures and uses, classification of jigs & fixtures, principles of location and clamping, types of clamping & work holding devices, typical examples of jigs and fixtures.

Text Books:

1. Manufacturing Processes / JP Kaushish/ PHI Publishers-2nd Edition
2. Manufacturing Technology Vol-II/P.N Rao/Tata McGraw Hill

References:

1. Metal cutting and machine tools /Geoffrey Boothroyd, Winston A.Knight/ Taylor & Francis
2. Production Technology / H.M.T. Hand Book (Hindustan Machine Tools.
3. Production Engineering/K.C Jain & A.K Chitaley/PHI Publishers

COURSE CODE &TITLE:PEC-ME504A POWER PLANT ENGINEERING (ELECTIVE-I)
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C504A

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C504A.1	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:
By the end of the course, the student will be

Course Index	Course Outcomes
C504A.1	Understanding of steam power plant systems & components
C504A.2	Understanding of Diesel Power Plant & Gas turbine power plants
C504A.3	Understanding of Hydro Electric Power Plant
C504A.4	Analyze Combined Operations of Different Power Plants
C504A.5	Analyze the measurements &control of power plant
C504A.6	Analyze Power Plant Economics& Environmental Considerations

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III BTech (ME) V Semester (2019-20 AB)

PEC-ME504A: POWER PLANT ENGINEERING (ELECTIVE-I)

Theory:3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

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 and 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, supercharging.
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.
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 – IV

Combined Operations Of Different Power Plants: Introduction, advantages of combined working, load division between power stations, storage type hydro-electric plant in combination with steam plant, run-of-river plant in combination with steam plant, pump storage plant in combination with steam or nuclear power plant, co-ordination of hydro-electric and gas turbine stations, co-ordination of hydro-electric and nuclear power stations, co-ordination of different types of power plants.
Power Plant Instrumentation And Control: Importance of measurement and instrumentation in power plant, measurement of water purity, gas analysis, O2 and CO2 measurements, measurement of smoke and dust, measurement of moisture in carbon dioxide circuit, nuclear measurements.

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

References Books:

1. Power Plant Engineering: P.K.Nag/ II Edition /TMH.
2. Power station Engineering – ElWakil / McGrawHill.

COURSE CODE &TITLE: PEC-ME504B AUTOMOBILE ENGINEERING (ELECTIVE-I)
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C504B

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C504B.1	The course imparts the principles of automobile systems and provides the salient features of safety, emission and service of automobiles.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C504B.1	Understand the different components and system
C504B.2	Understand the automobile power transmission system
C504B.3	Understand the steering and suspension system
C504B.4	Understand the breaking and electrical system
C504B.5	Understand the engine specification
C504B.6	Understand the safety system

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III BTech (ME) V Semester (2019-20 AB)

PEC-ME504B: AUTOMOBILE ENGINEERING (ELECTIVE-I)

Theory: 3Hrs/ Week **Credits :3**
Int Marks: 25 **Ext Marks :75**

UNIT – I

Introduction: Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft.

UNIT – II

Transmission System: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, gear boxes, types, sliding mesh, construct mesh, synchromesh gear boxes, epicyclic gear box, over drive torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

Steering System: Steering geometry – camber, castor, king pin rake, combined angle toein, toeout types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears– types, steering linkages.

UNIT – III

Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

Braking System: Mechanical brake system, hydraulic brake system, master cylinder, wheel cylinder tandem master cylinder requirement of brake fluid, pneumatic and vacuum brakes.

Electrical System: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT – IV

Engine Specification And Safety Systems: Introduction- engine specifications with regard to power, speed, torque, no. of cylinders and arrangement

Safety: Introduction, safety systems - seat belt, air bags, bumper, anti lock brake system (ABS), wind shield, suspension sensors, traction control, mirrors, central locking and electric windows, speed control.

Text Books:

1. Automotive Mechanics – Vol. 1 & Vol. 2 / Kirpal Singh/standard publishers
2. Automobile Engineering / William Crouse/TMH Distributors
3. Automobile Engineering/P.S Gill/S.K. Kataria& Sons/New Delhi.

References Books:

1. Automotive Engines Theory and Servicing/James D. Halderman and Chase D. Mitchell Jr.,/Pearsoneducationinc.
2. Automotive Engineering / K Newton, W.Steeds& TK Garrett/SAE
3. Automotive Mechanics : Principles and Practices/ Joseph Heitner/Van Nostrand Reinhold
4. Automobile Engineering / C Srinivasan/McGrawHill

COURSE CODE &TITLE: PEC-ME504C THEORY OF ELASTICITY & PLASTICITY (ELECTIVE-I)
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C504C

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C504C.1	To know the principal stresses and strains, octahedral stress and strains.
C504C.2	To know the stress, equations of equilibrium in differential form, compatibility equations, strain transformation.
C504C.3	To know the Investigation of Airy's stress function for simple beams.
C504C.4	Stresses in rotating discs of uniform thickness and cylinders and Prandtl's membrane analogy.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C504C.1	Ability to use mathematical knowledge to solve problem related to structural elasticity and Thermo-elasticity.
C504C.2	Understand displacement field concept, compatibility equations
C504C.3	Ability to solve 2-D problems, plane stress and plane strain concept and stress functions.
C504C.4	Solve bending of cantilever and bending of simply supported beams.
C504C.5	Understand Fourier analysis method, thick wall cylinder subjected to internal and external pressures.
C504C.6	Solve stresses in rotating discs of uniform thickness and cylinders, Torsion of circular, elliptical and triangular bars, torsion of thin open sections

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III BTech (ME) V Semester (2019-20 AB)

PEC-ME504C: THEORY OF ELASTICITY & PLASTICITY (ELECTIVE-I)

Theory:3Hrs/ Week **Credits :3**
IntMarks:25 **Ext Marks :75**

UNIT – I

Elasticity: Two dimensional stress analysis – Plane stress – Plane strain – Equations ofcompatibility – Stress function – Boundary conditions. Problem in Rectangular Coordinates – Solution by polynomials – Saint Venent's principles – Determination of displacement – Simple beam problems. Problems in Polar Coordinates – General equations in polar coordinates – Stress distribution symmetrical about axis – Strain components in polar coordinates – Simple and symmetric problems.

UNIT – II

Analysis of Stress and Strain in Three Dimensions: Principle stresses – Homogeneous deformations – Strain spherical and deviatoric stress – Hydrostatic strain. General theorems: Differential equations of equilibrium and compatibility – Displacement – Uniqueness of solution – Reciprocal theorem.

UNIT – III

Bending of Prismatic Bars: Stress function – Bending of cantilever beam – Beam of rectangular cross-section – Beams of circular cross-section.

UNIT – IV

Plasticity: Plastic deformation of metals – Structure of metals – Deformation – Creep stress relaxation of deformation – Strain rate condition of constant maximum shear stress – Condition of constant strain energy – Approximate equation of plasticity.
Methods of Solving Practical Problems: The characteristic method – Engineering method – Compression of metal under press – Theoretical and experimental data drawing.

REFERENCES:

1. Theory of Elasticity/Timoshenko S.P. and Goodier J.N./Koakusha Publishers
2. Theory of Elasticity and Plasticity/Sadhu Singh/ Khanna Publishers

COURSE CODE &TITLE: OEC-ME505A NANO-TECHNOLOGY (ELECTIVE-I)
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C505A

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C505A.1	On successful completion of the course, students should be able to: Understand the basic scientific concepts of nanoscience. Understand the properties of nano materials, characterization of materials, synthesis and fabrication. Understand the applications of nano technology in various science, engineering and technology fields.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C505A.1	Identify the essential concepts used in nanotechnology.
C505A.2	Identify the materials, properties, syntheses and fabrication, characterization and applications in various fields

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III BTech (ME) V Semester (2019-20 AB)
OEC-ME505A: NANO-TECHNOLOGY (ELECTIVE-I)

Theory:3Hrs/ Week **Credits :3**
IntMarks:25 **Ext Marks :75**

UNIT-I

INTRODUCTION:History of nano science, definition of nano meter, nano materials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes. Band structure.
PROPERTIES OF MATERIALS:Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

UNIT-II

SYNTHESIS AND FABRICATION: Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography. Requirements for realizing semiconductor nano structures, growth techniques for nano structures.

UNIT-III

CHARECTERIZATION TECHNIQUES:X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy.

UNIT-IV

CARBON NANO TECHNOLOGY: Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalling diamond films, grapheme, and applications of carbon nano tubes.

APPLICATIONS OF NANO TECHNOLOGY: Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin fins, applications of quantum dots.

TEXT BOOKS

Nano science and nano technology by M.S Ramachandra Rao, Shubra Singh, Wiley publishers.

REFERENCE BOOKS

- Introduction to Nano Technology by Charles P. Poole, Jr., Frank J.Owens, Wiley publishers.
- Nanotechnology by Jermy J Ramsden, Elsevier publishers.

COURSE CODE &TITLE: OEC-ME505B ROBOTICS (ELECTIVE-I)
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C505B

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C505B.1	To introduce the students to the basic terminologies, applications, design specifications, and mechanical design aspects both kinematics and dynamics of industrial robotics/ manipulators, sensors, actuators and image processing for robotic work cell control.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C505B.1	Understand the robot kinematics and trajectory planning.
C505B.2	Work individually and/or with an interdisciplinary team for the purpose of manipulator design for a specific need using mechanical kinematic structure along with the understanding of requirements from robotic work cell controller and its programming, for enabling robotic manipulator to work in an integrated automated industrial environment.

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III BTech (ME) V Semester (2019-20 AB)
OEC-ME505B: ROBOTICS (ELECTIVE-I)

Theory:3Hrs/ Week **Credits :3**
IntMarks:25 **Ext Marks :75**

Unit-I

Introduction: Background- Historical Development-Robot Arm kinematics and Dynamics- Manipulator Trajectory Planning and Motion Control-Robot Sensing- Robot Programming Language- Machine Intelligence.

Robot Arm kinematics: Introduction – The Direct Kinematics Problem-The Inverse Kinematics Solution.

Robot Arm Dynamics: Introduction – Lagrange-Euler Formulation- Newton-Euler Formation - Generalized D'Alemberts Equations of Motion.

Unit-II

Planning of Manipulator Trajectories: Introduction-General Considerations on Trajectory Planning- Joint Interpolated Trajectories- Planning of Manipulator Cartesian Path Trajectories.

Unit-III

Control of Robot Manipulators: Introduction – Control of the Puma Robot arm- Computed Torque Technique- Near Minimum Time Control- Variable Structure Control- Nonlinear Decoupled Feedback Control- Resolved Motion Control- Adaptive Control.

Unit-IV

Sensing: Introduction-Range Sensing-Proximity Sensing- Touch Sensors- Force and Torque Sensing.
Low-Level Vision: Introduction –Image acquisition- Illumination Techniques- Imaging Geometry- Some Basic Relationship Between Pixels – Preprocessing.
Robot Programming Languages: Introduction- Characteristics of Robot Level Languages- Characteristics of Task Level Languages.

Text Book:
1. Robotics By K.S. Fu, R.C. Gonzalez and C.S.G Le, McGraw- Hill International Editions1987.

Reference Books:
1. Industrial Robotics By M.P.Groover,Mitchell Weiss, Roger N. Nagel and N.G.Odrey, McGraw- Hill International Editions1986.
2. Robot Analysis- The Mechanics of Serial and Parallel Manipulators By Lung-Wen Tsai, Jhon Wiley and Sons,Inc

COURSE CODE &TITLE: OEC-ME505CARTIFICIAL INTELLIGENCE & MACHINE LEARNING (ELECTIVE-I)
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C505C

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C505C.1	To learn Artificial intelligent agents and Machine learning

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C505C.1	To understand Artificial intelligent agents and Machine learning .

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III BTech (ME) V Semester (2019-20 AB)
OEC-ME505C: ME505C ARTIFICIAL INTELLIGENCE & MACHINE LEARNING (ELECTIVE-I)

Theory:3Hrs/ Week **Credits :3**
IntMarks:25 **Ext Marks :75**

UNIT – I

Introduction: AI problems, history of AI intelligent agents: Agents and Environments,the concept of rationality, the nature of environments, structure of agents, problem solving agents.
Searching: uniformed search strategies, Game Playing: Adversial search, Games, minimax, algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, cutting of search.

UNIT – II

Knowledge Representation: Knowledge Representation & Reasons logical Agents, Knowledge – Based Agents, the Wumpus world, logic, propositional logic, Resolution patterns inproposional logic, Resolution, Forward & Backward Chaining.
First order logic: Inference in first order logic, propositional Vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution.

UNIT – III

Machine Learning Landscape: What Is Machine Learning, Why Use Machine Learning, Types of Machine Learning Systems,Supervised/Unsupervised Learning , Batch and Online Learning, Instance-Based Versus Model-Based Learning, Main Challenges of Machine Learning, Insufficient Quantity of Training Data, No representative Training Data, Poor-Quality Data, Irrelevant Features, Over fitting the Training Data, Under fitting the Training Data , Stepping Back, Testing and Validating

UNIT IV

Classification: Training a Binary Classifier, Performance Measures, Measuring Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall, Precision/Recall Tradeoff, The ROC Curve, Multiclass Classification, Error Analysis, Multilabel Classification, Multi output Classification.
Ensemble Learning and Random Forests: Voting Classifiers, Bagging and Pasting, Out-of-Bag Evaluation, Random Patches and Random Subspaces, Random Forests, Extra-Trees, Feature Importance, Boosting, AdaBoost, Gradient Boosting, Stacking, Exercises

TEXTBOOKS:

1. Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/ Pearson Education
2. Hands on machine-learning with scikit-learn and tensorflow. Concepts, tools and techniques to build Intelligent Systems …AurelienGeron, O'reillyPublicatons.

REFERENCES :

1. Artificial Intelligence , 2nd Edition, E.Rich and K.Knight (TMH).
2. Artificial Intelligence and Expert Systems – Patterson PHI

COURSE CODE &TITLE: LC-ME506 DYNAMICS OF MACHINERY LAB
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C506

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C506.1	Demonstrate the experimental determination of dynamic response of machine elements.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C506.1	Analysis of whirling effect on shaft.
C506.2	Analysis of frequency in beam and rotor.
C506.3	Analysis of gyroscopic effect of a rotating body.
C506.4	Analysis of static and dynamic balancing of masses for different masses systems
C506.5	Analysis of the forces acting on the governor's and force equilibrium equations.
C506.4	Analysis of gears and mechanisms and their respective motions.

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III BTech (ME) V Semester (2019-20 AB)
LC-ME506: DYNAMICS OF MACHINERY LAB

Lab: 3 Hrs/Week **Credits: 1.5**
Int Marks: 50 **Ext Marks: 50**

List of Experiments

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyze the motion of a motorized gyroscope when the couple is applied along its spin axis.
4. To determine the frequency of Un damped free vibration of an equivalent spring mass system.
5. To determine the frequency of damped force vibration of a spring mass system.
6. To study the static and dynamic balancing using rigid blocks.
7. To find the moment of inertia of a flywheel.
8. To plot follower displacement vs cam rotation for various Cam Follower systems.
9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism.
10. To find coefficient of friction between belt and pulley.
11. To study simple and compound screw jack and determine the mechanical advantage , velocity ratio and efficiency.
12. To study various types of gears- Spur, Helical, Worm and Bevel Gears

COURSE CODE &TITLE: LC-ME507 MACHINE TOOLS LAB
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C507

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C507.1	The students are required to understand the parts of various machine tools and operate them. They are required to understand the different shapes of products that can be produced on these machine tools.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C507.1	After completion of the course students will be able to: Exhibit the ability in developing sequence of machining operations required for industry. Capable of manufacturing components according to given drawings using various machine tools.

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III BTech (ME) V Semester (2019-20 AB)
LC-ME507: MACHINE TOOLS LAB

Lab: 3 Hrs/Week **Credits: 1.5**
Int Marks: 50 **Ext Marks: 50**

List of Experiments:

1. Introduction of general purpose machines -lathe, drilling machine, milling machine, shaper, planning machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on lathe machine.
4. Drilling and tapping
5. Shaping and planning
6. Slotting
7. Milling
8. Cylindrical surface grinding
9. Grinding of tool angles.

COURSE CODE &TITLE: MC-ME508 CONSTITUTION OF INDIA
SEMESTER & YEAR OF STUDY: V & 2021-22
COURSE INDEX: C508

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C508.1	To Enable the student to understand the importance of constitution
C508.2	To understand the structure of executive, legislature and judiciary
C508.3	To understand philosophy of fundamental rights and duties
C508.4	To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
C508.5	To understand the central and state relation financial and administrative

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C508.1	Understand the concept of Indian constitution
C508.2	Understand the structure of Indian government
C508.3	Understand the structure of state government
C508.4	Understand the local Administration
C508.5	Know the role of Election Commission apply knowledge

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
III BTech (ME) V Semester (2019-20 AB)
MC-ME508: CONSTITUTION OF INDIA

Lab: 2 Hrs/Week **Credits: 0**
Int Marks: 25 **Ext Marks: 75**

UNIT-I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT-III

A. **Local Administration** - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

UNIT-IV

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women .

Text Book:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H. M. Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)

References:

1. J.C. Johari, Indian Government and Politics Hans
2. J. Raj Indian Government and Politics
3. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi

Semester VI (Third year) Curriculum

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
		Ext	Int		L	T	P	
PCC-ME601	Metrology & Instrumentation	75	25	100	3	0	0	3
PCC-ME602	Heat Transfer	75	25	100	3	0	0	3
PCC-ME603	CAD/CAM	75	25	100	3	0	0	3
PEC-ME604	Professional Elective-II 1. Turbo Machinery Systems 2. Automation in Manufacturing 3. Advanced Materials	75	25	100	3	0	0	3
OEC-ME605	Open Elective-II 1. Industrial Tribology 2. Optimization Techniques 3. Mechatronics	75	25	100	3	0	0	3
LC-ME606	Metrology & Instrumentation Lab	50	50	100	0	0	3	1.5
LC-ME607	Heat Transfer Lab	50	50	100	0	0	3	1.5
LC-ME608	Simulation Lab	50	50	100	0	0	3	1.5
MC-ME609	Skill oriented course	--	50	50	1	0	2	2
	Total Credits							21.5

COURSE CODE &TITLE: PCC-ME601 METROLOGY & INSTRUMENTATION
SEMESTER & YEAR OF STUDY: VI & 2021-2022
COURSE INDEX: C601

Course Objectives:
The learning objectives of this course are:

Course Index	Course Objectives
C601.1	Inspection of engineering parts with various precision instruments.
C601.2	Concepts of tolerances, allowances and fits.
C601.3	Principles of measuring instruments and gauges and their uses.
C601.4	Spur gear and thread measurement and inspection for surface roughness
C601.5	Pressure, temperature, stress and strain measurements

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C601.1	After completion of the course students will be able to: Exhibit the ability in developing sequence of machining operations required for industry. Capable of Manufacturing components according to given drawings using various machine tools.
C601.2	Design tolerances and fits for selected product quality.
C601.3	Study the linear, angle measurement and limit gauges
C601.4	Understand concept of interferometry, comparators and optical measuring instruments
C601.5	Analyze the importance of surface roughness and gear measurement Measure various parameters such as stress, strain, pressure and temperature.

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PCC-ME601: METROLOGY & INSTRUMENTATION

Theory: 3Hrs/ Week **Credits :3**
Int Marks: 25 **Ext Marks :75**

UNIT-I

Systems of Limits and Fits: Introduction, nominal size, tolerance, limits, deviations, fits -Unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability, determistic & statistical tolerancing, selective assembly. International standard system of tolerances, selection of limits and tolerances for correct functioning.

UNIT-II

Linear Measurement: Length standards, end standards, slip gauges- calibration of the slip gauges, dial indicators, micrometers.
Measurement of Angles and Tapers: Different methods – bevel protractor, angle slip gauges- angle dekkor- spirit levels- sine bar- sine table, rollers and spheres used to measure angles and tapers.
Limit Gauges: Taylor's principles – design of go and no go gauges; plug, ring, snap, gap, taper, profile and position gauges.

UNIT-III

Optical Measuring Instruments: Tools maker's microscope and uses - autocollimators, optical projector, optical flats and their uses.
Interferometry: Interference of light, Michelson'sinterferometer,NPLflatness interferometer, and NPL gauge interferometer.
Comparators: Types - mechanical, optical, electrical and electronic, pneumatic comparators and their uses.

UNIT-IV

Surface Roughness Measurement: Differences between surface roughness and surface waviness – Numerical assessment of surface finish-CLA, Rt., R.M.S. Rz, R10 values, Method of measurement of surface finish – Profilograph, Talysurf, ISI symbols for indication of surface finish.
Gear Measurement: Nomenclature of gear tooth, tooth thickness measurement with gear tooth vernier & flange micro meter, pitch measurement, total composite error and tooth to tooth composite errors, rolling gear tester, involute profile checking.
Instrumentation: Temperature measurement- Expansion thermometers, Resistance Temperature Detectors, Thermistors, Thermocouples, radiative measurements. Pressure measurements- Manometers, Elastic transducers. Strain measurements- Resistance & semiconductor strain gauges, circuits and arrangements. Force & Torque measurements.

Text Books:

1. Engineering Metrology by R.K.Jain / Khanna Publishers
2. Engineering Metrology by Mahajan / Dhanpat Rai Publishers
3. Mechanical measurements by D.S.Kumar

Reference Books:

1. Dimensional Metrology, Connie Dotson, Cengage Learning.
2. Engineering Metrology by I.C.Gupta / Dhanpat Rai Publishers.
3. Engineering Metrology and Measurements by NV Raghavendra, L Krishna murthy, Oxford publishers.
4. Engineering Metrology by KL Narayana, Scitech publishers.
5. Mechanical and Industrial measurements by R.K.Jain

Course Code &Title: PCC-ME602 HEAT TRANSFER
Semester & Year of study: VI & 2021-2022
Course Index: C602

Course Objectives:
The learning objectives of this course are:

Course Objectives
This course is intended to impart knowledge of principles of heat transfer and analyze the heat exchange process in various modes for the evaluation of rate of heat transfer and the temperature distribution in different configurations.

