Second Year Engineering

Third Semester								
	Theory					Practical		
Code	Course Name	Hours/ week L/T	Credit Theory	University Marks	Internal Evaluation	Hours/ Week L/T	Credit Practical	Marks
PC	Mechanics of Solids	3-0	3	100	50	2	1	50
PC	Introduction to Physical Metallurgy &Engg Materials	3-0	3	100	50			
PC	Fluid Mechanics & Hydraulics Machines	3-0	3	100	50	2	1	50
PC	Engg. Thermodynamics	3-0	3	100	50	2	1	50
PC	Kinematics & Dynamics Machines	3-1	4	100	50	2	1	50
HS	Engineering Economics/ Organizational Behavior	2-1	3	100	50			
Total		19	19	600	300	8	4	200
Total Marks: 1100								
Total Credits: 23								

	PME3I101 MECHANICS OF SOLID (C201) *Theory L/T (Hours per week): 3/0, Credit: 3*	
MOS (C201)	C201.1	Understand the concept of stress.
	C201.2	Solve problem on biaxial state of stress and strain
	C201.3	Solve problem on Shear force, bending moment and bending of beam.
	C201.4	Analyse and solve problem on deflection of beam.
	C201.5	Analyse theory of column and struts.
	C201.6	Design of helical springs and torsion.

MODULE - I (10 Lectures)

1. Concept of Stress:

Load, Stress, Principle of St.Venant, Principle of Superposition, Strain, Hooke's law, Modulus of Elasticity, Stress-Strain Diagrams, Working Stress, Factor of safety, Strain energy in tension and compression, Resilience, Impact loads, Analysis of Axially Loaded Members : Composite bars in tension and compression - temperature stresses in composite rods, Concept of Statically indeterminate problems.

Shear stress, Complimentary shear stress, Shear strain, Modulus of rigidity, Poisson's ratio, Bulk Modulus, Relationship between elastic constants. 2. Biaxial State of Stress : Analysis of Biaxial Stress.Plane stress, Principal plane, Principal stress, Mohr's Circle for Biaxial Stress. Stresses in thin cylinders and thin spherical shells under internal pressure, wire winding of thin cylinders.

MODULE - II (10 Lectures)

3. . Biaxial State of Strain:

Two dimensional state of strain, Principal strains, Mohr's circle for strain, Calculation of principal stresses from principal strains, Strain Rossette. 4. Shear Force and Bending Moment Diagrams: Shear force and bending moment. Types of load and Types of support. Support reactions, Relationship between bending moment and shear force, Point of inflection. Shear Force and Bending Moment diagrams.

5. Bending of Beams: Theory of simple bending of initially straight beams, Bending stresses, Shear stresses in bending, Distribution of normal and shear stress, Composite beams.

MODULE - III (8 Lectures)

6. Deflection of Beams : Differential equation of the elastic line, Slope and deflection of beams by integration method and area - moment method. 7. Theory of Columns: Long columns, Euler's column formula, Lateral buckling, Critical Load, Slenderness ratio, Eccentric loading of short column

MODULE - IV (8 Lectures)

8. Torsion: Torsion in solid and hollow circular shafts, Twisting moment, Strain energy in shear and torsion, strength of solid and hollow circular shafts. Strength of shafts in combined bending and twisting, Close - Coiled helical springs.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	2	2	2	3	3	3		3	3	3

Contents beyond Syllabus:

1. Introduction to Mechanics of Composite Materials: Lamina and Laminates
2. Theorem of virtual work

TEXT BOOKS

1. Elements of Strength of Materials by S.P.Timoshenko and D.H.Young, Affiliated East West Press
2. Strength of Materials by G. H. Ryder, Macmillan Press
3. Strength of Materials by R.Subramaniam, Oxford University Press

REFERENCE BOOKS

1. Mechanics of Materials by Beer and Johnston, Tata McGraw Hill
2. Mechanics of Materials by R.C.Hibbeler, Pearson Education
3. Mechanics of Materials by William F.Riley, Leroy D.Sturges and Don H.Morris, Wiley a. Student Edition
4. Mechanics of Materials by James M. Gere, Thomson Learning
5. Strength of Materials by James M. Gere and Barry J. Goodno, Cengage Learning
6. Strength of Materials by S.S.Rattan, Tata McGraw Hill
7. Engineering Machanics of Solids by Egor P. Popov, Prentice Hall of India

	PME3I001 INTRODUCTION TO PHYSICAL METALLURGY AND ENGINEERING MATERIALS (C202) *Theory L/T (Hours per week): 3/0, Credit: 3*	
IPME (C202)	C202.1	Understand the classification, Engineering properties, Metallic Bond and common Crystal Structures of Engineering Materials.
	C202.2	Learn about concept of Plastics deformation, Cold Working and Hot working, re- crystallization and grain Growth.
	C202.3	Understand the Alloy Formation-Their Types, Solid Solutions and Solubility.
	C202.4	Learn about Allotropic transformation-Lever rule, Interpretation of solidification behaviours and microstructure of different alloys
	C202.5	Analyse Phase diagram, Steel -Cast iron,T.T.T. diagram: concept of heat treatment of steels
	C202.6	Understand Optical properties of Materials, about plastics, ceramics and composite materials.