Course Outcomes:
By the end of the course, the student will be

Course Index	**Course Outcomes**
C602.1	Understand modes and mechanism of heat transfer
C602.2	Analysis of one dimensional transient conduction heat Transfer
C602.3	Analysis of natural and forced convection
C602.4	Understand the heat transfer with phase change
C602.5	Analysis of heat exchangers
C602.6	Understand the radiation heat transfer characteristics

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PCC-ME602: HEAT TRANSFER

Theory: 3Hrs/ Week **Credits :3**
Int Marks: 25 **Ext Marks :75**

UNIT – I

INTRODUCTION: Modes and mechanisms of heat transfer – basic laws of heat transfer –General discussion about applications of heat transfer.

CONDUCTION HEAT TRANSFER: Fourier rate equation – general heat conduction equation in cartesian, cylindrical and Spherical coordinates.

ONE DIMENSIONAL STEADY STATE CONDUCTION HEAT TRANFER: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – critical radius of insulation.

UNIT – II

ONE DIMENSIONAL TRANSIENT CONDUCTION HEAT TRANSFER: Systems with negligible internal resistance – significance of biot and fourier numbers - chart solutions of transient conduction systems.

CONVECTIVE HEAT TRANSFER: Classification of convective heat transfer – dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem for forced and free convection, application for developing semi – empirical non- dimensional correlation for convective heat transfer – Significance of non dimensional numbers – concepts of continuity, momentum and Energy Equations.

UNIT –III

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EXTERNAL FLOWS: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -flat plates and cylinders.

INTERNAL FLOWS: Concepts about hydrodynamic and thermal entry lengths – division of internal flow based on this –use of empirical relations for horizontal pipe flow and annulus flow.

FREE CONVECTION: Development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for vertical plates and pipes.

UNIT IV

HEAT TRANSFER WITH PHASE CHANGE

BOILING: Pool boiling – regimes- calculations on 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.

RADIATION 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 grey bodies – radiation shields – electrical analogy for radiation networks.

Text Books:

1. Heat Transfer /P.K.Nag/ TMH
2. Principles of Heat Transfer /Frank Kreith, RM Manglik & MS Bohn/Cengage learning publishers

References Books:

1. Heat and Mass Transfer /Arora and Domkundwar/Dhanpatrai & sons
2. Fundamentals of Engg. Heat and Mass Transfer / R.C.Sachdeva / New Age International
3. Heat and Mass Transfer /Cengel/McGraw Hill.

Course Code &Title: PCC-ME603 CAD/CAM
Semester & Year of study: VI & 2021-2022
Course Index: C603

Course Objectives:
The learning objectives of this course are:

Course Objectives
Understand the basic fundamentals of computer aided design and manufacturing.
To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc.
To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication.
To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control.
To learn the overall configuration and elements of computer integrated manufacturing systems.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C603.1	Understand the basic operation of a computing system
C603.2	Describe the mathematical basis in the technique of representation of geometric entities including points, lines, and parametric curves, surfaces and solid, and the technique of transformation of geometric entities using transformation matrix.
C603.3	Understand the concepts of numerical control machines and write manual part programs and other computer languages for part programming.
C603.4	Describe the use of GT and CAPP for the product development

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PCC-ME603: CAD/CAM

Theory: 3Hrs/ Week **Credits :3**
Int Marks: 25 **Ext Marks :75**

UNIT – I

Computers in industrial manufacturing, product cycle, CAD / CAM Hardware, basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices.

Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT – II

Geometric Modeling: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

Part Programming for NC Machines: NC, NC modes, NC Elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming.
Direct Numerical Control, Adaptive Control. NC Part Programming

UNIT – III

Group Technology: Part family, coding and classification, production flow analysis, types and advantages. Computer aided processes planning – importance, types.

Computer Aided Quality Control: Terminology used in quality control, use of computers in Quality control. Inspection methods- contact and noncontact types, computer aided testing, integration of CAQC with CAD/CAM.

UNIT – IV

Computer Integrated Manufacturing Systems: Types of manufacturing systems, machine tools and related equipment, material handling systems, material requirement planning, computer control systems, human labor in manufacturing systems, CIMS benefits. Recent trends in manufacturing, digital manufacturing, types and applications.

Text Books:

1. CAD / CAM / CAE E Zimmers & M.Groover/Pearson Education
2. Automation, Production systems & Computer integrated Manufacturing/ Groover/P.E

References Books:

1. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH.
2. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson.
3. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson.
4. Product manufacturing and cost estimation using CAD/CAE/ Kuang Hua Chang, Elsevier Publishers.

Course Code &Title: PEC-ME604A TURBO MACHINERY SYSTEMS
Semester & Year of study: VI & 2021-2022
Course Index: C604A

Course Objectives:
The learning objectives of this course are:

Course Objectives
To make students learn about different types of compressors, gas turbines and rockets to calculate power and efficiency of reciprocating compressors.
To make students learn mechanical details, and to calculate power and efficiency of rotary compressors

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C604A.1	Understanding the Thermodynamics of air compressors
C604A.2	Analyzing the working and the performance of compressors
C604A.3	Understanding the thermodynamics of gas Turbines
C604A.4	Analyzing the working and the performance of Gas turbines
C604A.5	Analyzing the jet propulsion engines and the performance parameters
C604A.6	Analyzing the Rocket propulsion engines and the performance parameter

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PEC-ME604A: **TURBO MACHINERY SYSTEMS (Elective-II)**

Theory: 3Hrs/ Week **Credits :3**
Int Marks: 25 **Ext Marks :75**

UNIT-I

Compressors: Classification –positive displacement and roto dynamic machinery – Power producing and power absorbing machines, fan, blower and compressor – positive displacement and dynamic types –reciprocating and rotary types.

Reciprocating: Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, under cooling, saving of work, minimum work condition for two stage compression.

UNIT-II

Rotary (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor –mechanical details and principle of working – efficiency considerations.

Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations –Polytropic efficiency.

UNIT-III

Gas Turbines: Simple gas turbine plant – ideal cycle, essential components – parameters of performance –actual cycle – regeneration, inter cooling and reheating –closed and semi-closed cycles.
– merits and demerits, types of combustion chambers.

Jet Propulsion: Introduction to Gas Dynamics: control volume and system approaches acoustic waves and sonic velocity – mach number types of jet engines - energy flow through jet engines, thrust, thrust power and propulsive efficiency turbojet components-diffuser, compressor, combustion chamber, turbines, exhaust systems.

UNIT-IV

Performance of Turbo Propeller Engines: ramjet and pulsejet, scramjet engines. Rocket propulsion – rocket engines, Basic theory of equations - thrust equation effective jet velocity – specific impulse - rocket engine performance - solid and liquid propellant rockets - comparison of various propulsion systems.

Text Books:

1. Thermal Engineering – R.S.Khurmi & J.S.Gupta- S.chandPubl
2. Gas Turbines /V.Ganesan /TMH
3. Fundamental of Gas dynamics-2nd edition/ M J Zucker/ Wileypublishers
4. Fundamentals of compressible flow with aircraft and rocket propulsion/S. M. Yahya/New Age international Publishers

References Books:

1. Thermal Engineering / RK Rajput/ Lakshmi Publications
2. Gas Turbines and Propulsive Systems /P.Khajuria&S.P.Dubey /Dhanpatrai
3. Aircraft & Missile propulsion /MJ Zucrow/Wiley

Course Code &Title: PEC-ME604B AUTOMATION IN MANUFACTURING
Semester & Year of study: VI & 2021-2022
Course Index: C604B

Course Objectives:
The learning objectives of this course are:

Course Objectives
To study the types and strategies and various components in Automated Systems.
To understand the automated flow lines, line balancing, material storage and retrieval and inspection

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C604B.1	Understand strategies of automation, pneumatic and hydraulic components.
C604B.2	Understand the different automated material handling techniques and methods of part transport, transfer mechanism.
C604B.3	Solve the line balancing problems in the various flow line systems with and Without usage of buffer storage.
C604B.4	Understand the storage and retrieval systems and automated inspection systems.
C604B.5	Apply adaptive control principles and implementation
C604B.6	Analyze automated inspection methodologies.

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III BTech (ME) VI Semester (2019-20 AB)
PEC-ME604B: AUTOMATION IN MANUFACTURING (Elective-II)

Theory: 3Hrs/ Week **Credits: 3**
Int Marks: 25 **Ext Marks: 75**

UNIT-I

Introduction: Types and strategies of automation, pneumatic and hydraulic components, circuits, automation in machine tools, mechanical feeding and tool changing and machine tool control.

UNIT – II

Automated Flow Lines: Methods of part transport, transfer mechanism, buffer storage, control function, design and fabrication considerations. Analysis of automated flow lines, General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT – III

Assembly System And Line Balancing: Assembly process and systems, assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.
Automated Material Handling And Storage Systems: Types of equipment, functions, analysis and design of material handling systems, conveyor systems, and automated guided vehicle systems.
Automated storage and retrieval systems: work in process storage, interfacing handling and storage with manufacturing.

UNIT –I V

Adaptive Control Systems: Introduction, adaptive control with optimization, adaptive control with constraints, application of adaptive control in machining operations. Consideration of various parameters such as cutting force, temperatures, vibration and acoustic emission in the adaptive controls systems.
Automated Inspection: Fundamentals, types of inspection methods and equipment, Coordinate Measuring Machines.

Text Books:

1.Automation, Production Systems and Computer Integrated Manufacturing : M.P. Groover./ PE/PHI.

References Books:

1. Computer Control of Manufacturing Systems by Yoram Coren.
2. CAD / CAM/ CIM by Radhakrishnan.
3. Automation by W. Buekinsham.

Course Code &Title: PEC-ME604C ADVANCED MATERIALS
Semester & Year of study: VI & 2021-2022
Course Index: C604C

Course Objectives:
The learning objectives of this course are:

Course Objectives
The objective for this course is to understand the mechanics of different materials. This understanding will include concepts such as anisotropic material behaviour, constituent properties and manufacturing processes of different composites. Suitability of smart and nano materials for engineering applications.

Course Outcomes:
By the end of the course, the student will be

Course Index	**Course Outcomes**
C604C.1	Identifying scope and future of composite materials, properties, applications.
C604C.2	Understand manufacturing techniques of PMC, MMC, CMC, CCC, and GCC.
C604C.3	Understand analysis of mechanics of composites like macro and micro analysis of laminates.
C604C.4	Identifying functionally graded materials and its manufacturing techniques.

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III BTech (ME) VI Semester (2019-20 AB)
PEC-ME604C: ADVANCED MATERIALS (Elective-II)

Theory: 3Hrs/ Week **Credits: 3**
Int Marks: 25 **Ext Marks: 75**

UNIT-I

INTRODUCTION TO COMPOSITE MATERIALS: Introduction, classification: polymer matrix composites, metal matrix composites, ceramic matrix composites, carbon–carbon composites, fiber- reinforced composites and nature-made composites, and applications .

REINFORCEMENTS: Fibres- glass, silica, kevlar, carbon, boron, silicon carbide, and born carbide fibres. Polymer composites, thermoplastics, thermosetting plastics, manufacturing of PMC, MMC & CCC and their applications.

UNIT-II

MANUFACTURING METHODS: Autoclave, tape production, moulding methods, filament winding, hand layup, pultrusion, RTM.

MACROMECHANICAL ANALYSIS OF A LAMINA: Introduction, generalized Hooke's law, reduction of Hooke's law in three dimensions to two dimensions, relationship of compliance and stiffness matrix to engineering elastic constants of an orthotropic lamina, laminate-laminate code.

UNIT-III

FUNCTIONALLY GRADED MATERIALS: Types of functionally graded materials- classification different systems-preparation-properties and applications of functionally graded materials.

SHAPE MEMORY ALLOYS: Introduction-shape memory effect-classification of shape memory alloys composition-properties and applications of shape memory alloys.

UNIT-IV

NANO MATERIALS: Introduction-properties at nano scales-advantages & disadvantages- applications in comparison with bulk materials (nano – structure, wires, tubes, composites). state of art nano advanced.

Text Books:

1. Mechanics of Composite Materials / R. M. Jones/ Mc Graw Hill Company, New York
2. Material science and Technology: A comprehensive treatment/Robert W.Cahn,/VCH

References:

1. Analysis of Laminated Composite Structures / L. R. Calcote/Van Nostrand Rainfold,NY 1969
2. Analysis and performance of fibre Composites /B. D. Agarwal and L. J. Broutman /Wiley-Interscience, New York, 1980

Course Code &Title: OEC-ME605A INDUSTRIAL TRIBOLOGY
Semester & Year of study: VI & 2021-2022
Course Index: C605A

Course Objectives:
The learning objectives of this course are:

Course Objectives
To learn tribology, Friction and wear and lubricatnts and lubrication types, Film lubrication theory.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C605A.1	Students at the end of the course learn laws friction and factors affecting wear,Fluid film in simple shear, transformation hardening.

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III BTech (ME) VI Semester (2019-20 AB)
OEC-ME604A: ADVANCED MATERIALS
(OPEN Elective-II)

Theory: 3Hrs/ Week **Credits: 3**
Int Marks: 25 **Ext Marks: 75**

UNIT-I

Tribology: Introduction to tribology, bearings, historical background, economic considerations.

Friction: Introduction, causes of friction, laws of friction, sources of sliding friction, adhesion, ploughing, energy dissipation mechanisms, friction characteristics of metals, and non metals, friction of ceramic materials, rolling friction, source of rolling friction, stick slip motion, measurement of friction.

UNIT-II

Wear: Types of wear, various factors affecting wear, simple theory of sliding wear, mechanism of sliding wear of metals, abrasive wear, materials of adhesive and abrasive wear situation, corrosive wear, surface fatigue wear situations, brittle fracture wear, wear of ceramics, wear measurement.

UNIT-III

Lubricants and Lubrication Types: Importance of lubrication, Types and properties of lubricants, viscosity, viscometry, effect of pressure temperature on viscosity, testing methods, hydro dynamic lubrication, elasto-hydro dynamic lubrication, boundary lubrication, solid lubrication, hydrostatic lubrication.

Film Lubrication Theory: Fluid film in simple shear, viscous flow between very close parallel plates, shear stress variation, Reynolds equation for film lubrication, high speed unloaded journal bearings, loaded journal bearings, reaction torque on the bearings, virtual coefficient of friction, the somerfield diagram.

UNIT-IV

Surface Engineering and Materials for Bearings: Surface modifications, transformation hardening, surface fusion, thermo chemical processes, surface coatings, plating and anodizing, fusion processes, vapour phase processes, materials for rolling element bearings, materials for fluid film bearings, materials for marginally lubricated and dry bearings.

TEXT BOOKS:

1. "Principles of Tribology" by Halling j., McMillan Press Ltd.
2. "Friction and Wear of Engineering Materials" by ,I.M. Hutchings, Edwar Arnold, London ,1992.
3. "Friction and Lubrication" E.P. Bowden and Tabor., Heinemann Educational Books Ltd.,1974.

REFERENCE BOOKS

1. Tribology Hand Book", by Neale M.J., Butterworths
2. "Introduction to Tribology of Bearings", B.C. Majumdar, H. Wheeler and Company Pvt. Ltd.

Course Code &Title: OEC-ME605B OPTIMIZATION TECHNIQUES

Semester & Year of study: VI & 2021-2022
Course Index: C605B

Course Objectives:
The learning objectives of this course are:

Course Objectives
To enable the students learn the latest non-linear optimization techniques such as classical optimization methods, dynamic programming, integer programming etc. Provide basic knowledge and enough competence to formulate the optimization problems.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C605B.1	Students at the end of the course learn advanced optimization techniques to show real life problems.
C605B.2	Students can able to formulate and solve various practical optimization problems in manufacturing and service organizations.

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III BTech (ME) VI Semester (2019-20 AB)
OEC-ME605B: OPTIMIZATION TECHNIQUES
(OPEN Elective-II)

Theory: 3Hrs/ Week **Credits: 3**
Int Marks: 25 **Ext Marks: 75**

Unit-I

Introduction to Optimization: Engineering applications of optimization- Statement of an optimization problem- Classification of optimization problem- Optimization techniques.
Classical Optimization Techniques: Single variable optimization- Multivariable optimization with equality constraints- Multivariable optimization with inequality constraints.

Unit-II

Nonlinear Programming: One-Dimensional Minimization: Unimodal function- Elimination methods- Unrestricted search- Exhaustive search- Dichotomous search- Fibonacci method- Golden section method- Interpolation
methods- Quadratic interpolation method- Cubic interpolation method- direct root method.
Nonlinear Programming: Unconstrained Optimization Techniques: Direct search methods- Random search methods- Univariate method- Pattern search method- Rosenbrock's method of rotating coordinates- The simplex method- Descent methods- Gradient of function- Steepest descent method- Conjugate gradient method (Fletcher-Reeves method)- Quasi-Newton methods- Variable metric method (Davidon- Fletcher-Powell method).

Unit-III

Nonlinear Programming: Constrained Optimization Techniques: Characteristics of a constrained problem- Direct method- The complex method- Cutting plane method- Methods of feasible directions- Indirect methods- Transformation techniques- Basic approach in the penalty function method- Interior penalty function method- Convex programming problem- Exterior penalty function method.

Unit-IV

Geometric programming (G.P): Solution of an unconstrained geometric programming, differential calculus method and arithmetic method. Primal dual relationship and sufficiency conditions.Solution of a constrained geometric programming problem (G.P.P). Complimentary geometric programming(C.G.P)
Dynamic programming(D.P): Multistage decision processes. Concepts of sub optimisation, computational procedure in dynamic programming calculus method and tabular methods.Linear programming as a case of D.P., Continuous D.P.

Text Book:

1. Optimization Theory and Applications, by S.S.Rao, Wiley Eastern Limited, New Delhi.

References:

1. Optimization of Design of Machine Elements, by R.C.Johnson.
2. Computer Aided Analysis and Design of Machine Elements, by RaoV.Dukkipati, M.AnandaRao and R.B.Bhat.
3. Engineering optimization methods and applications, by G.V.Reklaits, A.Ravindarn and K.M.Ragsdell, by Publications John Wiley and Sons.

Course Code &Title: OEC-ME605C MECHATRONICS
Semester & Year of study: VI & 2021-22
Course Index: C605C

Course Objectives:
The learning objectives of this course are:

Course Objectives
To provide a clear view on key elements of mechatronics system, representation into block diagram
To accustom with various sensors, data acquisition system
To impart knowledge about microprocessor, microcontrollers used in mechatronics
To familiarize with PLC programming

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C605C.1	Identification of key elements of mechatronics system, representation into block diagram.
C605C.2	Apply knowledge of the concept of signal processing and signal conditioning for its industrial applications
C605C.3	Develop Mechatronics system according to an Industrial Applications.
C605C.4	Development of PLC Ladder programming for Industrial Applications

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III BTech (ME) VI Semester (2019-20 AB)
OEC-ME605C MECHTRONICS
(OPEN Elective-II)

Theory:3Hrs/ Week **Credits :3**
IntMarks:25

UNIT-I

Mechatronics system design: Introduction to Mechatronics: What is mechatronics, integrated design issues in mechatronics, Mechatronics key elements, the mechatronics design process, advanced approaches in mechatronics.

UNIT-II

Modeling and simulation of physical systems: Simulation and block diagrams, Analogies and impedance diagrams, Electrical systems, Mechanical translational systems, Mechanical rotational systems, electromechanical coupling, Fluid systems.

UNIT-III

Sensors and transducers: An introduction to sensors and transducers, Sensors for motion and position measurement, Force, torque and tactile sensors, Flow sensors, Temperature-sensing devices. Actuating devices: Direct current motor, Permanent magnet stepper motor, Fluid power actuation.

Signals, systems and controls: Introduction to signals, systems and controls, System representation, Linearization of nonlinear systems, Time delays.

UNIT-IV

Real time interfacing: Introduction, Elements of a data acquisition and control system, Overview of the I/O process, Installation of the I/O card and software.

Advanced applications in mechatronics: Sensors for condition monitoring, Mechatronic control in automated manufacturing, Artificial intelligence in mechatronics, Microsensors in mechatronics.

Text Book:
1. Mechatronics System Design by DevdasShetty and Richard A. Kolk, P.W.S. Publishing Company, 2001.

References:
1. Mechatronics by W. Bolton, Pearson Education, Asia, II-Edition, 2001

Course Code &Title: LC-ME606: METROLOGY & INSTRUMENTATION LAB
Semester & Year of study: VI & 2021-22
Course Index: C606

Course Objectives:
The learning objectives of this course are:

Course Objectives

The Metrology and instrumentation Laboratory course is designed for measuring and gauging instruments for inspection of precision linear, geometric forms, angular and surface finish measurements. The student can learn the measurements with and calibration of instruments. They also understand the machine tool alignment test. Instrumentation lab introduces the students with the theory and methods for conducting experimental work in the laboratory and calibration of various instruments for measuring pressure, temperature, displacement, speed, vibration etc.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C606.1	Student will become familiar with the different instruments that are available for linear, angular, roundness and roughness measurements they will be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc)
C606.2	Students will be able to select proper measuring instrument and know requirement of calibration, errors in measurement etc. They can perform accurate measurements.

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III BTech (ME) VI Semester (2019-20 AB)

LC-ME606: METROLOGY & INSTRUMENTATION LAB

Theory: 3Hrs/ Week **Credits: 1.5**
Int Marks: 50 **Ext Marks :50**

METROLOGY LAB

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier caliper for tooth thickness inspection and flange micro meter forchecking the chordal thickness of spur gear.
4. Machine tool alignment test on the lathe.
5. Machine tool alignment test on drilling machine.
6. Machine tool alignment test on milling machine.
7. Angle and taper measurements with bevel protractor, Sine bar, rollers and balls.
8. Use of spirit level in finding the straightness of a bed and flatness of a surface.
9. Thread inspection with two wire/ three wire method & tool makers microscope.
10. Surface roughness measurement with roughness measuring instrument.

INSTRUMENTATION LAB

1. Calibration of pressure gauge.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge.
5. Calibration of thermocouple.
6. Calibration of capacitive transducer.
7. Study and calibration of photo and magnetic speed pickups.
8. Calibration of resistance temperature detector.
9. Study and calibration of a rotameter.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.

Course Code &Title: LC-ME607: HEAT TRANSFER LAB
Semester & Year of study: VI & 2021-22
Course Index: C607

Course Objectives:
The learning objectives of this course are:

Course Objectives

The laboratory course is aimed to provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer including condensation & boiling for several geometries.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C607.1	The student should be able to evaluate the amount of heat exchange for plane, cylindrical & spherical geometries and should be able to compare the performance of extended surfaces and heat exchangers.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
III BTech (ME) VI Semester (2019-20 AB)

LC-ME607: HEAT TRANSFER LAB

Theory: 3Hrs/ Week **Credits 1.5**
Int Marks:50 **Ext Marks :50**

List of Experiments

1. COP of VCR System with Capillary and thermal expansion valve.
2. Determination of overall heat transfer co-efficient of a composite slab
3. Determination of heat transfer rate through a lagged pipe.
4. Determination of heat transfer rate through a concentric sphere
5. Determination of thermal conductivity of a metal rod.
6. Determination of efficiency of a pin-fin
7. Determination of heat transfer coefficient in natural and forced convection
8. Determination of effectiveness of parallel and counter flow heat exchangers.
9. Determination of emissivity of a given surface.
10. Determination of Stefan Boltzman constant.
11. Determination of heat transfer rate in drop and film wise condensation.
12. Determination of critical heat flux.
13. Determination of Thermal conductivity of liquids and gases.
14. Investigation of Lambert's cosine law.

Course Code &Title: LC-ME608: SIMULATION LAB
Semester & Year of study: VI & 2021-22
Course Index: C608

Course Objectives:
The learning objectives of this course are:

Course Objectives

To impart the fundamental knowledge on using various analytical tools like ANSYS, FLUENT, etc., for Engineering Simulation.

To know various fields of engineering where these tools can be effectively used to improve the output of a product.

To impart knowledge on how these tools are used in Industries by solving some real time problems using these tools.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C608.1	The student will be able to appreciate the utility of the tools like ANSYS or FLUENT in solving real time problems and day to day problems.
C608.2	Use of these tools for any engineering and real time applications.
C608.3	Acquire knowledge on utilizing these tools for a better project in their curriculum as well as they will be prepared to handle industry problems with confidence when it matters to use these tools in their employment.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
III BTech (ME) VI Semester (2019-20 AB)

LC-ME608: SIMULATION LAB

Theory: 3Hrs/ Week **Credits 1.5**
Int Marks:50 **Ext Marks :50**

13. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances scanning and plotting. Study of script, DXE and IGES files.

14. **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 modeling surface and assembly modeling. Study of various standard translators. Design simple components.

15. a) Determination of deflection and stresses in 2D and 3D trusses and beams.
b) Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.
c) Determination of stresses in 3D and shell structures (at least one example in each case)
d) Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
e) Steady state heat transfer Analysis of plane and Axisymmetric components.

16. a) Development of process sheets for various components based on tooling Machines.
b) Development of manufacturing and tool management systems.
c) Study of various post processors used in NC Machines.
d) Development of NC code for free form and sculptured surfaces using CAM packages.
e) Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package. Through RS 232.
f) Quality Control and inspection.

Packages to be provided to cater to drafting, modeling & analysis from the following:
Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM, Gibbs CAM, Master CAM etc.

SEMESTER-VII (FOURTH YEAR)

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
		Ext	Int		L	T	P	
PEC-ME701	Professional Elective-III 1. Finite Element Method 2. Measurements & CNC Machines 3. Advanced Foundry & Welding Technology	75	25	100	3	0	0	3
PEC-ME702	Professional Elective-IV 1. Experimental stress analysis 2. Design for Manufacture 3. Total Quality Control & Management	75	25	100	3	0	0	3
PEC-ME703	Professional Elective-V 1. Unconventional machining processes 2. Production planning & control 3. Mechanical Vibrations	75	25	100	3	0	0	3
OEC-ME704	Open Elective-III 1. Non Destructive Evaluation 2. Additive Manufacturing 3. Concurrent Engineering	75	25	100	3	0	0	3
OEC-ME705	Open Elective-IV 1. Cryogenic Engineering 2. Tool Design 3. Supply Chain Management	75	25	100	3	0	0	3
HSMC-ME706	Industrial Engineering & Management	75	25	100	3	0	0	3
MC-ME707	Skill oriented course	--	50	50	1	0	2	2
Summer Internship 2 Months (Mandatory) after third year(to be evaluated during VII semester					0	0	0	1.5
	Total Credits							21.5

Course Code &Title: PEC-ME701A FINITE ELEMENT METHOD
Semester & Year of study: VII & 2022-2023
Course Index: C701A

Course Objectives:
The learning objectives of this course are:

Course Objectives
To learn basic principles of finite element analysis procedure
To learn the theory and characteristics of finite elements that represent engineering structures
To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses performed by others
Learn to model complex geometry problems and solution techniques.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C701A.1	Understand the concepts behind vibration methods and weighted residual methods in FEM
C701A.2	Identify the application and characteristics of FEA elements such as bars, beams, and plane and isoperimetric elements
C701A.3	Identify the application and characteristics of FEA elements such as 3-D element.
C701A.4	Develop element characteristic equation procedure and generation of global stiffness equation will be applied.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
III BTech (ME) VII Semester (2019-20 AB)

PEC-ME701A: FINITE ELEMENT METHOD (Elective-III)

Theory: 3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

UNIT-I

Introduction to finite element method, stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variation and weighted residual methods, concept of potential energy.

One dimensional problem: Discretization of domain, element shapes, discretization procedures, band width, node numbering, and mesh generation, assembly of global stiffness matrix and load vector, Finite element equations, treatment of boundary conditions.

UNIT – II

Analysis of Trusses: Finite element modeling coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, and strain, support reaction calculations.

Analysis of Beams: Element stiffness matrix for Hermit beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

UNIT – III

Finite element modelling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric solids to axisymmetric loading with triangular element.

Higher order and isoperimetric elements: One dimensional quadratic element,Cubic elements in natural coordinates, two dimensional four nodeisoperimetric elements and numerical integration.

UNIT – IV

Steady state heat transfer analysis: One dimensional analysis of a fin and two dimensional steady state heat conduction problems with convection - Simplex elements only. Two dimensional analysis of thin plate, Finite Element formulation of inviscid and incompressible flow – Potential function formulation – Stream function.

Dynamic Analysis: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of Eigen values and Eigen vectors of 1-D bar element, truss and beam, free vibration analysis. Formulation analysis of a uniform shaft subjected to torsion.

Text Books:

1.The Finite Element Methods in Engineering / SS Rao / Pergamum.

References Books:

1. Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah /Pearson publishers
2. An introduction to Finite Element Method / JN Reddy / McGraw Hill
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smithand Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.
4. Finite Element Analysis: Theory and Application with Ansys, Saeed Moaveniu, Pearson Education.

Course Code &Title: PEC-ME701B: MEASUREMENTS & CNC MACHINES
Semester & Year of study: VII & 2022-2023
Course Index: C701B

Course Objectives:
The learning objectives of this course are:

Course Objectives

To learn multi spindle automatic lathe and ISO System of limits, Tool maker's microscope.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C701B.1	Student will able to understand multi spindle automatic lathe and ISO System of limits, Tool maker's microscope and NC,CNC,DNC part programming.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

PEC-ME701B: MEASUREMENTS & CNC MACHINES (Elective-III)

Theory: 3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

UNIT-I

Automatic screw lathes, Multi spindle automatic lathes, Turret lathes, Numerical control, NC operation, Coordinate system, Data input devices, Data storage, Programme editing, Machining centres, Turning centres, Vertical turning centres, Milling centres, Advantages of NC, Computers & NC, CNC, DNC, CNC part programming: Designation of co-ordinate axes for CNC machines, Functions of machine control units, Tape format, Manual part programming and computer assisted part programming (using APT language). Exercises involving simple contours and positioning.

UNIT-II

ISO system of limits, Fits and Tolerances, Interchangeability, Plain limit gauges, Measurement of screw threads, major diameters, Minor diameters and effective diameter, Pitch, Limit gauges for internal and external threads, Measurement of spur gears, pitch, profile, lead, backlash, tooth thickness.

UNIT-III

Tool maker's microscope, Straightness measurement, Slip gauges, Twisted strip mechanical comparator, Optical lever comparator, Optical projector, Electric comparator, Pneumatic comparator, Squareness testing, Optical bevel protractor, Sine bar, Angle gauges, Precision level, Autocollimeter, Angle dekkor, Optical dividing heads and rotary tables, Flatness measurement, Roundness measurement. Co-ordinate measuring machines.

UNIT-IV

Surface texture: Parameters, sampling length, Specification, Stylus instruments for surface roughness measurement. Acceptance tests on machine tools: Lathe, Milling machine, Radial drill, Laser equipment.

Text Books:

1. Process & Materials of Manufacture, R.A.Lindberg, 4th edition, Prentice-Hall of India, New Delhi.
2. A Text Book of Engineering Metrology, I.C.Gupta, Dhanpat Rai & Sons, Delhi.
3. CNC and Computer Aided Manufacturing, T.K.Kundra, P.N.Rao & N.K.Tewari, Tata McGraw- Hill Publishing Company Ltd, Delhi.

References:

1.A.S.T.M.E., Hand book of Industrial Metrology, Prentice-Hall of India, New Delhi.
2.A.S.T.M.E., Hand book of Manufacturing Engineering.
3.Manufacturing Processes & Materials for Engineers, L.E.Doyle & others, Prentice-Hall of India, New Delhi.

Course Code &Title: PEC-ME701C ADVANCED FOUNDRY & WELDING TECHNOLOGY
Semester & Year of study: VII & 2022-2023
Course Index: C701C

Course Objectives:
The learning objectives of this course are:

Course Objectives
To impart knowledge regarding various advanced welding practices in industries.
To understand the various parameters and requirements for welding processes.
To know the comparative merits and demerits of various welding processes
To learn about the joint designs adopted in different types of welding techniques.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C701C.1	Students are introduced to various advanced welding techniques which make them interested to choose a career in the field of welding.
C701C.2	Students will understand the advanced welding practices in Industries and their comparative merits and demerits.
C701C.3	Students will be able to choose the right kind of welding techniques for joining raw materials of various thicknesses.
C701C.4	Students will be able to choose appropriate welding technique suitable for joining various types of metals.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

PEC-ME701C: ADVANCED FOUNDRY & WELDING TECHNOLOGY

(Elective-III)

Theory: 3Hrs/ Week **Credits :3**
Int Marks: 25 **Ext Marks :75**

UNIT-I

Moulding: Development of metal castings- Materials for moulding- Foundry sand control- Different types of cores- Core making processes- Materials for core making- Moulding and core making machines. Recent developments in core mould making- Cold set process- Investment process- Shell moulding- Hot box method- Shaw process. Vacuum moulding- moulding for mass production.

UNIT-II

Melting and Solidification: Furnaces used in foundry for melting ferrous and nonferrous metals- principals of operation of cupola and charge calculations. Family of cast irons- Production of malleable and S.G. Irons- Methods of alloying and inoculants and their effects on the structure and properties of cast iron. Principles of Solidification: Nucleation- Crystal growth- Morphology and structure of cast metals and alloys- Pure metals- Single phase alloys and eutectics. Solidification in sand and chill moulds.

UNIT-III

Special Welding Processes: Resistance welding processes- Spot, Seam, Projection, Flash butt welding - Machine cycle for resistance welding- Parameters in resistance welding- Electrodes for resistance welding – Solid State Welding: Cold welding – Forge welding - Ultrasonic welding Diffusion welding – Radiation welding: Laser Beam Welding, Electron Beam Welding – Automatic welding systems.

UNIT-IV

Weldability of Metals: Factors influencing weldability of metals- Welding of Cast steels, Carbon steels, Stainless steels and Cast iron. Weldability of Cu and its alloys, Al and its alloys- Ti and its alloys- Mg and its alloys- Temperature changes in welding and their effects on mechanical properties. Absorption of gases by welds and their effects- Residual stresses and distortion- Heat treatment of welded parts.

Welding Joints, Weld Symbols and Joint Design principles: Types of joints – types of welds – Variants of joints and weld types - Welding symbols – principles of weld joint design and evolving of good weld designs.

Text Books:

1. Foundry Technology, by Jain P.L.
2. Welding Engineering and Technology, by R.S. Parmar.

References:

1. Foundry Engineering, by Agarwal.
2. Foundry Engineering, by Taylor F. & Others.
3. Principles of Metal Castings, by Heine & Others.

Course Code &Title: PEC-ME702A: EXPERIMENTAL STRESS ANALYSIS
Semester & Year of study: VII & 2022-2023
Course Index: C702A

Course Objectives:
The learning objectives of this course are:

Course Objectives

Objective of the course is to measure strain through various experimental methods like strain gauges, photo elasticity techniques, brittle coatings, moiré methods and birefrigerent coatings to understand the relation between the mechanics theory and experimental stress analysis to learn usage of the experimental techniques on the practical problems.

Course Index	Course Outcomes
C702A.1	Understand plane stress and plane strain conditions, 3 dimensional stress system
C702A.2	Study methods various strain measurement recording techniques and concept of photo elasticity.
C702A.3	Analyze 3 dimensional photo elasticity concept
C702A.4	Know the importance of brittle coatings
C702A.5	Understand the Moire fringe mechanism and experimental procedure

Course Code &Title: PEC-ME702A: EXPERIMENTAL STRESS ANALYSIS
Semester & Year of study: VII & 2022-2023
Course Index: C702A

Course Objectives:
The learning objectives of this course are:

Course Objectives

Objective of the course is to measure strain through various experimental methods like strain gauges, photo elasticity techniques, brittle coatings, moiré methods and birefrigerent coatings to understand the relation between the mechanics theory and experimental stress analysis to learn usage of the experimental techniques on the practical problems.

Course Index	Course Outcomes
C702A.1	Understand plane stress and plane strain conditions, 3 dimensional stress system
C702A.2	Study methods various strain measurement recording techniques and concept of photo elasticity.
C702A.3	Analyze 3 dimensional photo elasticity concept
C702A.4	Know the importance of brittle coatings
C702A.5	Understand the Moire fringe mechanism and experimental procedure

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

PEC-ME702A: EXPERIMENTAL STRESS ANALYSIS

(Elective-IV)

Theory: 3Hrs/ Week **Credits: 3**
Int Marks: 25 **Ext Marks :75**

UNIT – I

Introduction: Stress, strain, Plane stress and plane strain conditions, Compatibility conditions. Problems using plane stress and plane strain conditions, stress functions, mohrs circle for stress strain, Three-dimensional stress strain relations.

UNIT – II

Strain Measurement and Recordings: Introduction, static recording and data logging, dynamic recording at very low frequencies, dynamic recording at intermediate frequencies, dynamic recording at high frequencies, dynamic recording at very high frequencies, telemetry systems. **Photo Elasticity:** Photo elasticity – Polariscope – Plane and circularly polarized light, Bright and dark field setups, Photo elastic materials – Isochromatic fringes – Isoclinics

UNIT – III

Three Dimensional Photo Elasticity : Introduction, locking in model deformation, materials for three-dimensional photo elasticity, machining cementing and slicing three-dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear- difference method in three dimensions, applications of the Frozen-stress method, the scattered-light method.

Brittle coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, and crack detection, ceramic based brittle coatings, and resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data.

UNIT – IV

Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire- Fringes, experimental procedure and techniques.

Text Books:

1. Theory of Elasticity by Timoshenke and Goodier Jr.
2. Experimental stress analysis by Dally and Riley, Mc Graw-Hill.

References Books:

1. A treatise on Mathematical theory of Elasticity by LOVE.A.H.
2. Photo Elasticity by Frocht.
3. Experimental stress analysis, Video course by K.Ramesh / NPTEL.

Course Code &Title: PEC-ME702B: DESIGN FOR MANUFACTURING
Semester & Year of study :VII & 2022-2023
Course Index: C702B

Course Objectives:
The learning objectives of this course are:

Course Objectives
Understand the design rules and considerations with reference to various manufacturing processes.
To discusses capabilities and limitations of each manufacturing process in relation to part design and cost.
To examine DFM principles including how the design affects manufacturing cost, lean manufacturing, six sigma, etc.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C702B.1	Understand design philosophy and creativity in design
	Design components for machining.
C702B.2	Simulate the casting design for a specific product.
C702B.3	Evaluate weld joints design and the effect of thermal stresses
C702B.4	Design components for sheet metal work and understanding Keeler Goodman forging line diagram

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

PEC-ME702B: DESIGN FOR MANUFACTURING
(Elective-IV)

Theory: 3Hrs/ Week **Credit :3**
Int Marks: 25 **Ext Marks :75**

UNIT - I

Introduction: Design philosophy-steps in design process-general design rules for manufacturability- basic principles of designing for economical production - creativity in design.

UNIT - II

Machining processes: Overview of various machining processes-general design rules for machining- Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT - III

Metal Casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting, Simulation software in rolling and deformation.

Metal Joining: Appraisal of various welding processes factors in design of weldments – general design guidelines- pre and post treatment of welds- effects of thermal stresses in weld joints-design of brazed joints.

UNIT - IV

Extrusion & Sheet Metal Work: Design guide lines extruded sections- design principles for punching, blanking, bending, and deep drawing-Keeler Goodman forging line diagram – component design for blanking.

Text Books:

1. Design for manufacture, John cobert, Adisson Wesley 1995
2. Design for Manufacture by Boothroyd
3. Design for manufacture, James Bralla

Reference Book:

1. ASM Hand book Vol.20

Course Code &Title :PEC-ME702C: TOTAL QUALITY CONTROL & MANAGEMENT
Semester & Year of study :VII & 2022-2023
Course Index: C702C

Course Objectives:
The learning objectives of this course are:

Course Objectives
To learn Concept of TQM and process effectiveness.
To learn Concept Quality system.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C702C.1	Select and apply appropriate techniques in identifying customer needs, as well as the quality impact that will be used as inputs in TQM methodologies
C702C.2	Measure the cost of poor quality and process effectiveness and efficiency to track performance quality and to identify areas for improvement.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

PEC-ME702C: TOTAL QUALITY CONTROL & MANAGEMENT
(Elective-IV)

Theory: 3 Hrs/week **Credits:3**
Int Marks: 25 **Ext Marks :75**

UNIT-I

Concepts of TQM: Philosophy of TQM, Customer focus, Organization, Top management commitment, Team work, Quality philosophies of Deming, Cross by and Muller.

UNIT-II

TQM process: QC tools, Problem solving methodologies, New management tools, Work habits, Quality circles, Bench marking, Strategic quality planning.

UNIT-III

TQM systems: Quality policy deployment, Quality function deployment, Standardization, Designing for quality, Manufacturing for quality.

UNIT-IV

Quality system: Need for ISO 9000 system, Advantages, Clauses of ISO 9000, Implementation of ISO 9000, Quality costs, Quality auditing, Case studies.
Implementation of TQM: Steps, KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods, Case studies.

References:

1. Total Quality Management by Rose, J.E., Kogan Page Ltd., 1993.
2. The Essence of Total Quality Management by John Bank, PHI, 1993.
3. Beyond Total Quality Management by Greg Bounds, Lyle Yorks et al, McGraw Hill, 1994.
4. The Asian Productivity Organization by Takashi Osada, 1991.

5.KAIZEN by Masaki Imami, McGraw Hill, 1986.

Course Code &Title :PEC-ME703A: UNCONVENTIONAL MACHINING PROCESSES
Semester & Year of study :VII & 2022-2023
Course Index: C703A

Course Objectives:
The learning objectives of this course are:

Course Objectives
The course aims in identifying the classification of unconventional machining processes.
To understand the principle, mechanism of metal removal of various unconventional machining processes.
To study the various process parameters and their effect on the component machined on various unconventional machining processes.
To understand the applications of different processes.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C703A.1	Need for non-traditional machining and their classification
C703A.2	Principle of working, mechanism of ECM
C703A.3	Understand the working principle and applications of EDM
C703A.4	Analyze the process of EBM
C703A.5	Understand the working principle and applications of Plasma machining and IBM

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IV BTech (ME) VII Semester (2019-20 AB)

PEC-ME703A: UNCONVENTIONAL MACHINING PROCESSES
(Elective-IV)

Theory: 3 Hrs/week **Credits:3**
Int Marks:25 **Ext Marks: 75**

UNIT - I

Introduction: Need for non-traditional machining methods-classification of modern machining processes – considerations in process selection, applications.

Ultrasonic Machining – Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

UNIT -II

Electro-Chemical Machining: Fundamentals of electrochemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM – Simple problems for estimation of metal removal rate, fundamentals of chemical, machining, advantages and applications. Photo chemical milling process, process parameters, surface roughness, accuracy, MRR, basic limitations, advantages and applications. STEM process, process parameters, surface roughness, accuracy, MRR, basic limitations, advantages and applications.

UNIT - III

Thermal Metal Removal Processes: General principle and applications of Electric Discharge Machining, Electric Discharge Grinding and wire EDM – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface.

Electron Beam Machining, Laser Beam Machining - Basic principle and theory, mechanics of material removal, process parameters, efficiency & accuracy, applications

UNIT - IV

Plasma Machining: Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. **Ion Beam Machining:** Application of ion beam machining, metal removal mechanism, process parameters, accuracy and surface finish, MRR, limitations, advantages and applications.

Text Book:

1. Advanced machining processes/ VK Jain/ Allied publishers.

References Books:

1. Modern Machining Process / Pandey P.C. and Shah H.S. / TMH.
2. New Technology / Bhattacharya A/ the Institution of Engineers, India 1984.

Course Code &Title : **PEC-ME703B: PRODUCTION PLANNING & CONTROL**
Semester & Year of study :VII & 2022-2023
Course Index: C703B

Course Objectives:
The learning objectives of this course are:

Course Objectives

An understanding of the concepts of production and service systems.

The ability to apply principles and techniques in the design, planning and control of these systems to optimize/make best use of resources in achieving their objectives.

Identify different strategies employed in manufacturing and service industries to plan production and control inventory.

Measure the effectiveness, identify likely areas for improvement, develop and implement improved planning and control methods for production systems.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C703B.1	Explain the objectives and functions of PPC.
C703B.2	Appraise different forecasting techniques and estimate the future demand of the product.
C703B.3	Optimize the inventory parameters to minimize the total variable cost.
C703B.4	Understand the concepts of Material Requirement planning.
C703B.5	Determine optimum production schedule.
C703B.6	Illustrate the duties of dispatcher and functions of follow up and outline the role of computers in PPC

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

PEC-ME703B: PRODUCTION PLANNING & CONTROL
(Elective-IV)

Theory: 3 Hrs/week **Credits:3**
Int Marks: 25 **Ext Marks: 75**

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

UNIT-II

Inventory management : Functions of inventories – relevant inventory costs – EOQ model – Inventory control systems – ABC analysis – VED analysis
Material Requirement Planning, Bill of material, MRP II, Master Production Scheduling.

UNIT-III

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

UNIT-IV

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 – priority 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&RakeshSarin

References:

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

Course Code &Title : **PEC-ME703C: MECHANICAL VIBRATIONS**
Semester & Year of study :VII & 2022-2023
Course Index: C703C

Course Objectives:
The learning objectives of this course are:

Course Objectives
To learn Harmonically exited vibrations.
To learn Two degree and multi degree of freedom systems

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C703C.1	Understand free and forced vibrations.
C703C.2	Analyze single & two-degree of freedom systems.
C703C.3	Analyze multi degree of freedom system for forced vibrations with and without damping.
C703C.4	Solve the nonlinear vibration problems using different analytical and graphical methods.
C703C.5	Calculate unbalanced forces in rotating machinery and reciprocating engines and concept of vibration absorber.
C703C.6	Describe various condition monitoring techniques to diagonise the machine condition.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

PEC-ME703C: MECHANICAL VIBRATIONS
(Elective-IV)

Theory: 3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

UNIT-I

Harmonically Exited Vibrations:
Introduction, equations of motion, response of an undamped and damped system under harmonic excitation, response of a damped system under harmonic motion of the base, response of a damped system under rotating unbalance, forced vibration with coulomb damping.

Two Degree of Freedom Systems:
Introduction, equations of motion for forced vibration, free vibration analysis of an undamped system, torsional system, coordinate coupling and principal coordinates, forced vibration analysis.

UNIT-II

Multi degree of Freedom Systems: Introduction, modeling of continuous systems as multi degree of freedom systems, influence coefficients, potential and kinetic energy expressions in matrix form, generalized coordinates and generalized forces, using Lagrange's equation to derive equations of motion, equations of motion of undamped systems in matrix form, Eigen value problem, solution of the eigen value problem, free vibration of undamped systems, forced vibrations of undamped systems using modal analysis, forced vibration of viscously damped system.

UNIT-III

NONLINEAR VIBRATIONS:
Introduction, examples of nonlinear vibration problems, exact methods, approximate analytical methods, sub harmonic and super harmonic and super harmonic oscillations, systems with time dependent coefficients, graphical methods, stability of equilibrium states, limit cycles, chaos.

UNIT-IV

VIBRATION CONTROL:
Introduction, vibration nomograph and vibration criteria, reduction of vibration at the source, balancing of rotating shafts, balancing of reciprocating engines, control of vibration, control of natural frequencies, introduction of damping, vibration isolation, vibration absorbers.

Text Books:

1. S.S.Rao, Mechanical Vibrations, 4/e, Pearson Education Inc., 2009.
2. B.C. Nakra and K.K. Chowdary, ''Mechanical Measurements'', 2nd Edition, TMH, New Delhi, 2004.

References Books:

1. William T Thomson & Marie Dillon Dahleh, ''Theory of Vibrations with application'', 5th Edition, Pearson Education Publication, 2007.
2. Tse, Morse and Hinkel, '' Mechanical Vibrations'', Chapman and Hall, 1991.
3. Den Hartong J.P., ''Mechanical vibrations'', McGraw Hill, 1986.
4. V.P.Singh, Mechanical vibrations, 3rd edition, DhanpatRai& Sons, 2001.

Course Code &Title : **OEC-ME704A: NON DESTRUCTIVE EVALUATION**
Semester & Year of study :VII & 2022-2023
Course Index: C704A

Course Objectives:
The learning objectives of this course are:

Course Objectives
To acquire familiarity with different types of NDT techniques
To understand the basic principles underlying each NDT technique
To know the advantages and limitations of each technique
To understand the considerations for selection of appropriate NDT technique(s) for various applications
To become familiar with common types of defects arising in different types of manufactured products and the NDT method(s)

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C704A.1	Learn various NDT techniques for inspection.
C704A.2	Acquire skills needed for selection of appropriate NDT technique(s) for new inspection jobs
C704A.3	Understand Eddy Current Testing principles.
C704A.4	Acquire sound knowledge of established Radiography principle and Ultrasonic Testing
C704A.5	Understand the Industrial application of NDE Techniques
C704A.6	Understand the Industrial application of NDE Technique

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

OEC-ME704A: NON DESTRUCTIVE EVALUATION
(Elective-III)

Theory:3Hrs/ Week **Credits 3**
Int Marks:25 **Ext Marks :75**

UNIT- I

Introduction to NDET and Surface NDT Techniques Introduction to non-destructive testing and evaluation, liquid penetrant testing and magnetic particle testing. Test procedure, Effectiveness and limitations of each of these techniques.

Eddy Current Testing and Eddy current principle, Eddy Current Test System depth of penetration, eddy current. Standardization and calibration of eddy current

UNIT- II

Radiographic Testing Radiography principle, electromagnetic radiation sources, X-ray films, exposure, pentameter, radiographic imaging, inspection standards and techniques, Radiography applications, limitations and safety.

Ultrasonic Testing, probe configuration, applications and limitations. Ultrasonic transducers, inspection methods, flaw characterization technique.

UNIT -III

Introduction to infrared and thermal testing, Heat transfer active-passive techniques, Contact and non- contact thermal inspection method, Thermally quenched phosphors liquid crystals, Thermo mechanical behavior of materials, IR imaging in aerospace applications, Defects: honey combs ect.

UNIT- IV

Industrial application of NDET visual examination, Defects in materials / products and Selection of NDET Methods Study of defects in castings, welding, forgings, rolled products etc. and defects arising during service. Selection of NDET methods to evaluate them. Standards and codes.

Text Books:

1. Baldevraj, Jayakumar T., Thavasimuthu M., (2008) “Practical Non-Destructive Testing”, 3rd edition, Narosa Publishers.
2. Non-destructive test and evaluation of Materials, J Prasad, GCK Nair, TMH Publishers

Reference Books:

1. American Society for Metals, “Non-Destructive Evaluation and Quality Control”: Metals Hand Book: 1992, Vol. 17, 9th Ed, Metals Park, OH.
2. Paul E Mix, “Introduction to nondestructive testing: a training guide”, Wiley, 2nd edition New Jersey, 2005.

Course Code &Title : **OEC-ME704B: ADDITIVE MANUFACTURING**
Semester & Year of study :VII & 2022-2023
Course Index: C704B

Course Objectives:
The learning objectives of this course are:

Course Objectives

The course aims at the importance of Additive Manufacturing, classifications, models, specifications of various

Additive Manufacturing Techniques. To learn the different tools, soft-wares required and the applications of Additive Manufacturing.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C704B.1	Set up and fabricate 3D part using an additive manufacturing machine.
C704B.2	Select and use correct CAD formats in the manufacture of a 3D printed part.
C704B.3	understand the role of additive manufacturing in the design process and the implications for design
C704B.4	understand the effects of surface finish and micro structural properties on behavior for components produced using additive manufacturing

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

OEC-ME704B ADDITIVE MANUFACTURING
(Open Elective-III)

Theory:3Hrs/ Week **Credits 3**
Int Marks:25 **Ext Marks :75**

UNIT – I

INTRODUCTION: Prototyping fundamentals, historical development, fundamentals of rapid prototyping, Advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.
LIQUID-BASED RAPID PROTOTYPING SYSTEMS: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and Laser scanning, applications, advantages and disadvantages, case studies. Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT-II

SOLID-BASED RAPID PROTOTYPING SYSTEMS: Laminated object manufacturing (LOM) - models and Specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modeling (FDM) - models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT – III

POWDER BASED RAPID PROTOTYPING SYSTEMS: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Three dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT – IV

RAPID TOOLING: Introduction to rapid tooling (RT), conventional tooling Vs RT, Need for RT. rapid tooling classification: indirect rapid tooling methods: spray metal deposition, RTV epoxy tools, Ceramic tools, investment casting, spin casting, die casting, sand casting, 3D Keltool process. Direct rapid tooling: direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

Text Books:

1. Rapid prototyping: Principles and Applications /Chua C.K., Leong K.F. and LIM C.S/World Scientific Publications

References Books:

1. Rapid Manufacturing / D.T. Pham and S.S. Dimov/Springer
2. Wohlers Report 2000 /Terry T Wohlers/Wohlers Associates
3. Rapid Prototyping & Manufacturing / Paul F.Jacobs/ASME Press
4. Rapid Prototyping / Chua & Liou

Course Code &Title : **OEC-ME704C: CONCURRENT ENGINEERING**
Semester & Year of study :VII & 2022-2023
Course Index: C704C

Course Objectives:
The learning objectives of this course are:

Course Objectives
Student has to understand the concept and need for sequential engineering or Concurrent engineering and it's benefit for the modern industry.
Student has to understand the co-operation/ coordination required between the different departments like marketing, design and the latest software's available so far
The student has to know the different procedures to be followed during the design, modifications, and optimization techniques for the Design for Manufacture (DFM).
The student has to understand the importance of quality of the product and know the methods of evaluating the quality.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C704C.1	The student shall understand the product development and Background and challenges faced by modern production environment, Product life cycle.
C704C.2	Student will learn about Concurrent engineering-Definition, Objectives, Benefits & CE Implementation Process in an organization.
C704C.3	Learns Concurrent Engineering Tools & Techniques and their application in an organization.
C704C.4	Student learns about JIT - Design, development & Implementation of JIT, Project time management, Techniques of time management.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)
OEC-ME704C: CONCURRENT ENGINEERING
(Open Elective-III)

Theory: 3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

UNIT-I

Introduction: Product development objectives and product development cycle. Background and challenges faced by modern production environment, Sequential engineering process, Role of CAD/CAM in CE – Product life cycle.

UNIT- II

Concurrent Engineering: Definition need and utility, Objectives of CE, Benefits of CE, Life cycle design of products, Life cycle costs. Support for CE: Classes of support for CE activity, CE organizational, Structure CE, Team composition and duties, Computer based Support, CE Implementation Process

Concurrent Engineering Tools & Techniques – Quality function Deployment– Value function analysis – Failure Mode & Effect Analysis –

UNIT -III

Design for Manufacture & Assembly – Design for economics- Design for X – Taguchi's Robust Design, Product Data Management ,approach – Pugh process – customer Focused Design – Agile manufacturing -rapid prototyping –simulation.

UNIT -IV

Implementing CE in an organization – concurrent Engineering Teams – their roles and responsibilities Organizational functions to support CE team environment. Setting Team goals, measuring performance of team &managing a CE Team, Limitations of team.

Introduction JIT - Design, development & management for JIT – Implementation of JIT, supply product Life cycle management – Project time management – Techniques of time management. Collaborative product commerce simple case studies in CE

Text / References Books:

1. Kusiak John, Concurrent Engineering, Wiley
2. Concurrent Engineering Menon Chapman & hall
3. M.M. Anderson and L Hein, integrated Product Development, IFS Publications
4. J. Cleetus, Design for Concurrent Engineering, CE Research Centre, Morgantown
5. Prasad, Concurrent Engineering Fundamentals: Integrated Product Development, Prentice hall India
6. I. Moustapha , Concurrent Engineering in Product Design and Development , New Age International

Course Code &Title : **OEC-ME705A: CRYOGENIC ENGINEERING**
Semester & Year of study :VII & 2022-2023
Course Index: C705A

Course Objectives:
The learning objectives of this course are:

Course Objectives

To impart the knowledge of multistage refrigeration system, cascade system, liquefaction of air, properties of metals, cooling by adiabatic de magnetization and principles so as to enable the student to prepare an energy audit of any mechanical system

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C705A.1	Understand the basic concepts of Multistage refrigeration system-cascade system
C705A.2	Understand the Liquefaction of air, Hydrogen & helium
C705A.3	Evaluate the performance parameters and properties of cryogenic metals and strength
C705A.4	Understanding of the cryobiology , cryosurgery, Cry heat transfer

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IV BTech (ME) VII Semester (2019-20 AB)
OEC-ME705A: CRYOGENIC ENGINEERING
(Open Elective-IV)

Theory: 3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

UNIT-I

Introduction necessity of low temperature - Multistage Refrigeration system –Cascade system - Manufacture of dry ice-Joule Thompson coefficient.

Liquefaction of air - Linde system- Analysis- Dual pressure cycle analysis-Liquefaction of Hydrogen andHelium-problems.

UNIT-II

Application of Lower temperatures- Effects on the properties of metals-strength-Thermal properties- super conductivity-super fluidity.

UNIT-III

Applications like expansion fitting - cryobiology-cryosurgery - space research-computers underground power lines. Low temperature insulation- Reflective insulation-Evacuated powders- Rigid foams-Super insulation.

UNIT-IV

Cooling by adiabatic de-magnetization - Gas separation and cryogenic systems separation of gases- Rectifying columns-Air separating- single and double columns Air separation plant.
Storage and handling of cryogenic liquids - Dewars and other types of containers.

Text Books:

1. Cryogenic Systems, R.F. Barron, Oxford University Press **2012-13**
2. Cryogenic Research and Applications, Marshall Sitting, Von Nostrand Inc, New Jersey
3. Cryogenics Engineering Edit by B.A.Hands, Academic Press, 1986

References Books:

1. Cryogenics Engineering, R. B. Scott, Von Nostrand Inc, New Jersey, 1959
2. Cryogenics process Engineering, K.D.Timmerhaus & TM Flynn, Plenum press, 1998
3. Cryogenic Engineering – Thomas M. Flynn
4. Safety in Handling of Cryogenic Fluids, Fredrick J. Edeskutty and Watter F. Stewart Plenum Press, 1996
5. Hand Book of Cryogenic Engineering, J.G.Weisend–II, Taylor and Francis, 1998
6. Refrigeration and Air-conditioning, S.Domkundwar.

Course Code &Title : **OEC-ME705B: TOOL DESIGN**
Semester & Year of study :VII & 2022-2023
Course Index: C705B

Course Objectives:
The learning objectives of this course are:

Course Objectives
To gain the knowledge of different drives and mechanisms used in machine tools.
To gain the knowledge of design of gear boxes & feed boxes used in machine tools.
To gain the knowledge of design of structures, guide ways, spindles of machine tools.
To gain the knowledge of various control systems used in machine tools.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C705B.1	Ability enhancement for the design of various components of structures, guide ways, spindles of machine tools.
C705B.2	Ability enhancement to adopt & implement the recent trends required as per the applications.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

OEC-ME705B: TOOL DESIGN

(Open Elective-IV)

Theory: 3Hrs/ Week **Credits 3**

Int Marks: 25 **Ext Marks :75**

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.

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.

UNIT-II

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. **Tool Design for Numerically Controlled Machine Tools:** Fixture Design for Numerically Controlled Machine Tools, Cutting Tools for Numerical Control, Tool-holding Methods for Numerical Control

UNIT-IV

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 ", IvanaSuchy, McGraw Hill Book Co., 2005.
3. Production technology, HMT,Tata McGraw Hill.

Course Code &Title : **OEC-ME705C: SUPPLY CHAIN MANAGEMENT**
Semester & Year of study :VII & 2022-2023
Course Index: C705C

Course Objectives:
The learning objectives of this course are:

Course Objectives

To learn Economy and Organization of supply chain management,
Planning and managing inventories.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C705C.1	Student will able to understand Role of supply chain management and supply chain drives.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

OEC-ME705C: SUPPLY CHAIN MANAGEMENT

(Open Elective-IV)

Theory: 3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

UNIT-I

Role of supply chain management in Economy and Organization- Introduction to SCM, Evolution, Key concepts, Decisions and Importance of SCM.

Supply chain strategy and Performance Measures- Competitive supply chain strategies, CRM strategy, Supplier relationship strategy- Performance Measures (Financial, Productivity, Quality and cycle time).

UNIT-II

Supply chain drives- Introduction, Facilities, Inventory, Transportation and Information. Supply chain design- Network design and operation models.

Sourcing and Transportation- Role of sourcing, Supplier selection and contracts, Procurement process, Role of Transportation, Design options for transportation network.

UNIT-III

Planning and Managing Inventories-Introduction, cycle/safety/seasonal stock, Inventory for short life cycle products, Multi echelon inventory.

UNIT-IV

Information Technology in SCM- Role of IT, E-business and future trends.

Supply chain innovations- Introduction, Supply chain integration, Restructuring, Agile supply chains.

References:

1. Supply chain management text and cases: Janat Shah, Pearson Education, 2009.
2. Supply chain management strategy, planning and operation, Sunil Chopra, Peter Meindl, PHI.
3. Supply chain management: Chopra, Pearson Education, 2009. Business

logistics/ Supply chain management, 5/e: Ballou, Pearson Education

Course Code &Title : **HSMC-ME706: INDUSTRIAL ENGINEERING & MANAGEMENT**
Semester & Year of study :VII & 2022-2023
Course Index: C706

Course Objectives:
The learning objectives of this course are:

Course Objectives
To impart fundamental knowledge and skill sets required in the Industrial Management and Engineering profession, which include the ability to apply basic knowledge of mathematics, probability and statistics, and the domain knowledge of Industrial Management and Engineering
To produce graduates with the ability to adopt a system approach to design, develop, implement and innovate integrated systems that include people, materials, information, equipment and energy.
To enable students to understand the interactions between engineering, business, technological and environmental spheres in the modern society.
To enable students to understand their role as engineers and their impact to society at the national and global context.

Course Outcomes:
By the end of the course, the student will be

Course Index	Course Outcomes
C706.1	Design and conduct experiments, analyze, interpret data and synthesize valid conclusions.
C706.2	Design a system, component, or process, and synthesize solutions to achieve desired needs.
C706.3	Can use the techniques, skills, and modern engineering tools necessary for engineering practice. Can adopt appropriate considerations for public health and safety, cultural, societal, and environmental constraints.
C706.4	Knows about Functions work effectively within multi-disciplinary teams.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) VII Semester (2019-20 AB)

HSMC-ME706: INDUSTRIAL ENGINEERING & MANAGEMENT

Theory: 3Hrs/ Week **Credits 3**
Int Marks: 25 **Ext Marks :75**

UNIT-I

Introduction to personnel management- Functions, Motivation, Theories of motivation, Hawthrone studies, Discipline in industry, Promotion, Transfer, lay off and discharge, Labour turnover.

Industrial relations- Trade unions, Industrial disputes, Strikes, Lock-out, Picketing, Gherao, Settlement of industrial disputes, Collective bargaining, Industrial dispute act 1947 and factories act 1948.

UNIT-II

Production Planning and Control: Types of productions, Production cycle, Product design and development, Process planning, Forecasting, Loading, Scheduling, Dispatching, Routing, Progress, Control, Simple problems.

Plant Layout: Economics of plant location, Rural Vs Suburban sites, Types of layouts, Types of building, Travel chart technique, Assembly line balancing simple problems.

UNIT-III

Materials Handling- Principles, Concept of unit load, Containerization, Pelletization, Selection of material handling equipment, Applications of belt conveyors, Cranes, Forklift trucks in industry.

Plant Maintenance: Objectives and types.

Work Study: Concept of productivity, Method Study - Basic steps in method study, Process charts, Diagrams, Models and Templates, Principles of motion economy, Micro motion study, Therbligs, SIMO chart. Work Measurement - Stop watch procedure of time study, Performance rating, allowances, Work sampling, Simple problems.

UNIT-IV

Materials Management: Introduction, Purchasing, Objectives of purchasing department, Buying techniques, Purchase procedure, Stores and material control, Receipt and issue of materials, Store records. Inventory Control, EOQ model(Simple problems).

Quality Control - Control charts of variables and attributes (Use of formulae only). Single and Double sampling plans.

Text Book:

1. Industrial Engineering Management, by Dr. O. P .Khanna.

References:

1. Principles of Management by Koontz &Donnel.
2. Production and Operations Management by Everette Adam & Ronald Ebert.
3. Operations Management by John McClain & Joseph Thames.
4. Industrial Engineering and Production Management by Telsay, S. Chand& Co.

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM
IV BTech (ME) (2019-20 AB)

Semester VIII (Fourth Year)

Code	Course Title	Max Marks		Total Marks	Hours per week			Credits
Project	Project Work							14
	Total Credits							14

ADIKAVI NANNAYA UNIVERSITY

UNIVERSITY COLLEGE OF ENGINEERING

R A J A M A H E N D R A V A R A M

Department of
Mechanical
Engineering

BTech (ME)

MODEL QUESTION PAPERS

II, III & IV YEAR
(*For the admitted batch of* 2019-20)

Board of Studies
University College of Engineering

ADIKAVI NANNAYA UNIVERSITY :: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering, Civil Engineering II-I Semester

BSC-ME-301, BSC-CE-301 PROBABILITY AND STATISTICS

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) State and prove Bayes' theorem (8M)

   b) Find the moment generating function of a random variable X defined by the density function $f(x) = \begin{cases} \frac{1}{3} & -1 < x < 2 \\ 0 & elsewhere \end{cases}$ (7M)

   (OR)

   c) Out of 800 families with 5 children each, how many would you expect to have (i) 3 boys (ii) 5 girls (iii) either 2 or 3 boys (7M)

   d) There are 15 boys and 5 girls in a class. If three students are selected one after the other what is the probability that they are (1) All boys (2) 2 boys one girl (3) All girls. (8M)

2. a) Let X is the random variable with the following distribution. Find E(X), $E(X^2)$ (8M)

   b) Binomial distribution approaches poisson distribution as n ❼∞, prove this statement E $(2X+1)^2$

X	-3	6	9
P(X=x)	1/6	½	1/3

(7M)

   (OR)

   c) In a distribution exactly normal 7% of the items are under 35 and 89% are under 63. What are the mean and standard deviation of the distribution? (8M)

   d) Fit a Poisson distribution for the following data and calculate the expected frequencies, N = 200. (7M)

X	0	1	2	3	4	
F(x)	109	65	22	3	1	

3. a) Explain briefly the following : I) Point Estimation ii) Interval Estimation (7M)

   b) A lady stenographer claims that the she can take dictation at the rate of 120 words per minute. Can we reject her claim on the basis of 100 trails in which she demonstrates a mean of 116 words with a S.D of 15 words. (8M)

   (OR)

   c) Two independent samples of 8 and 7 items respectively had the following values.

Sample1	11	11	13	11	15	9	12	14
Sample2	9	11	10	13	9	8	10	-

Is the difference between the means of samples significant? (8M)

d) A manufacturer of electric bulbs claims that the percentage of defectives in his product does not exceed 6. A sample of 40 bulbs is found to contain 5 defectives would you consider the claim justified (7M)

4. a) Fit a second degree parabola to the following data using method of least squares. (8M)

X	0	1	2	3	4
Y	2	3	2.5	2.6	6.5

(b) Calculate the correlation coefficient for the following heights (inches) of fathers (x) and their sons (y): (7M)

X : 65 66 67 67 68 69 70 72

(OR)

c) Find the rank correlation coefficient for the following data (8M)

X	68	64	75	50	64	80	75	40	55	64
Y	62	58	68	45	81	60	68	48	50	70

d) Determine the constants '**a**' and '**b**' by the method of least squares such that $\mathbf{y = a}\, e^{bx}$ fit the following data (7M)

X	2	4	6	8	10
Y	4.077	11.084	30.128	81.897	222.62

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Two cards are selected at random from 10 cards numbered 1 to 10. Find the probability that the sum is even if the two cards are drawn one after the other with replacement.

b) State and prove addition theorem

c) Define continuous random variable and discrete random variable

d) Use Poisson recurrence formula to find probabilities x = 0 ,1 ,2 with mean 3

e) Explain the types of errors in sampling

f) If we can assert with 95% that the maximum error is 0.05 and P is given as 0.2. Find the size of the sample.

g) Write the normal equations of straight line by using method of least square

h) Define rank and correlation coefficient.

ADIKAVI NANNAYA UNIVERSITY :: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering II-I Semester

PCC-ME-302 Applied Thermodynamics (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) What do you understand by the ideal gas temperature scale? (7M)
   b) Explain the working of Electrical Resistance thermometer with a neat sketch (8M)

   (OR)

   c) Explain what do you understand by concept of continuum? How will you define density and pressure using this concept? (7M)
   d) A balloon is filled with air (200 kPa and 300K) such that it becomes as sphere of diameter 1m. It is then gradually heated till the pressure rises to 500 kPa. Determine the amount of work done during the process, assuming that the pressure inside the balloon is proportional to the diameter of the balloon. (8M)

2. a) Explain the Vander waals equation of state (8M)
   b) What are the uses of compression by charts? (7M)

   (OR)

   c) Explain Limitations of first law of thermodynamics. (7M)
   d) A fluid contained in a cylinder receives 150 kJ of mechanical energy by means of a paddle wheel, together with 50 kJ in the form of heat. At the same time, the piston in the cylinder moves in such a way that the pressure remains constant at 200 kN/m^2 during the fluid expansion from 2 m^3 to 5 m^3. What is the change in internal energy and in enthalpy. (8M)

3. a) What are the causes of entropy increase? (8M)
   b) How is the absolute scale independent of the working substance? (7M)

   (OR)

   c) Discuss the significance of Gibbs and Helmholtz functions. (7M)
   d) Two blocks of metal, each having a mass of 10 kg and having a specific heat of 0.4 kJ/kg.K, are at a temperature of 40^0C. A reversible refrigerator receives heat from one block and rejects heat to the other. Calculate the work required to cause a temperature difference of 100^0C between the two blocks. (8M)
   (7M)

4. Steam initially at 0.4 Mpa, 300^0C is cooled at constant volume. (a) At what temperature will the steam become saturated vapour? (b) What is the quality at 90^0C? What is the heat transferred per kg of steam in cooling from 225^0C to 90^0C (15M)

   (OR)

   a) Why cannot a throttling calorimeter measure the quality if the steam is very wet? How is the quality measured then? (8M)
   d) A steam boiler initially contains 5 m^3 of steam and 5 m^3 of water at 1 MPa. Steam is taken out at constant pressure until 4 m^3 of water is left. What is the heat transferred during the process? (7M)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) What are the causes of irreversibility?

b) State the first law for a closed system undergoing a change of state.

c) What is meant by Clausius inequality?

d) Explain the term (a) Latent heat (b) sensible heat.

e) What is meant by dry bulb depression?

f) Draw the Lenoir cycle on T-s diagram?

ADIKAVI NANNAYA UNIVERSITY :: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering II-I Semester

PCC-ME-303 Mechanics of Solids (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

PART-A

Answer All Questions

1.a)The extension in a rectangular steel bar of length 400 mm and thickness 10 mm is found to be 0.21 mm. the bar tapers uniformly in width from 100 mm to 50 mm. if the Young's modulus is 200 GPa, determine the axial load on the bar **.** (7M)

b) At a point in a strained material, the intensities of normal stresses on two planes at right angles to each other are 35 N/mm2 and 20 N/mm2 both tensile. They are accompanied by shear stress of 15 N/mm^2.Find the principal planes and principal stresses. Find also maximum shear stress. (8M)

(OR)

c) Two vertical rods one of steel and the other of copper are each rigidly fixed at the top and 50cm apart. Diameters and lengths of each rod are 2cm and 4cm respectively. A cross bar fixed to the rods at the lower ends Carries a load of 5000N such that the cross bar remains horizontal even after loading. Find the stress in each rod and position of the load on the bar. Take Es= $2.x10^5 N/mm^2$,
Ec= $1x\ 10^5 N/mm^2$ (8M)

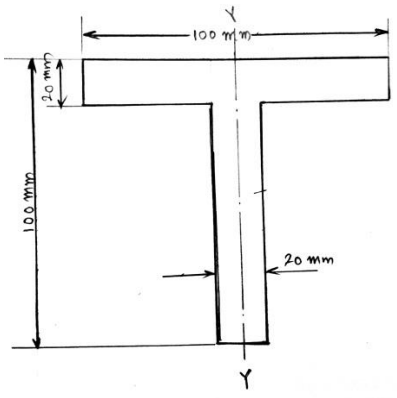
d) Derive equation for the relation between three elastic moduli. (7M)

2. a) A simple supported beam of length 8m rests on supports 6m apart, the right hand end is overhanging by 2 m. The beam carries a uniformly distributed load of 1500 N/m over the entire length. Draw the shear force and bending moment diagrams and find the point of contra flexure, if any? (15M)

(OR)

b) A simply supported beam of span 10 m carry as UDL of 10 KN/m over a length of 3 m from left support and also from right support. Draw SF and BM diagram. [15M]

3.a) The Shear force acting on a section of a beam is 50KN. The section of the beam is T shaped of Dimensions 100mm x 100mm x 20mm as shown in the fig. The moment of inertia about the horizontal neutral axis is $314.221 \times 10^4\ mm^4$. Calculate the shear stress at the neutral axis at the junction of the web and flange. (15M)



b) A steel beam of I-section, 200 mm deep and 160 mm wide has 16 mm thick flanges and 10 mm thick web. The beam is subjected to a bending moment of 200 kN m at a critical section. Determine the maximum bending stress if the web of the beam is kept horizontal. [8]

c) Show that maximum shear stress in a beam of rectangular section is 1.5 times the average shear stress. [7]

(OR)

4. a) Determine the maximum and minimum hoop stress across the section of a pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 8 N/mm^2. Also sketch the radial pressure distribution and hoop stress distribution across the section? (15M)

(OR)

b) A cylinder has an internal diameter of 230 mm, has walls 5 mm thick and is 1 m long. It is found to change in internal volume by 12×10-6 m3 when filled with a liquid at a pressure p. If Young's Modulus = 200 GPa and Poisson's Ratio = 0.25, and assuming rigid end plates, determine: a) The values of hoop and longitudinal stresses; b) The necessary change in pressure p to produce a further increase in internal volume of 15 %. The liquid may be assumed incompressible. (15M)

PART-B

5. **Answer any five Questions** **5X3 = 15M**

a) Draw the Stress- Strain diagram for Cast Iron and mention the Salient points?
b) What are the effects of inclined load on the Beam?
c) What is the section modulus and how it will affect the strength of the beam?
d) What is the section modulus and how it will affect the strength of the beam?
e) Define the torsional rigidity of the shaft? What does it represent?
f) State the assumption made in deriving the bending equation.
g) Derive the section modulus expression for a circular cross section.
h) What is hoop-stress and volumetric strain in shells?

ADIKAVI NANNAYA UNIVERSITY :: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering II-I Semester

PCC-ME-304 Metallurgy and Material Science (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Explain point defect, Line defect and plane defect. (8M)
   b) Mention the types of solid solutions with examples (7M)

(OR)

c) Draw the close packed planes and directions in simple cube, BCC and FCC crystals and find out the Miller indices of the planes. (8M)
d) Explain briefly the various types of crystal imperfections, with the help of neat sketches (7M)

2. a) Write equations for the following invariant reactions: eutectic, peritectic, monotectic, eutectoid and peritectoid. How many degrees of freedom do exist at invariant reaction points in binary phase diagram? (8M)
   b) Draw iron-carbon equilibrium diagram and mark on it all salient temperatures, composition and phases involved. (7M)

(OR)

c) Explain Hume - Rotherys rules for the formation of substitutional solid solutions. (8M)
d) Discuss the application of Hadfield manganese steels. (7M)

3. a) Classify different types of cast iron. Why silicon is added to cast iron? Explain the effects of any four alloying elements on the properties of cast iron. (8M)
   b) Explain the structure and properties of plain carbon steels. (7M)

(OR)

c) What is a eutectic temperature? Explain. (8M)
d) Describe the allotropic transformations of iron and explain their important Applications (7M)

4. a) Discuss different types of annealing processes. (8M)
   b) Define hardenability of a material and list the factors affecting hardenability. (7M)

(OR)

c) How do you carry out age hardening for Al alloys? (8M)
d) Explain the properties of Cu-Al alloy and applications (7M)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Define covalent and metallic bonds in solids.
b) Explain the importance of phase rule.
c) What are the advantages of heat treatment of metals?
d) Write the specific properties of nano materials.
e) Name a few Titanium alloys.
f) Differentiate between brass and bronze.

ADIKAVI NANNAYA UNIVERSITY :: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering II-I Semester

PCC-ME-305 Fluid Mechanics & Hydraulic Machinery

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Write briefly about different types of Pressure measuring devices (8M)

   b) A triangular plate of base width 1.5 m and height 2 m lies immersed in water with the apex downwards. The base of the plate is 1 m below and parallel to the free water surface. Calculate the total pressure on the plate and the depth of the centre of pressure. (7M)

   (OR)

   c) A cylindrical buoy, 1.6 m in diameter x 1.3 m in length and weighing 5 kN floats in sea water with its axis vertical , A 500 N load is placed centrally at the top of the buoy. If the buoy is to remain in stable equilibrium, find the maximum permissible height of the centre of gravity of the load above the top of the buoy. Specific weight of sea water =10 kN/m^3 (8M)

   d) The pressure outside the droplet of water of dia 0.04 mm is 10.32 N/cm^2. Calculate the pressure within the droplet if surface tension is given as 0.0725 N/m of water. (7M)

2. a) Derive the Bernoulli's equation from the Euler's equation. (8M)

   b) A 60 cm diameter pipeline carries oil (specific gravity= 0.85) at 82500 m^3 per day. The friction head loss is 8.5 m per 1000m of pipe run. It is planned to Place pumping stations every 20 km along the pipe. Make calculations for the pressure drop in kN/m^2 between pumping stations. (7M)

   (OR)

   c) Define Euler number, Weber number, Mach number and Froude number and explain the importance of these numbers. (8M)

   d) A thin plate is moving in still atmospheric air at a velocity of 5m/sec. The length of the plate is 0.6m and width 0.5m. Calculate the thickness of boundary layer at the end of the plate. Take density of air as 1.25 kg/m^3 and kinematic viscosity is 0.15 stokes. (7M)

3. a) State Buckingham's π-theorem. What is the advantage of Buckingham's π-theorem over Rayleigh's method of dimensional analysis (8M)

   b) The velocity profile for laminar boundary layer flow is given as $u/U = (y/\delta)^{0.22}$. Find displacement thickness, momentum thickness and energy thickness. (7M)

   (OR)

   c) A jet of water of diameter 100mm strikes a curved plate at its centre with a velocity of 15m/sec. The curved plate is moving with a velocity of 7m/sec in the direction of the jet. The jet is deflected through an angle of 150^0. Assuming the plate is smooth find

   i) Force exerted on the plate in the direction of the jet.

   ii) Power of the jet.

   iii) Efficiency (7M)

   d) Derive an expression for force exerted by the jet of water on moving curved plate? (8M)

4. a) What equation is employed to find the work done by the impeller of a centrifugal pump? Derive the equation for work done. (7M)

b) What are the equations for work done and discharge of a reciprocating pump? Define the slip and coefficient of discharge of a reciprocating pump. (8M)

(OR)

c) What is the importance of a draft tube in a Francis turbine? Discuss different types of draft tubes. (7M)

d) A turbine is to operate under a head of 25 meters at 200 rpm. The discharge is 9 m^3/sec. If the turbine efficiency is 90% determine: (i) specific speed of the turbine (ii) power generated (iii) performance under a head of 20 meters. Also state the type of the turbine. (8M)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) How does the dynamic viscosity of liquid and gases vary with temperature?

b) What is minor loss in pipe flow?

c) Define boundary layer separation.

d) Find the force exerted by a jet of water of diameter 70mm on a stationary flat 2M plate, normally with a velocity of 25m/s.

e) Define the terms, Slip and Negative slip in reciprocating pumps.

f) Draw inlet and outlet velocity triangles for a Pelton wheel.

g) Why pumps are generally less efficient than turbines.

h) What are the advantages of amplifiers and sensors in fluidics?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM
II B.Tech (ME) III SEMESTER (2019-20AB)
MC-ME309 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE
MODEL QUESTION PAPER

Max Time: 3 Hours **Max Marks: 75M**

SECTION-A (4× 15 = 60 M)
Answer ALL questions

1.a. Define Traditional Knowledge? Explain about its nature, scope and characteristics. **(15M)**

(or)

b. Explain about the historical impact of social change on traditional knowledge system.

2.a. Explain the need of protecting the traditional knowledge significance in detail. **(15M)**

(or)

b. what do you mean by biological diversity? Explain about Biological Acts2002.

3.a. illustrate certain non IPR mechanisms of Traditional knowledge protection. **(15M)**

(or)

b. why do we need to protect Traditional knowledge? What benefits do traditional knowledge bring to the society.

4.a. Explain about Traditional Knowledge in sectors like Engineering and Agriculture. **(15M)**

(or)

b. Illustrate the importance of conservation and sustainable development of Food security of the country and protection of Tk.

SECTION-A (5×3 = 15 M)

Answer Any FIVE questions

5. a) Define Western knowledge.

b) What are different kinds of traditional knowledge?

c) List out the role of Government to harness in TK.

d) Illustrate different strategies to increase traditional knowledge.

e) Define bio technology

f) Write about indigenous knowledge.

g) Define intellectual property.

h) How TK related to Biodiversity.

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering II-II Semester

ESC-ME-401 Basics of Electrical and Electronics Engineering

(MODEL QUESTION PAPER)

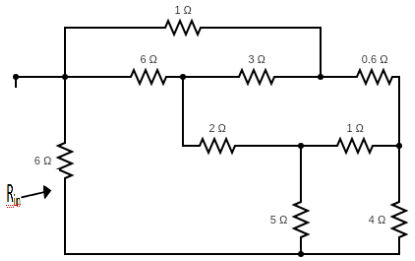
Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Derive the necessary equations for converting star connected resistances to delta connected resistances. (7M)

b) Using star –delta and Delta – Star transformation find the input resistance for the below network. (8M)



(OR)

c) A coil joined in series with a pure resistor of R=800ohms across100V,50Hz supply. The reading at voltmeter across the coil is 45V and across pure resistor is 80V.Find resistance and inductance of the coil. (8M)

d) derive resonant frequency for a RLC series circuits. A circuit has R=10ohms, L=0.14, C=8uF.Find: (i).resonant frequency (ii).quality factor (iii).band width (iv). Half power frequencies. (7M)

2. a) The expression for Fermi level in P type and n type semiconductor (7M)

b) Classify the materials with the help of neat energy band diagrams (8M)

(OR)

c) Define Hall Effect and derive expression for Hall voltage and Hall coefficient (8M)

d) Explain the concept of Fermi level in extrinsic semiconductors (7M)

3. a) Discuss the operation bridge rectifier with capacitive filter and derive equation for ripple factor. (15M)

(OR)

b) Explain forward and reverse bias in case of PN Junction. (8M)

c) Derive expression for dynamic resistance of a diode. (7M)

4. a) Derive current gain, voltage gain, input resistance and output resistance of simplified Common Collector amplifier? (8M)

b) Explain in detail the working of JFET .Draw its drain and transfer characteristics (7M)

(OR)

c) List the advantages of FET over BJT. (7M)

d) Draw hybrid model of transistor and explain each h-parameter of CE configuration? (8M)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) State and explain Kirchhoff's voltage and current Law

b) Define joule's Law of Electrical heating?

c) What are self-inductance and mutual inductance?

d) Define the following terms:

i) RMS value ii) Form factor iii) Peak factor iv) Average value Name a few Titanium alloys.

e) Explain the need for biasing of transistor?

f) Discuss about intrinsic and extrinsic semiconductors

g) Thermal runaway

h) Define Pinch off Voltage

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering II-II Semester

PCC-ME-402 THERMAL ENGINEERING (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Briefly discuss pumping, rubbing friction losses and gas exchange process. (8M)
   b) Define volumetric efficiencyand discuss the effect of various factors affecting (7M)

   (OR)

   c) Explain about heat loss factor and time loss factor (8M)
   d) Compare actual cycle and air standard cycle of SI engine. (7M)

2. a) Explain the working of a four stroke CI engine and indicate the processes on PV and TS plots. (8M)
   b) Explain the working of fuel injection system of CI engine. (7M)

   (OR)

   c) Explain the wet sump lubrication system with neat sketch. (8M)
   d) Explain about the Forced circulation cooling system with neat sketch. (7M)

3. a) Compare rotary compressors and reciprocating compressors. (8M)
   b) A single cylinder, single acting air compressor has a cylinder diameter of 15.2cm and a stroke of 22.8 cm. Air is drawn into the cylinder at a pressure of 1.013 bar and a temperature of 150C. It is compressed adiabatically to 6.1 bar. Calculate the theoretical power required to drive the compressor if it runs at 100 rpm and the mass of air compressed per minute. (7M)

   (OR)

   c) Explain the working of reciprocating compressor and derive the expression for work neglecting the clearance. (8M)
   d) A single stage single acting compressor delivered 14m3 of free air per minute from 1 bar to 7 bar. The speed of compressor is 320 rpm. Assuming that compression and expansion follow the law PV1.35=constant and clearance is 5% of the swept volume, find the diameter and stroke of the compressor. Take L=1.4 D. The temperature and pressure of air at the suction are same as atmospheric air. (7M)

4. a) Explain the working of axial flow compressor with a neat sketch. (7M)
   b) Compare the work inputs for a Root – blower and Vane type compressor when inducted volume of 0.03 m3/revaluation is same and pressure is increased from 1.0 to 1.5 bar in both cases. Assume, for vane type, the internal compression takes place through half the pressure range (8M)

   (OR)

   c) Explain the working of Root's blower with a neat sketch and derive the expression its efficiency. (8M)
   d) Derive the expression for slip factor and pressure coefficient in case of centrifugal compressor. (7M)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Draw the P-v plot of actual cycle and Fuel-air cycle for the optimum spark advance.

b) What is the need of providing lubrication to the IC engine?

c) What is meant by delay period?

d) Define volumetric efficiency? Explain its importance for calculation of volumetric efficiency in the performance test?

e) Define the volumetric efficiency of the reciprocating compressor.

f) Define degree of reaction for the axial flow compressor?

g) List out the advantages of multistage compression.

h) Explain surging

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering II-I Semester

PCC-ME-403 Production Technology (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Explain the following with suitable sketches.
   (i) Cope and drag pattern (ii) Skeleton pattern. (10M)
   b) What are the consequences when turbulence of the metal occurs in the gating system? (5M)

   (OR)

   c) Sketch cupola furnace and label essential parts. Also describe the operation of cupola in detail. (15M)

2. a) Explain the working principle of MIG welding with a neat diagram. (7M)
   b) Write any seven differences between AC and DC arc welding. (8M)

   (OR)

   c) Explain in brief about resistance welding. (8M)
   d) Explain about any two Non-Destructive testing of welding (7M)

3. a) Explain about hot working and cold working processes? (8M)
   b) Explain about impact extrusion and hydrostatic extrusion? (7M)

   (OR)

   c) Explain powder metallurgy? (15M)

4. a) Write a short note on spring back bending process. (5M)
   b) Explain about blow moulding process. (10M)

   (OR)

   c) Write about types of presses and press tools? (8M)
   d) Explain injection moulding process? (7M)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) What are the factors which govern the selection of proper material for pattern materials?

b) Write any two merits and demerits of lost wax process.

c) Write a short note on right ward welding with a diagram.

d) Define soft soldering and hard soldering.

e) Write a short note on wire drawing.

f) Explain pre & post treating of welded joints?

g) Write about applications of powder metallurgy?

h) Write any two differences between thermo plastics and thermo setting plastics

ADIKAVI NANNAYA UNIVERSITY :: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering II-II Semester

ESC-ME-404 Machine Drawing (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

Note:

1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer any TWO questions in Part-A
3. Answering Part-B Compulsory

PART-A

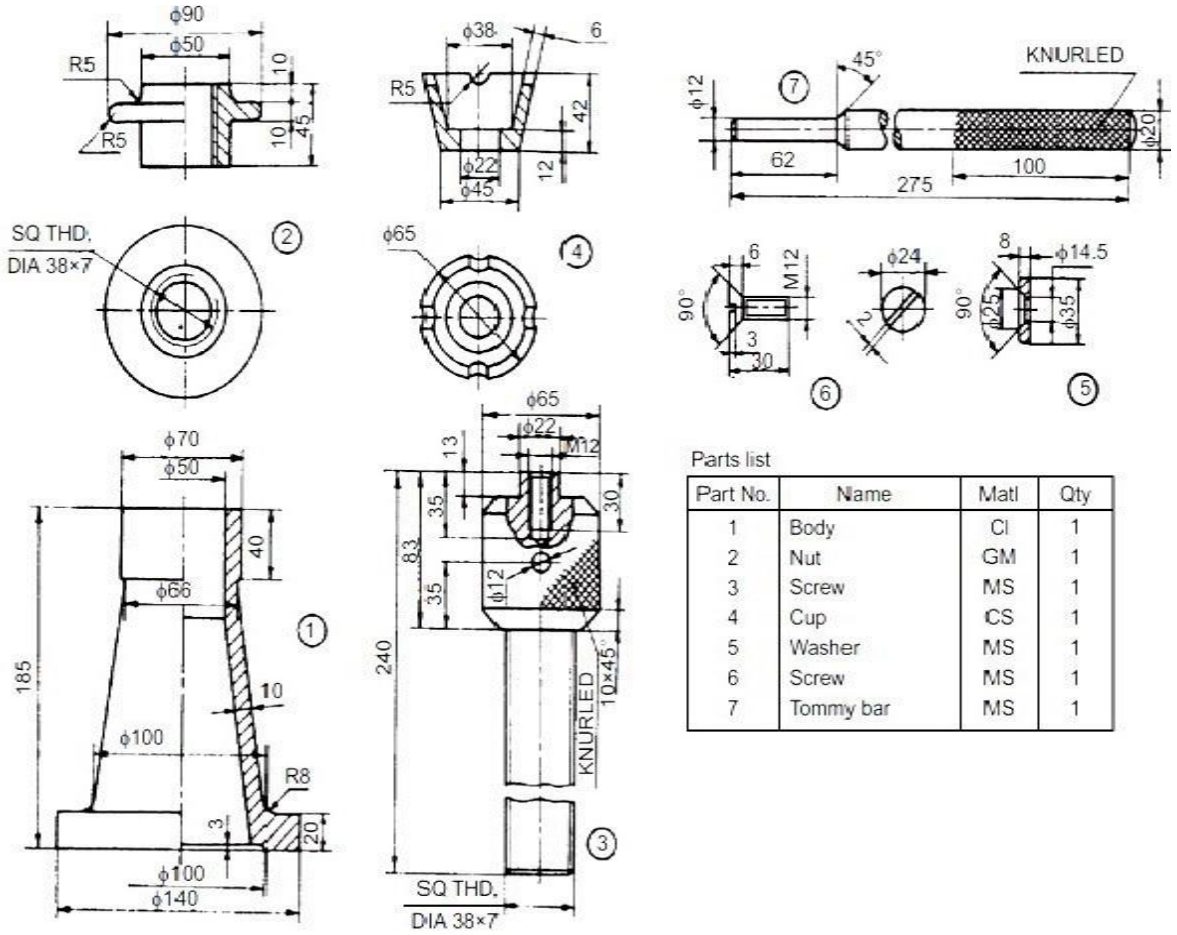
1. Sketch the conventional representation of the following materials: (10M)
   i) Steel ii) Lead iii) Glass iv) Asbestos

2. Draw the sectional front and side view of a cotter-joint with two sleeves and each sleeve is having a width of 32 mm and thickness 6 mm and the clearance is 3 mm and taper as 1 in 30. (10M)

3. Draw to 1:1 scale full sectional front view and top view of a knuckle joint whose rod diameter is 20mm. (10M)

PART-B

4. The fig. below the detailed drawings of a screw jack. Assemble all the parts and draw the following assembled views' i) Half Sectional front view ii) Top view. (55M)



Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Nut	GM	1
3	Screw	MS	1
4	Cup	CS	1
5	Washer	MS	1
6	Screw	MS	1
7	Tommy bar	MS	1

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech (Common for Mechanical Engineering, Civil Engineering) II-II Semester

HSMC-ME-405, HSME-CE-405 MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions **4x15=60M**

1. a) What is managerial economics? Explain its nature and significance. 15M

(OR)

b) What do you understand by elasticity of Demand? Explain the factors governing it.

2. a) Discuss about different costs in cost analysis. 15M

(OR)

b) A hi-tech rail can carry a maximum of 36000 passengers per annum at a fare of Rs.400. the variable cost per passenger is Rs.150 while the fixed costs are 25, 00,000/- per year. Find the break-even point in terms of number of passengers and also in terms of fare collection. 15M

3. a) Explain the advantages and disadvantages of partnership firm. 15M

(OR)

b) Discuss the business challenges in the era of globalization. 15M

4. a) What is capital budgeting? Explain the significance of capital budgeting. 15M

(OR)

b) What is ratio analysis? Discuss the different types of balance sheet ratios. 15M

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Explain Law of demand and types of demand

b) Write about Isoquants and Isocosts

c) Explain the objectives of pricing

d) What are the profitable ratios?

e) Write about the joint stock company

f) Explain the features of Monopoly competition.

g) How to determine the demand

h) Explain about the financial statements

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-I Semester

PCC-ME-501 DYNAMICS OF MACHINERY (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Explain the effect of gyroscopic effect on four wheeled vehicle. (8M)

   b) What do you mean by friction axis and friction circle? Explain. (7M)

   (OR)

   c) A ship is propelled by a rotor of mass 2000kg rotates at a speed of 2400rpm. The radius of gyration of rotor is 0.4m and spins clockwise direction when viewed from bow (front) end. Find the gyroscopic couple and its effect when: i) The ship takes left turn at a radius of 350 m with a speed of 35kmph ii) The ship pitches with the bow rising at an angular velocity of 1rad/s iii) The ship rolls at an angular velocity of 0.15rad/s (15M)

2. a) What is meant by tractive resistance in case of wheeled vehicle? What are its main components? (7M)

   b) An internal shoe brake has a diameter of 320 mm and width of 30 mm. The cam forces are equal. Maximum pressure is not to exceed 80 N/mm2 .$\varphi 1 = 15^o$, $\Phi 2 = 145^o$, a =220 mm, c =125 mm and μ =0.32. Determine the actuating force and the brake torque. (8M)

   (OR)

   c) In a belt transmission dynamometer, the driving pulley rotates at 300rpm. The distance between the centre of the driving pulley and the dead mass is 800mm. The diameter of each of the driving as well as the intermediate pulleys is equal to 360mm. Find the value of the dead mass require to maintain the lever in a horizontal position when the power transmitted is 3kW. Also find its value when the belt just begins to slip on the driving pulley. Coefficient of friction being 0.25 and the maximum tension in the belt 1200N. (8M)

   d) Explain the working of internal expanding shoe break with the help of neat sketch. (7M)

3. a) The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment 1mm=5N-m; crank angle 1mm=1o. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270mm2. The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800r.p.m. (7M)

   b) A Proell governor has equal arms of length 300 mm. The upper and lower ends of the arms are pivoted on the axis of the governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the balls are 150 mm and 200 mm. The mass of each ball is 10 kg and the mass of the central load is 100 kg. Determine the range of speed of the governor. (8M)

   (OR)

   c) In a Hartnell governor the radius of rotation is 7 cm when speed is 500 rpm. At this speed, ball arm is normal and sleeve is at mid position. The sleeve movement is 2 cm with +5% of change in speed. The mass of sleeve is 6 kg and friction is equivalent to 25 N at the sleeve. The mass of the ball is 2 kg. If ball arm and sleeve arms are equal, find, (i) Spring rate (ii) Initial compression in the spring, and (iii) Governor effort and power for 1% change in the speed if there is no friction. 1 of 2 (15M)

4. a) The following data refers to a two- cylinder uncoupled locomotive: Rotating mass per cylinder = 280kg Reciprocating mass per cylinder = 300kg Distance between wheels = 1400mm Distance between cylinder centers = 600mm Diameter of treads of driving wheels =1800mm Crank radius = 300mm Radius of centre of balance mass = 620mm Locomotive speed = 50Km/hr Angle between cylinder cranks = 90^{o} Dead load on each wheel = 3.5tonne

   Determine the: i) Balancing mass required in the planes of driving wheels if whole of the revolving and two-third of the reciprocating mass are to be balanced ii) Swaying couple iii) Variation in tractive force iv) Maximum and minimum pressure on the rails v) Maximum speed of locomotive without lifting the wheels from the rail (15M)

   (OR)

   b) Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 12kg, 10kg, 18kg and 15kg respectively and their radii of rotations are 40mm, 50mm, 60mm and 30mm. The angular position of the masses B, C and D are 600, 1350 and 2700 from mass A. Find the magnitude and position of the balancing mass at a radius of 100mm. (15M)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) What is the effect of gyroscopic couple when a ship is rolling?

b) Define the terms: Coefficient of friction and Limiting angle of friction.

c) Explain clearly how the functions of fly wheel and governor differ from each other.

d) What is Controlling Force?

e) Explain dynamic balancing.

f) What is meant by critical speed of a shaft?

g) Define sensitiveness of a governor.

h) List the characteristics of brakes.

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-I Semester

PCC-ME-502 DESIGN OF MACHINE MEMBERS-I (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) The following data is given for a 3600 hydrodynamic bearing: Journal diameter = 100 mm ; Bearing length = 100 mm Radial load = 50 kN ; Journal speed = 1440 rpm Radial clearance = 0.12 mm ; Viscosity of lubricant = 16 cp Calculate (a) minimum film thickness (b) coefficient of friction and (c) power lost in friction. (15)

(OR)

b) Design a bearing and journal to support a load of 4500N at 600 rev/min using a hardened steel journal and a bronze backed Babbitt bearing. The bearing is lubricated by oil rings. Take room temperature as 210 C and the oil temperature as 800 C. (15)

2. a) Determine the dimensions of small and big end bearings of the connecting rod for a diesel engine with the following data: Cylinder bore = 100 mm Maximum gas pressure = 2.45 MPa (l/d) ratio for piston pin bearing = 1.5 (l/d) ratio for crank pin bearing = 1.4 Allowable bearing pressure for piston pin bearing = 15 MPa Allowable bearing pressure for crank pin bearing = 10 MPa (15)

(OR)

b) What are the cross-sections commonly employed for connecting rods? Why I-section is chosen for high-speed I.C engines? (7)

c) Determine the diameter of the connecting rod of 150 mm length, subjected to an axial compression load of 180 KN, taking to be freely hinged at the ends. Take the factor of safety to be 7. E = 2.15 x 105 N/mm2. (8)

3. a) The section of a crane hook is a rectangle 60 mm × 40 mm. The center of curvature of the section is at a distance of 80 mm from the centroid of the section. A load of 15 kN is acting through the center of curvature. Determine the maximum and minimum bending stresses induced in the hook. (15)

(OR)

b) List the type of threads used in power screws. Give practical example for each type of threads. State advantages and disadvantages of using different types of threads in "power screws". (15)

4. a) It is required to design a pair of spur gears with 200 full-depth in volute teeth consisting of a 20-teeth pinion meshing with a 50 teeth gear. The pinion shaft is connected to a 25 kW, 1440 rpm electric motor. The starting torque of the motor can be taken as 150% of the rated torque. The material for the pinion is plain carbon steel Fe410, while the gear is make of grey cast iron FG 200. The factor of safety is 2. Design the gears based on the Lewis equation and using velocity factor to account for the dynamic load. (15)

(OR)

b) A pair of helical gears consists of an 18 teeth pinion meshing with a 45 teeth gear. 7.5 kW power at 2000 rpm is supplied to the pinion through its shaft. The normal module is 6 mm, while the normal pressure angle is 200. The helix angle is 230. Determine the tangential, radial and axial components of the resultant tooth force between the meshing teeth. (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) State any two advantages and disadvantages of deep groove ball bearings.

b) What is meant by conformability and embeddability with respect to sliding contact bearing materials? Name the materials used for piston rings.

c) What is the difference between the centre and overhung crank shafts?

d) Why is the pinion weaker than the gear made of same material?

e) Define the term bearing life. Show its mathematical equation.

f) What is a whipping action with reference to a connecting rod?

g) Comment on the best suitable cross section for crane hook.

h) Write the design criteria followed in the design of power screws

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-I Semester

PCC-ME-503 METAL CUTTING & MACHINE TOOLS (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Explain the effects of the following parameters on chip formation: (i) Velocity (ii) Material of work piece (iii) Depth of cut (iv) Tool Geometry. (15M)

(OR)

b) Explain the various types of chips. (8M)

c) Draw Merchants force diagram. State the assumptions made in the development of such a diagram. (7M)

2. a) Explain briefly the following lathe accessories: (i) Driving Plate (ii) Lathe Centers. (8M)

b) Explain the different types of tool post with neat sketches. (8M)

(OR)

c) Discuss the constructional features of speed gear box. (8M)

d) Explain briefly the following operations with neat sketches: (i) Knurling (ii) Forming. (7M)

3. a) Describe schematic diagram of universal milling machine. (8M)

b) Determine the indexing crank movement for milling square bolt by simple indexing. (7M)

(OR)

c) Explain briefly a Jig boring machine with a neat sketch. (8M)

d) Explain briefly "Twist drill nomenclature" with neat sketches. (7M)

4. a) Differentiate between transverse and plunge grinding. (8M)

b) Describe the working principle of surface grinding. (7M)

(OR)

c) Explain briefly the following types of Jigs:
(i) Universal Jig
(ii) Diameter Jig
(iii) Channel Jig. (15M)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Discuss the methods of chip control.

b) What are the advantages of using a taper turning attachmen

c) How is metal removal rate in a shaping machine calculated?

d) Define the terms 'Indexing' and 'Dividing head'.

e) What is the difference between pull broaching and push broaching? Explain.

f) What are the differences between Jigs and Fixtures? Explain.

g) How does the rake angle affect the life of the cutting tool?

h) Explain Face milling with a neat sketch.

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-I Semester

PEC-ME-504A POWER PLANT ENGINEERING (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Enumerate and explain the steps involved in coal handling.
   b) Explain the general layout of ash handling and dust collection systems. (8+7)

   (OR)

   a) Explain the working of spreader stoker with neat sketch.

   b) What are the different types of cooling towers? Explain with a neat sketch. (8+7)

2. a) Describe the various methods used for starting diesel engine. Describe the correct sequence of steps for starting and stopping procedure.

   b) What are the essential components of a simple open cycle gas turbine plant? How inter cooling and regeneration help in improving thermal efficiency of the plant? (8+7)

   (OR)

   c) Explain the working details of gas turbine power plant indicating all auxiliaries.
   d) Draw the schematic representation of Fuel cell and explain its working (Hydrogen and oxygen). (8+7)

3. a) Draw the line diagram and explain the working details of hydro power plant giving salient points.

   b) Draw the general layout of tidal power plant and what are the limitations of that plant. (8+7)

   (OR)

   c) What is a spillway? Why spillways are required? What are the different types of spillways?
   d) Explain with a neat sketch a pumped storage hydro plant, state its advantages. (8+7)

4. a) What are the principal parts of a nuclear reactor? Explain the working of each part.
   b) Draw the line diagram and explain the working of Gas cooled reactor. (8+7)

   (OR)

   c) Explain Types of Reactors ? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) List out the fuel and handling equipments.
b) Classify cooling Towers used in power plants.
c) What is meant by super charging?
d) Differentiate the open and closed cycle of GT.
e) What is the need of spill ways?
f) What is VAWT?
g) What is meant by fertile materials in nuclear fuels?
h) What are the types of nuclear reactors?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-I Semester

PEC-ME-504B AUTOMOBILE ENGINEERING (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Explain briefly the constructional features of the various parts of a car body
   b) Sketch the mechanical pump and describe its working. (8+7)

   (OR)

   c) How carburetors are classified? Explain the construction and operation of a simple Carburetor.
   d) Explain the working principle of a CRDI with neat sketch. (8+7)

2. a) Discuss the working principles of i) Torque tube drive. ii) Hotchkiss drive.
   b) What are the functions of universal joint and Propeller shaft (8+7)

   (OR)

   c) Discuss about the Davis steering mechanism in the automobiles.
   d) Explain about the differential rear axle with neat sketch. (8+7)

3. a) Discuss the construction of tandem master cylinder.
   b) What is meant by self locking tendency of brakes? What factors helps this to occur? (8+7)

   (OR)

   c) Explain the working principles of Hydraulic braking system with neat sketches.
   d) Sketch and explain various steering geometries. (8+7)

4. a) Explain Engine specification with regards Power, speed?
   b) Discuss different energy alternatives with their merits and demerits. (8+7)

   (OR)

   c) Explain Safety Systems? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) What is the use of carburetor in S.I. engine?

b) Explain about the requirements of diesel injection system.

c) What is the spark advance and retard mechanism?

d) Explain about the starting system of automobile.

e) What are the functions of clutch?

f) Why the shock absorbers are used in automobile

g) Define Chassis.

h) What is the function of a propeller shaft?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-I Semester

PEC-ME-504C THEORY OF ELASTICITY & PLASTICITY (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Discuss various applications of polar coordinates and advantages of considering problem using polar coordinates. (8)

   b) Explain about Strain components in polar co-ordinates. (7)

   (OR)

   c) Show that $\epsilon_x = k(x^2+y^2)$, $\epsilon_y = k(y^{2+} z^2)$, $7_{xy} = k'xyz$, $\epsilon_z = 7_{xz} = 7_{yz} = 0$ Where k, k' are small constants, is not a possible state of strain. (15)

2. a) Determine principal stresses and principal strains for the state of stress at a point given below in kg/cm2.

$$\tau_{ij} = \begin{matrix} 200 & 30 & 40 \\ 30 & 100 & 20 \\ 40 & 20 & 50 \end{matrix}$$

   (15)

   (OR)

   b) Derive expression for Equations of equilibrium in three dimensions? (7)

   c) Derive the expression for strain at a point in case of a body stressed in three dimensions? (8)

3. a) Derive the equations of Beam of rectangular cross-section? (15)

   (OR)

   b) Derive the expression for Beams of circular cross-section. (15)

4. a) Explain the concept of Structure of metals in plasticity? (15)

   (OR)

   b) Explain the Condition of constant maximum shear stress? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Discuss Hooks law.
b) Explain Saint Venant's principle?
c) Write short notes on Reciprocal theorem
d) Write short notes on Homogenous deformations.
e) Write short notes on Stress invariants.
f) Explain about twisting of rectangular bars.
g) Define Hydrostatic strain?
h) Discuss about Principle of superposition

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-I Semester

OEC-ME-505A NANO-TECHNOLOGY (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Explain Properties of nano materials. (15)

(OR)

b) Give some examples of Nano Particles and their applications in detail. (15)

2. a) Explain Synthesis techniques for nano Particles. (15)

(OR)

b) Explain Requirements for realizing semiconductor nano structures? (15)

3. a) Draw the schematic diagrams depicting the working of the following:
(i) Scanning Tunneling Microscope
(ii) Atomic Force Microscope. (15)

(OR)

b) Explain Photo luminescence spectra? (15)

4. a) Explain different Applications of Nano technology? (15)

(OR)

b) Explain Applications of nano structured thin fins and quantum dots? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Define nano meter & nano materials?

b) What are Mechanical properties of Nano materials?

c) What is the difference between PVD & CVD?

d) What is meant by XANES & XAFS?

e) What are the applications of nano carbon tubes?

f) What are the growth techniques for nano structures?

g) What are the Characterics of carbon allotropes?

h) What are electrical and dielectric properties of Nano materials?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-I Semester

OEC-ME-505B ROBOTICS (MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a)What is Robotics? Explain the various components involved in Robotic system with block Diagram. (15)

(OR)

b) Explain Lagrange Euler Formulation determine the equation of motion for the RP manipulator. (15)

2. a) What are the considerations that are made while planning a joint interpolated motion trajectory? Explain. (15)

(OR)

b) Explain the classification of robots by different controlling methods. (15)

3. a) Explain various feedback components used for robot operation. (15)

(OR)

b) Explain variable Structure control. (15)

4. a) Explain Robot Programming languages? (15)

(OR)

b) Explain Touch Sensors? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Define degree of freedom.

b) What are the different types of control modes in a robot system?

c) Define manipulator.

d) What is trajectory planning?

e) What is the difference between forward inverse kinematics?

f) Discuss about planar two link manipulators.

g) What are the Characteristics of robot level language?

h) Explain about application of encoders.

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-I Semester

OEC-ME-505C ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Define Artificial intelligence? Explain types of agents. (15M)

   (OR)

   b) Explain briefly any two uniformed search strategy. (15M)
2. a) Explain the concept of forward & backward chaining? (15M)

   (OR)

   b) Explain the Pattern Recognition Problems in Artificial Neural Networks? (15M)
3. a) Explain about Supervised, Unsupervised Learning and Batch and Online Learning (15M)

   (OR)

   b) Over fitting the Training Data and under fitting the Training Data. (15M)
4. a) Explain about Measuring Accuracy Using Cross-Validation. (15M)

   (OR)

   b) Explain the Random Patches and Random Subspaces. (15M)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Define Rationality.

b) Write a short note on Minmax Algorithm.

c) What is the main aim of Wumpus World?

d) Define First Order Logic.

e) Types of Machine Learning Systems.

f) Training Data.

g) Confusion Matrix.

h) Voting classifier

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-II Semester
III BTech (ME) III-II Semester

MC-ME508 CONSTITUTION OF INDIA
MODEL QUESTION PAPER

Time:3hrs **Max.Markss:75**

SECTION-A (4 X 15 = 60 M)
Answer ALL Questions

1.a) What is a Constitution? Explain the importance of Preamble. **(15M)**

OR

b) Explain in detail the Fundamental Rights and Duties.

2.a) Explain Judiciary and its structure. **(8M)**

b) Explain Federalism and Centre-State relationship structure **(7M)**

OR

c) Explain the role of President and his powers. **(8M)**

d) Elucidate upon the structure of Lok Sabha. **(7M)**

3.a) Explain the Role and Importance of Municipalities **(15M)**

OR

b) Explain the significance of Panchayat Raj.

4.a) What is the role of Election Commission? Explain the powers vested to Election Commissioner. **(15M)**

OR

b) What are some of the functions taken up by the EC for the welfare of SC/ST/OBC and Women?

SECTION- B (5×3=15M)
Answer any FIVE Questions

5. Explain about:

a) History of Indian Constitution
b) Directive Principles of State Policy
c) The Supreme Court
d) Council of Ministers
e) Structure of State Secretariat
f) Grass root Democracy
g) Zila Panchayat
c) Sources of Indian Constitution

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-II Semester
PCC-ME-601 METROLOGY & INSTRUMRNTATION
(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Define fit and describe various types of fits in brief? (8M)

   b) Determine and sketch the limits of tolerance and allowance for a 42 mm shaft and hole pair designated as H 8 - g10. The basic size lies in the range of 30 – 50 mm. The multipliers for grades 8 and 10 are 25 and 64 respectively. The fundamental deviation for g shaft is (- 2.5 D0.34) microns. The standard tolerance unit is i = 0.45 (D) 1/3+ 0.001D in microns. (7M)

   OR

   c) Explain the construction and working of a Vernier Caliper. (7M)

   d) State and explain the Taylor's principle of gauge design with neat sketch of Plug gauge and Snap gauges. (8M)

2. a) With a neat sketch explain the working principle of Auto Collimator. (8M)

   b) Explicate the uses of interferometer in measuring flatness of surfaces. (7M)

   OR

   c) Explain the construction and working of Sigma mechanical comparator with a neat sketch. (8M)

   d) State and explain the methods of measuring primary texture of a surface. (7M)

3. a) What are the various errors in screw threads? Discuss sources of these errors and precautions need to minimize or completely eliminate these errors. (8M)

   b) Explain with a schematic sketch' the method of checking the in volute gear tooth profile. (7M)

   OR

   c) State various applications of straight edges. (7M)

   d) What are the various alignment tests performed on vertical milling machine and discuss any two of them in detail. (8M)

4. a) Explain the Nomenclature of gear tooth? (15M)

   OR

   b) Explain the concept of Strain measurements? (15M)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) State the condition when the shaft based system is used for limits and fits.
b) Write short notes on 'Standards'.
c) What are the applications of tool makers microscope?
d) List the advantages of electronic comparators.
e) What are the applications of flange micro meter?
f) Name the various instruments required for performing the alignment tests on machine tool.
g) Define gear tooth?
h) Write a brief note on involute profile?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-II Semester

PCC-ME-602 HEAT TRANSFER

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) A Stainless steel plate is of 2 cm thick is maintained at a temperature of 5500C at one face and 500C on the other. The thermal conductivity of stainless steel at 3000C is 19.1 W/m K. Calculate the heat transferred through the material per unit area. (8M)

   b) In what way is the science of heat transfer different from thermodynamics? Explain. (7M)

   OR

   c) Derive the general conduction equation for cylindrical co-ordinate (7M)

   d) Derive the general conduction equation for Spherical co-ordinates, the system being with uniform heat generation and unsteady state. (8M)

2. a) Explain why the conductivity of metals decreases and conductivity of insulating material increases with increases in temperature. (7M)

   b) A metallic plate, 3cm thick is maintained at 4000C on one side and 1000C on the other side. How much heat is transferred through the plate? Take k for the metallic plate as k=370 W/m-K. (8M)

   OR

   c) What is critical thickness of insulation on a small diameter wire or pipe, explain its physical significance and derive an expression for the same. (7M)

   d) Calculate the rate of heat loss for a red brick wall of length 5m, height 4m, and thickness 0.25m, the temperature of the inner surface is 1100C and that of the outer surface is 400C. The thermal conductivity of red brick k = 0.70 W/m-K. Calculate also the temperature at an interior point of the wall, 20cm distance from the inner wall. (8M)

3. a) Differentiate between mechanisms of heat transfer by free and forced convection. Mention some of the areas where these mechanisms are predominant. (8M)

   b) Water at 750C flows through a 0.005 m diameter tube with a velocity of 1m/s. If the tube wall temperature is 250C, make calculations for the heat transfer coefficient. Use the correlation, St = 0.023 Re 0.2 Pr – 0.667. The thermo-physical properties of water are: Thermal conductivity is 0.647 W/(m.K); Viscosity is 1.977 kg/h.m; Density is 1000 kg/m3; Specific heat 4.187 kJ/(kg.K). (7M)

   OR

   c) Describe Buckingham's method of π-terms to formulate a dimensionally homogenous equation. (7M)

   d) A flat plate 1m wide and 1.5 m long is to be maintained at 900C in air when free stream temperature is 100C. Determine the velocity at which air must flow over the plate so that the rate of energy dissipation from the plate is 3.75kW. (8M)

4. a) Draw the boiling curve for pool boiling of water and explain flow regimes. (7M)

   b) Saturated steam at a temperature of 650C condenses on a vertical surface at 550C. Determine the thickness of the condensate film at locations 0.2 m and 1.0 m from the top. Also calculate condensate flow rate at these locations. (8M)

   OR

   c) Derive an expression for the shape factor in case of a radiation exchange between two surfaces. (8M)

   d) Show that the emissive power if a black body is π – times the intensity of emitted radiation. (7M)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) What is the convection mode of heat transfer?

b) What are the applications of heat transfer?

c) What is the function of fin?

d) What is critical radius of insulation?

e) Differentiate the free and forced convection.

f) What are the advantages of dimensional analysis?

g) What is film wise condensation?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-II Semester

PCC-ME-603 CAD/CAM

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) How do you distinguish between a CPU and a Microprocessor?
   b) What are the Input devices and Output devices, explain them briefly. (8+7)

   (OR)

   c) Briefly describe the types of storage devices used in computers.
   d) Explain the Raster scan graphics coordinate system. (8+7)
2. a) Give a classification of the different surfaces that can be used in Geometric modeling applications.
   b) What is meant by sweep? Discuss in detail the various types of sweep techniques available for 3D Geometric construction. (8+7)

   (OR)

   c) Explain linier and circular interpolations in CNC systems.
   d) What is manual CNC part programming? Explain with an example. (8+7)
3. a) Explain about the OPITZ coding system generally used in Group Technology.
   b) What are the main objectives of MRP (Manufacturing Resource Planning)? Explain them briefly. (8+7)

   (OR)

   c) What are the main features of CNC Machine Tool? Write any 10 G-codes and 10 M-codes with a short description.
   d) Discuss the advantages of computer assisted part programming over manual part programming. (8+7)
4. a) Explain types of manufacturing systems? Recent trends in manufacturing? (15)

   (OR)

   b) Discuss the various topologies used in CIM with their relative advantages and disadvantages.
   c) How does Lean production differ from Flexible production system? Explain. (8+7)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) What is Parametric CAD system?

b) Differentiate between implicit and explicit functions.

c) What is meant by Surface Patch?

d) What are the Boolean operations used in solid modeling?

e) What are the different elements of NC system?

f) What is the need of Group Technology?

g) Give some advantages by the implementation of CIM.

h) How SME (Society of Manufacturing Engineers) defined CIM?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-II Semester

PEC-ME-604A TURBO MACHINERY SYSTEMS

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Prove that the turbine overall efficiency is greater than the turbine stage efficiency. (7)
   b) Derive the polytrophic compression efficiency through an infinitesimal compression stage. (8)

   (OR)

   c) Discuss the effect of back pressure during flow through a converging diverging nozzle. Show variation of pressure, velocity and P exit as a function of back pressure. (8)
   d) The inlet condition to a steam nozzle is 10 bar and 250^0 C. The exit pressure is 2 bars. Assuming isentropic expansion and negligible inlet velocity, calculate the throat area, exit velocity and exit area of the nozzle. (7)
2. a) A stage of an impulse turbine has two rows of moving blades separated in a row of fixed guide blades. The moving blades have tip angle of, the velocity of discharge from the nozzle is 540 m/s. The relative velocity of steam drops by 0 38 10 % during passage through each ring of blades and the final discharge is axial. Calculate the blade speed and blade efficiency? (15)

   (OR)

   b) Explain the concept of surging in an axial flow compressor. (15)
3. a) Explain the Parameters of Gas turbine plant? (15)

   (OR)

   b) Explain the principle of outward flow radial cascade. Describe its effects. (7)
   c) What is matching of compressor and turbine performance in axial flow gas turbines? (8)
4. a) Explain the Specifications and Performance of rocket engines? (8)
   b) Write a short note on types of combustion chambers. (7)

   (OR)

   c) Explain the Performance of solid and liquid propellant rockets? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Write short note on free vortex blades?
b) Define slip factor?
c) What is the difference between pressure coefficient and adiabatic coefficient?
d) Define Mach number?
e) What is meant by acoustic waves and sonic velocity?
f) Write a short note on Basic theory of equations?
g) What is the difference between ramjet and pulsejet, scramjet engines?
h) Comparison of various propulsion systems?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-II Semester

PEC-ME-604B Automations in Manufacturing

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) What is automation? Discuss various types of automation. (7)
   b) List various mechanical feeding devices. Explain any one with neat sketch. (8)
   (OR)
   c) List six basic components required in a hydraulic fluid system and state their essential functions. (8)
   d) Discuss various types of automation strategies mentioning their importance. (7)
2. a) Discuss the various control functions of an automated transfer line. (7)
   b) Explain about Geneva Mechanism. (8)
   (OR)
   c) Mention the objectives of automated flow line and discuss about in-line and rotary type Configuration lines. (8)
   d) Explain the analysis of transfer lines without storage. (7)
3. a) Discuss in detail the various steps involved in design of automated guided vehicle system. (8)
   b) Explain the various problems encountered in interfacing handling and storage systems with manufacturing units. (7)
   (OR)
   c) Explain automated storage systems? (15)
4. a) Differentiate between ACO and ACC types of adaptive control. (7)
   b) Explain the adaptive control for grinding operation with block diagram. (8)
   (OR)
   c) Explain different types of CMM with neat sketch. (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Explain about flexible automation.
b) Name three reasons for including a storage buffer in an automated production line?
c) What are the four automated assembly system configurations?
d) Name various types material handling equipment.
e) Define adaptive control constraints.
f) Write the functions of CMM
g) List out the advantages of automation.
h) What are two reasons for the existence of partially automated production lines?

ADIKAVI NANNAYA UNIVERSITY::RAJAMAHENDRAVARAM

B Tech Mechanical Engineering III-II Semester

PEC-ME-604C Advanced Materials

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) How do you classify the composites based on the matrix material used? (8)
   b) List a few composites with appropriate matrix and reinforcement? (7)

   (OR)

   c) Discuss the failure mechanisms in fiber reinforced polymer matrix composites? (8)
   d) Describe a failure theory which is widely used for testing of polymer composites? (7)

2. a) Derive the strain-stress relations for an orthotropic lamina in three-dimensional domain in terms of engineering constants. (15)

   (OR)

   b) Distinguish thermosetting plastics and thermo plastics. (8)
   c) Explain Manufacturing methods? (7)

3. a) Explain Types of functionally graded materials? (15)

   (OR)

   b) Explain Shape memory alloys? (15)

4. a) Advantages and disadvantages of Nano materials? (15)

   (OR)

   b) Write short notes on the following:
   i) Polymer matrix composites
   ii) Assumptions in lamination theory (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Define metal matrix composites?

b) Define thermosetting plastics?

c) Write a short note on Carbon –Carbon composite?

d) Define Hook's Law?

e) What are the applications of Shape memory alloys?

f) Define nano-scale?

g) Difference between CCC, PMC, MCC?

h) Define Auto clave?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B.Tech Mechanical Engineering III-II Semester

OEC-ME-605A INDUSTRIAL TRIBOLOGY

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Explain historical background of Tribology? (8)

   b) Explain Law of Friction? (7)

   (OR)

   c) Explain friction characteristics of metals, and non metals? (15)

2. a) Define the term wear? Draw the wear maps and explain their salient features with reference to wear mechanisms? (15)

   (OR)

   b) Explain mechanism of sliding wear of metals? (15)

3. a) What are the basic functions of a lubricant? List the important factors to be consider in the selection of lubrication system for given application? (15)

   (OR)

   b) Discuss the significant design parameters in Elasto-hydrodynamic lubrication?

4. a) Give important advantages of rolling bearings over plain bearings? (15)

   (OR)

   b) List the properties of the following bearing materials
   i) Steel
   ii) Bronze
   iii) Porus materials
   vi) Plastics (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Define Tribology?
b) Define Rolling Friction?
c) What are various factors of affecting wear?
d) What are the Types and properties of lubricants?
e) Define virtual coefficient of friction?
f) Write a short note on fusion processes, vapour phase processes?
g) Define Reynolds equation for film lubrication?
h) Write a short note on simple theory of sliding wear?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

PEC-ME-701A FINITE ELEMENT METHOD

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Derive the stress strain relation for a plane stress condition starting from Hook's law.

   b) A bar of uniform cross section and length L is fixed at one end and is subjected to an axial load of P. If the body is also subjected to a constant body load of F_b throughout its length, develop the total potential energy expression. (8+7)

   (OR)

   c) For the three stepped bar shown in figure 1, determine the displacements at node 2 and 3 and the reactions at the supports. Also find the stresses in each section. (15)

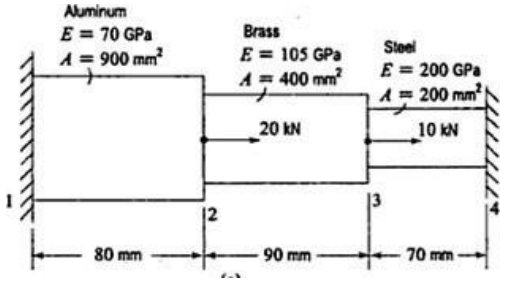


Figure 1

2. a) For a two-dimensional truss structure, as shown in the figure 2, determine displacements of the nodes and normal stresses developed in the members using FE. Use $E = 30\times10^6$ N/cm^2 and a diameter of the circular cross-section of 0.25 cm. (15)

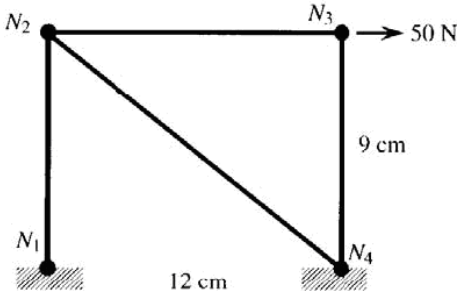


Figure 2

(OR)

b) A beam is fixed at one end and supported by a roller at the other end, has a 20 kN concentrated load applied at the centre of the span of 10 m. Calculate the deflection and slope and also construct shear force and bending moment diagrams. Take I = 2500 cm^4 and E = 20 × 10^6 N/cm^2. (15)

3. a) Derive the shape functions for the four noded tetrahedron elements from the first principles.

   b) Discuss the importance of semi automatic meshing and auto mesh along with the practical applications. (8+7)

(OR)

c) Evaluate the axisymmetric stiffness matrix ***K*** of the triangular element shown in the figure 3. Consider the coordinates of nodes as 1 (2, 1), 2 (4, 0), and 3 (3, 2). Also assume E = 2.6 GPa and ν = 0.2.

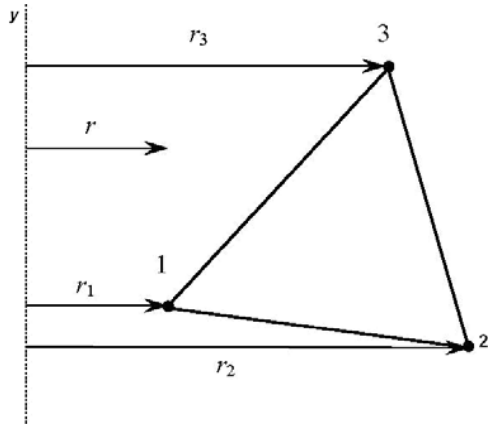


Figure 3

4. a) Derive the conductivity matrix for two dimensional triangular elements subjected to convection on one face of the element. (15)

(OR)

b) For the stepped bar shown in the figure 4. Develop the global stiffness and mass matrices and also determine the natural frequencies and mode shapes. Assume E = 200 GPa and mass density = 7850 kg/m^{3,} $L_1 = L_2 = 0.3$ m, $A_1 = 350$ mm^2, $A_2 = 600$ mm^2. (15)

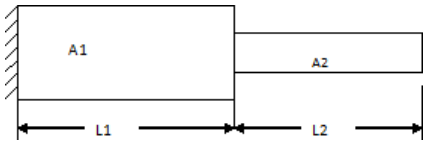


Figure 4

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) What is the principle of finite element method?
b) Write the stress strain relations for 2 D plane stress and plane strain conditions.
c) Differentiate between truss and beam element based on degree of freedom.
d) What is Hermiteshape function?
e) Write the formula for the load vector of a triangular element subjected to body force.
f) What is the size of the stiffness matrix for axisymmetric triangular element?
g) What is the degree of freedom for the thermal problems?
h) Where do you apply finite element analysis for thermal problems?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

PEC-ME-701B MEASUREMENTS & CNC MACHINES

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Explain Multi spindle automatic lathe operations? (8)
   b) What are the tools materials that are used for NC and CNC machining? (7)
   (OR)
   c) Explain Machining centers, turning centers, Vertical turning centers? (8)
   d) Explain in detail the various functions of a DNC system? (7)
2. a) Explain ISO system of limits, Limit gauges for internal and external threads? (15)
   (OR)
   b) Explain Measurement of spur gears and backlash? (15)
3. a) Explain with neat sketch of Tool maker's microscope operation? (8)
   b) Write a short note on Slip gauges? (7)
   (OR)
   c) Explain Optical bevel protractor? (8)
   d) Write a short note on Autocollimeter? (7)
4. a) Explain Parameters & Specification of Surface texture? (15)
   (OR)
   b) Explain the working process of Lathe & Milling machine? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) What are the various applications of CNC machines?
b) Write a short note on ATC (Automatic Tool Changer)
c) Write a short note on Machine centers.
d) CNC is management control system". Discuss.
e) Classify the NC systems?
f) Write a short note on Radial drill?
g) Define backlash?
h) What is meant by Angle dekkor?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

PEC-ME-701C ADVANCED FOUNDRY & WELDING TECHNOLOGY

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) What are the basic steps in casting (8)
   b) Explain different types of moulding process based upon moulding methods? (7)
   (OR)
   c) What are the functions of sand preparation? (7)
   d) Explain the steps involved in preparation of sand. (8)
2. a) With a neat sketch explain the working of Cupola furnace. (15)
   (OR)
   b) Explain any two types of moulding machines. (15)
3. a) Explain Electron Beam Welding with neat labeled sketch. Mention some applications. (15)
   (OR)
   b) Explain how different process parameter influence Laser Beam Welding. (15)
4. a) With suitable sketch explain the process of TIG welding. What are its disadvantages? (15)
   (OR)
   b) What are the different joint designs in adhesive bonding? Explain how a good joint design can be selected? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15M**

a) Differentiate between green sand mould and dry sand mould.
b) Explain draft allowance.
c) What are the factors affecting the selection of pattern materials.
d) What are core prints?
e) Write short note on core baking
f) What are the requirements of core sand?
g) What is deformation resistance welding?
h) Compare vacuum brazing with welding.

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

PEC-ME-702A EXPERIMENTAL STRESS ANALYSIS

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Explain the principal of plane stress and plain strain also writes their any two examples? (8)
   b) Discuss the importance of compatibility conditions also write their mathematical relations? (7)

   (OR)

   c) What do you understand by principle stresses and principle planes? Explain. (8)
   d) What are the conditions of Mohr's circle for stress and strain? (7)
2. a) What are the various types of strain gauges used in strain measurement? Also explain electrical resistance strain gauge with its neat sketch? (8)
   b) Explain the importance of static recording and data logging system also write their any two practical applications? (7)

   (OR)

   c) What are the basic characteristics of a Strain gauge? Write a brief note in Electrical resistance Strain gauges. (8)
   d) What are the recording instruments for strain gauges? Explain how dynamic recording of high frequencies are measured?
3. a) Discuss the crack patterns which can be obtained under various combinations of stresses. Illustrate with neat sketches. (8)
   b) What are neutral fringes? (7)

   (OR)

   c) What are the two techniques used for moiré-fringe analysis? Discuss the displacement approach in detail? (8)
   d) What are various crack detection methods? (7)
4. a) Explain the principle of Geometrical approach to moiré fringe analysis? (7)
   b) What is meant by coating sensitivity also write it's any two practical applications? (8)

   (OR)

   c) Explain the normal and oblique incidence methods as applied to birefringent coatings. How these methods help in separating the principal stresses? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) Define Plane stress and Plane?
b) Write Brief note on: Strain gauge rosettes
c) Write Brief note on Telemetry systems
d) Brief explanations of Moire fringes?
e) Define neutral fringe?
f) What is the component of a Circular Polariscope?
g) Write short note on crack detection methods?
h) Define Isochromatic fringes – Isoclinics?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

PEC-ME-702B DESIGN FOR MANUFACTURE

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Explain the principles which are to be followed while designing a product considering the economical aspects. (8)

   b) What is design philosophy? (7)

   (OR)

   c) Draw the schematic diagram of the basic elements of a design process and explain them briefly. (15)

2. a) Enumerate design rules and guidelines applicable to dimensional tolerances of various machining processes. (15)

   (OR)

   b) What are general design considerations for casting processes with respect to? (15)

   I. Economical molding
   II. Solidification
   III. Surface integrity

3. a) Explain the chief factors in the design of a weldment. (8)

   b) With a neat sketch explain design of closed die forging design and drop forging die design? (7)

   (OR)

   c) Explain Appraisal of various casting processes? (15)

4. a) Explain Keeler Goodman forging line diagram. (8)

   b) Discuss the design principles for deep drawing process? (7)

   (OR)

   c) Discuss the guidelines for design for manufacture. (8)

   d) Classify various manufacturing process. (7)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) What is design for machining?
b) Brief note on Fettling and cleaning
c) Write about Machining Process.
d) What are the Components of Design for blanking?
e) Define Extrusion?
f) Write a short note on general design rules for manufacturability?
g) Explain design rules for sand casting?
h) Write a short note on Simulation software in rolling?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

PEC-ME-702C TOTAL QUALITY CONTROL & MANAGEMENT

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) What are the determinants of quality? (7)
   b) Discuss the difference between traditional quality management and modern quality management? (8)

   (OR)

   c) Explain Philosophy of TQM? (15)
2. a) Define benchmarking. Explain the process of benchmarking. (15)

   (OR)

   b) What are the limitations of bench marking? (8)
   c) What is the relevance of marketing and customer focus to quality improvement? (7)
3. a) What is the basis for using 3-sigma limits in control charts? Do you justify the same for attribute control charts? (15)

   (OR)

   b) Explain the construction and use of demerit control chart. (8)
   c) Discuss the various types of quality costs. (7)

   (OR)
4. a) What are the objectives of ISO 9000? (8)
   b) Which are the four tiers of documentation in ISO 9000? (7)

   (OR)

   c) What are the advantages of ISO 9000 standards to buyer and seller? (8)
   d) What are the objectives of internal audit for ISO9000 standards? (7)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) What is PDSA cycle?
b) What is inspection by variables?
c) Should the buyer-supplier relationship be based on trust or suspicion? Why?
d) Briefly point out the anatomy ‘Quality circles’.
e) What is the purpose served by drawing fish-bone diagram?
f) Should quality be free? Why or why not?
g) Is there any relation between quality appraisal cost and failure cost?
h) For whom ISO 90003 certification is applicable?
i) Is ISO certification product based or process based? Explain briefly.

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

PEC-ME-703A UNCONVENTIONAL MACHINING PROCESSES
(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Give the complete classification of modern machining methods. (8)
   b) Describe the horn of an ultrasonic machine. (7)

   (OR)

   c) Comment about the applications of modern machining methods. (7)
   d) Explain the basic mechanism of metal removal in ultrasonic machining. (8)
2. a) State and explain the working principle of Abrasive Jet Machining in detail. (15)

   (OR)

   b) Briefly explain the various process parameters that affect the material removal rate and surface quality in ECM. (15)
3. a) Define Dielectric? Write a note on it indicating its functions and characteristics? (7)
   b) Explain the process of wire cut EDM and list any two of its advantages, limitations and applications. (8)

   (OR)

   c) What materials are generally used for generation of laser? Explain. (8)
   d) Discuss the thermal features of laser beam. (7)

   (OR)
4. a) With the help of suitable diagrams explain the use of various modes of plasma for various purposes in industry. (15)

   (OR)

   b) Explain Applications of Iron Beam Machining? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) What are the various types of energy sources used in non-traditional machining techniques? Give examples for each.
b) Differentiate the conventional and unconventional machining processes in terms of principles.
c) Why is AJM not suitable for UCM processes?
d) Why WJM is not suitable for brittle materials? Explain.
e) Name some of the tool material used in EDM?
f) What is the dielectric fluids commonly used in EDM process?
g) Explain the principle of Laser beam?
h) Distinguish between thermal and Non-thermal process in EBM process?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

PEC-ME-703B PRODUCTION PLANNING & CONTROL

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Explain the scope of production planning and control. (8)
   b) Explain different types of production systems and differentiate between them. (7)

   (OR)

   c) Distinguish between production planning and production control and state their objectives. (8)
   d) Discuss organization of Production planning and control department. (7)
2. a) Derive the expression for EOQ when the demand of the item is uniform, the production rate is infinite and no stocks out are allowed. (8)
   b) Explain the various elements of JIT. (7)

   (OR)

   c) What is meant by VED analysis? What is its significance? (7)
   d) Alpha industry estimates that it will sell 12000 units of its product for the forthcoming year. The ordering cost is Rs. 100 per order and the carrying cost per unit per year is 20% of the purchase price per unit. The purchase price per unit is Rs.50.Find i) Economic Order quantity, ii) No. of orders per year and iii) Time between successive orders. (8)
3. a) Define routing and its significance. Explain about the important components of routing sheets? (8)
   b) What is aggregate planning? Write its functions, merits and demerits. (7)

   (OR)

   c) Explain various functions of Routing. (8)
   d) Bring out any four differences between scheduling and loading. (7)
4. a) Explain Types of scheduling? What is the significance of Gantt Charts? (8)
   b) Discuss in detail the sequential steps involved in dispatching. (7)

   (OR)

   c) Bring out any four differences between scheduling and loading. (7)
   d) Explain the applications of computer in production planning and control. (8)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) List out the various functions of production planning and control
b) What are the needs for PPC?
c) What is the importance of forecasting?
d) What are the differences between short term and long term forecasting?
e) What is meant by inventory control?
f) State the costs associated with inventory problems.
g) Define line balancing.
h) Explain routing procedure

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B Tech Mechanical Engineering VI-I Semester

PEC-ME-703C MECHANICAL VIBRATIONS

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

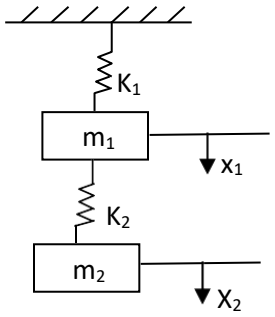
Answer All Questions

1. a) Discuss in detail what are main causes of vibration? (7)
   b) Derive an expression for vibration response of a single degree of freedom system if the damping Provided is over damped system? (8)

   (OR)

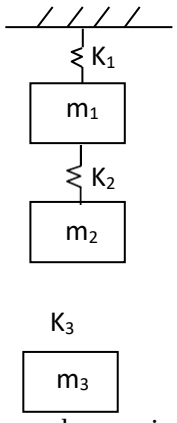
   c) Define the following terms? (8)
   I. Periodic motion
   II. Fundamental mode of vibration
   III. Degree of freedom
   IV. Simple harmonic motion

   d) Derive an expression for vibration response of a single degree of freedom system if the damping Provided is under damped system. (7)
2. a) Find the normal modes of the system shown in Fig. 1.Assume k1=k2=k and m1=m2=m (15)



   (OR)

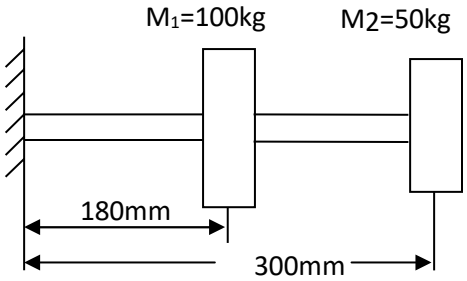
   b) Determine the natural frequencies and mode shapes of the system shown in the Fig.2. Assume m1=m2=m3=m and k1=k2=k3=k (15)



3. a) Explain sub harmonic and super harmonic and super harmonic oscillations? (15)

   (OR)

   b) Find the lowest natural frequency of vibration of system shown in Fig.3 by Rayleigh's method. Assume E= $1.96X10^{11} N/m^2$, I=$4X10^{-7} m^4$. (15)



4. a) What are the principles on which a Vibrometer and an accelerometer are based? Explain (15)

(OR)

b) Discuss Seismic instrument with help of a sketch? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) What is the difference between damped and undamped system?
b) What is meant by forced vibration & free vibration?
c) Define logarithmic decrement?
d) Write a short note on control of vibrations?
e) Write Lagrange's equation?
f) Write some examples of nonlinear vibrations?
g) Define stability of equilibrium states?
h) Brief note on vibration nomograph?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

OEC-ME-704A NON DESTRUCTIVE EVALUATION

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) State the principle of Radiographic test and what are the safety aspects of test? (7)
   b) Explain importance of NDT over Destructive Testing methods. (8)
   (OR)
   c) Explain the high sensitivity eddy current testing techniques with necessary Sketches. (7)
   d) What are the limitations of eddy current tests? (8)
2. a) State and explain the principle and working X -rays equipment. (7)
   b) Draw the Ultrasonic testing flaw detector architecture? Explain (8)
   (OR)
   c) Explain the design of ultrasonic transducers with suitable sketches. (8)
   d) State the principle of wave propagation, reflection in ultrasonic test. (7)
3. a) Write the procedure for liquid penetrant test with a suitable example. (8)
   b) Describe the different field of application of liquid penetrant test. What are its limitations? (7)
   (OR)
   c) Explain IR imaging in aerospace applications? (7)
   d) Explain Thermo mechanical behavior of materials? (8)
4. a) Explain the method for NDE for pressure vessels. Discuss the test methods. (7)
   b) Describe the NDE applications for offshore gas and petroleum projects. (8)
   (OR)
   c) Explain Industrial application of NDET visual examination? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) Classify various methods of Non-destructive tests?
b) List the main components of ultrasonic method.
c) Define the sensitivity related to penetrant flow detection.
d) What is the sensitivity related with penetrant flow detection.
e) Identify the instrumentation of eddy current testing.
f) State the principle behind acoustic emission technique?
g) What are the applications of Eddy current test?
h) What is the significance thermo graphic testing method?
i) Differentiate X rays and Gamma rays.

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

OEC-ME-704B ADDITIVE MANUFACTURING

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Compare and explain the differences between conventional machining and rapid prototyping. (7)
   b) Explain with a neat sketch the working principle of Stereo-lithography (SLA) process with advantages and disadvantages. (8)

   (OR)

   c) Compare RP technology with CNC technology. (7)
   d) Briefly explain the stereo lithography process with neat sketch and what are the process parameters of SLA system that influence the part quality? (8)
2. a) Explain with a neat sketch the working principle of FDM process. (7)
   b) List out the applications, advantages and disadvantages of laminated object manufacturing (LOM). (8)

   (OR)

   c) What are the various LOM materials and their typical applications? (8)
   d) How FDM used in Rapid prototyping? What are the applications of FDM models? (7)
3. a) Demonstrate the applications of SLS. (8)
   b) In detail explain about process details and machine details of 3-D printing. (7)

   (OR)

   c) Explain with a neat sketch the working principle of Selective Laser Sintering process. (7)
   d) Describe the working principle of three dimensional printing along with its advantages. (8)
4. a) What is rapid tooling? Compare rapid tooling with conventional tooling. (7)
   b) What are the steps involved in production of inserts using 3D Keltool process. (8)

   (OR)

   c) Which rapid tooling techniques are best suited for production of ceramic parts. Explain any one? (8)
   d) Classify indirect rapid tooling method and explain any one briefly. (7)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) List out the advantages of Rapid prototyping.
b) Explain the usage of LOM tools.
c) Enumerate the specifications of SLS machine.
d) What do you understand from spray metal deposition?
e) What is the consequence of building invalid tessellated model?
f) Mention RP applications in aerospace industry.
g) Write about RP Newly proposed formats.
h) Mention RP applications in biomedical industry

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

OEC-ME-704C CONCURRENT ENGINEERING

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) With the help of an example, explain the implementation of Concurrent Engineering in product development. (15)

(OR)

b) What is Design methodology? Explain in detail about Collaborative Product Development? (8)

c) Explain the role of CAD/CAM in Concurrent Engineering? (7)

2. a) Explain various Technologies to be integrated in Concurrent Engineering. (7)

b) What are the fundamental considerations for Computer optimized manufacturing? (8)

(OR)

c) Explain Failure Mode & Effect Analysis of CE? (15)

3. a) Explain X –Taguchi's Robust Design for Concurrent Engineering? (8)

b) Describe the processes related to product development in Simultaneous Design. (7)

(OR)

c) How Data base Management system is different from Management Information system? (8)

d) Mention the tools used in managing Concurrent Engineering. (7)

4. a) Explain the roles and responsibilities in Concurrent Engineering? (15)

(OR)

b) Explain Design, development & management for JIT? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) Write a brief note on Concurrent Engineering?

b) Write a brief note on Product life cycle?

c) What are the objectives CE?

d) What is purpose of design of economics in CE?

e) Define Project time management?

f) What are the Limitations of team?

g) Define need and utility?

h) Write a brief note on Pugh process?

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B Tech Mechanical Engineering VI-I Semester

OEC-ME-705A CRYOGENIC ENGINEERING

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. (a) Explain the various properties of Helium IV? (8)
   (b) Explain how the ultimate and yield strengths of engineering materials change with cryogenic temperature? (7)

   (OR)

   c) Explain the working of Precooled Linde Hampson System? Derive the expression for liquid yield for the precooled system. (15)
2. a) Discuss the instrumentation systems used in cryogenic applications. (7)
   b) With neat sketch explain any three types of heat exchangers used in cryogenic systems. (8)

   (OR)

   c) What is Debye characteristic temperature and super conductivity? (7)
   d) Explain the application of cryogenics in the field of electronics industry? (8)
3. a) Explain the working of i) Turbine flow meter ii) Vapour pressure thermometer? (15)

   (OR)

   b) Discuss the instrumentation systems used in cryogenic applications. (7)
   c) With neat sketch explain any three types of heat exchangers used in cryogenic systems. (8)
4. a) With a neat sketch and T-s diagram explain the working of a Claude refrigeration system. Derive an expression for COP assuming that expander work is utilized to compress the gas. (8)
   b) Draw the T-s diagram and derive an expression for COP of a thermodynamically ideal isobaric source cold - gas refrigerator. (7)

   (OR)

   c) Explain the working of Claude refrigerator. Derive an expression for COP assuming that the expander work is utilized to compressor the gas? (8)
   d) Explain the working of a dilution refrigerator with neat schematic. (7)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) Discuss any three applications of cryogenics in space technology?
b) Explain i) Meissonier effect ii) Fountain effect
c) Explain why the simple Linde-Hampson system does not work for gases such as neon, hydrogen and helium?
d) Define super fluidity?
e) With the help of a neat sketch, explain the magnetic cooling process?
f) What is meant by Joule Thompson coefficient?
g) List out types of containers?
h) Draw and explain the T-P diagram for a real gas.

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B Tech Mechanical Engineering VI-I Semester

OEC-ME-705B TOOL DESIGN

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) What is meant by locating? Explain the principle of 3-2-1 location with a neat sketch. (7)
   b) With the help of neat sketches explain the various clamping devices in use. (8)
   (OR)
   c) What are the advantages of using grey cast iron as material for one main body of Jigs & fixtures? (7)
   d) What is the need of chip – breakers on the single point cutting tool and sketch various chip – breakers used in practice? (8)
2. a) Sketch a Slab – milling fixture used in practices & mention its location and clamping. (15)
   (OR)
   b) Explain Design and development of Jigs and fixtures for simple components. (15)
3. a) Explain Design and development of cutting, forming and drawing dies? (15)
   (OR)
   b) Sketch and explain in various bending and forming dies used to obtain various shapes. (15)
4. a) Explain Taylor's principles of gauge design? (15)
   (OR)
   b) Explain Design steps and design of plug & ring gauge? (15)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) Write a short note on Analysis of clamping forces?
b) Define Rack & Pinion?
c) Write about general principles of lathe?
d) Brief note on Press working terminology?
e) What are the Elements of design of limit gauge?
f) Write a short note on gauge tolerances?
g) What is the purpose of Tool Design for Numerically Controlled Machine Tools?
h) Write a short note on Taylor's principles of gauge design?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

OEC-ME-705C SUPPLY CHAIN MANAGEMENT

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) What is Supply Chain Relationship? (7)
   b) Why is it important for the success of Supply Chain Management? (8)

   (OR)

   c) Explain focus areas in Supply Chain Management. (8)
   d) What is CRM? Explain customer driven supply chain. (7)
2. a) Explain various Sourcing and transportation decisions in Supply Chain Management. (8)
   b) What is internal Supply Chain Management? Explain its importance. (7)

   (OR)

   c) Explain Role of sourcing & Role of Transportation? (15)
3. a) Explain Planning and Managing Inventories? (15)

   (OR)

   b) What do you understand by economies of scale in supply chain? (15)
4. a) Explain Role of IT, E-business in SCM? (15)

   (OR)

   b) What is benchmarking? (7)
   c) Explain its significance in logistics and supply chain management. (8)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) What is SCM?
b) Explain the role of CRM in SCM.
c) What are the focus areas in SCM?
d) Explain Activity Based Costing.
e) Brief note on Multi echelon inventory?
f) What is the Facilities of Supply chain drives?
g) Brief note on Evolution & Key concepts of SCM?
h) What do you mean by global logistics?

ADIKAVI NANNAYA UNIVERSITY:: RAJAMAHENDRAVARAM

B Tech Mechanical Engineering VI-I Semester

HSMC-ME-706 INDUSTRIAL ENGINEERING & MANAGEMENT

(MODEL QUESTION PAPER)

Time: 3Hours **Max.Marks:75**

SECTION-A

Answer All Questions

1. a) Describe the nature and importance of management in modern business organization. (8)
   b) Explain the system approach and contingency approach to management. (7)

   (OR)

   c) Discuss about the functions of management. (7)
   d) What is productivity? What are the methods that are used to measure productivity? (8)
2. a) Explain different types of plant layout. (8)
   b) What are the symptoms of bad layout? (7)

   (OR)

   c) What do you mean by optimal design in plant layout? (7)
   d) Briefly discuss the factors to be considered for the selection of a location for a factory construction. (8)
3. a) State the differences between method study and work measurement with their objectives. (7)
   b) Explain the need and procedure for conducting work sampling study. (8)

   (OR)

   c) What are the techniques of work study and explain its significance. (8)
   d) What are the tools for recording information about method study? (7)
4. a) Define personnel management. Enumerate its importance in business organization. Also state its characteristics. (8)
   b) Enumerate various steps involved in job evaluation procedure. (7)

   (OR)

   c) The following table gives the coded measurement obtained from 20 subgroups of 5 each:

Subgroups No.	Statistics	Subgroups No.	Statistics
1	-1,2,1,0,1	11	0,1,-3,2,1
2	2,0,1,0,1	12	2,1,-1,0,0
3	1,1,0,0,1	13	0,1,-3,2,1
4	2,1,0,-1,0	14	0,0,-1,0,1
5	1,-1,0,0,-1	15	-1,2,1,1,2
6	1,-1,2,0,2	16	1,-1,2,0,2
7	-1,-1,0,-2,1	17	2,1,-1,0,0
8	1,1,2,-1,0	18	2,0,1,0,1
9	2,1,-1,0,0	19	0,1,1,-1,1
10	-2,1,-2,2,1	20	3,-3,1,1,1

   i. Construct the $\bar{X}$ and R charts and plot the points on the chart
   ii. What will be the control limits on $\bar{X}$ and R charts for immediate future?
   iii. Estimate the value of σ. (15)

SECTION-B

5. Answer any five Questions **5X3 = 15**

a) Define Industrial Engineering.
b) What are the objectives of plant maintenance?
c) Explain the term PMTS.
d) State the importance of Quality control.
e) What is profit sharing?
f) State Fulkerson's rule for numbering the nodes in a network.
g) What is scientific management and explain its importance.
h) What is maintenance and why it is important in manufacturing.