MODULE-I (08 Lectures)

Classification of Engineering Materials, Engineering properties of materials. Characteristicproperty of metals, bonding in solids, primary bonds like ionic, covalent and metallic bond,crystal systems, common crystal structure of metals, representations of planes anddirections in crystals, atomic packing in crystals, calculation of packing density, voids incommon crystal structures and imperfections crystals.

MODULE-II (08 Lectures)

Concept of plastic deformation of metals, critical resolve shear stress, dislocation theory,deformation by slip and twin, plastic deformation in polycrystalline metals, yield pointphenomenon and related effects, concept of cold working preferred orientation. Annealing ;recovery; recrystallization and grain growth; hot working.Concept of alloy formation, types of alloys, solid solutions, factors governing solids solubilityviz. size factor, valency factor, crystal structure factor and chemical affinity factor; orderdisordertransformation.

MODULE-III (10 Lectures)

Binary phase diagrams (a) Isomorphism system, (b) Eutectic system, (c) Peritectic system,(d)Eutectoid system and (e) Peritectoid system. Allotropic transformation. Lever rule andits application, Interpretation of solidification behaviors and microstructure of differentalloys belonging to those systems, Effect of non-equilibrium cooling, coring andhomogenization.Iron-cementite and iron-graphite phase diagrams, microstructure and properties ofdifferent alloys (alloy steels; stainless steel, tool steel, HSS, high strength low alloy steel)types of cast iron, their microstructures and typical uses. Specification of steel.T.T.T. diagram: concept of heat treatment of steels i.e. annealing, normalizing, hardening andtempering; microstructural effects brought about by these processes and their influences onmechanical properties; factor affecting hardenability.

MODULE-IV (10 Lectures)

Optical properties of Materials: Scattering, Refraction, Theory of Refraction and absorption,Atomic Theory of optical properties. Lasers, Optical fibres- Principle, structure, applicationof optical fibres.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Contents beyond syllabus

1. Advances in Material technology
2. Recyclable engineering materials
3. Functionally graded materials

Text Books:

1. Introduction to Physical Metallurgy by Avner, Tata McGraw Hill

2. Materials Science and Engineering by W.D.Callister, Wiley and Sons Inc.

3. Physical Metallurgy: Principles and Practice by Ragahvan, PHI.

Reference Books

1. Engineering Physical Metallurgy and Heat Treatment by Y.Lakhtin, Mir Publisher,Moscow.
2. Elements of Material Science and Engineering, L.H.VanVlack, Addison Wesley
3. Materials Science and Engineering by V.Raghavan, Prentice Hall of India Pvt.Ltd.
4. Elements of Materials Science & Engineering by Van Vlack, Pearson
5. Mechanical Metallurgy by Dieter, Tata MacGraw Hill
6. Composite Material science and Engineering by K. K. Chawla, Springer
7. Material Science and Metallurgy, by U. C. Jindal, Pearson

	PME3I102 FLUID MECHANICS AND HYDRAULIC MACHINES (C203) *Theory L/T (Hours per week): 3/0, Credit: 3*	
FM&HM (C203)	C203.1	Understand the fundamentals of fluid mechanics and fluids.
	C203.2	Determine the basic equation to find the force on submerged surfaces.
	C203.3	Calculate the centre of buoyancy of floating body, and the, velocity and acceleration of a fluid.
	C203.4	Learn about fluid kinematics and fluid dynamics.
	C203.5	Differentiate between hydraulic turbines and reaction turbines.
	C203.6	Analyse Centrifugal pumps an positive displacement pumps.

Module I (12 Lectures)

Introduction: Scope of fluid mechanics and its development as a sciencePhysical property of Fluid: Density, specific gravity, specific weight, specific volume,surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluidclassification.

Fluid statics: Pressure, Pascal's Law, Pressure variation for incompressible fluid,atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure,manometer.Hydrostatic process on submerged surface, force on a horizontal submerged planesurface, force on a vertical submerged plane surface.Buoyancy and floatation,Archimedes' principle, stability of immersed and floating bodies, determination ofmetacentric height.

Module II (14 Lectures)

Fluid kinematics: Introduction, description of fluid flow, classification of fluid flow. Reynold's number, Acceleration of fluid particles, flow rate and continuity equation, differential equation of continuity,Mathematical definitions of irrational and rotational motion. Circulation, potential function and stream function. Flow net

Fluid dynamics : Introduction to N-S equation, Euler's equation along a streamline, energy equation, Bernoulli's equation and its application to siphon, venturimeter, orificemeter, pitot tube.Flow in pipes and ducts: Loss due to friction, Minor energy losses in pipes Hydraulic Gradient Line (HGL), Total Energy Line (TEL), Power transmission in the fluid flow in pipes, fluid flow in pipes in series and parallel. Flow through nozzles.

Module III (8 Lectures)

Hydraulic turbines: Classification, Impulse and Reaction turbine; Tangential, Radial and axial turbine.Impulse turbine, Pelton wheel, bucket dimensions, number of buckets in pelton wheel, efficiency and performance curves.

Reaction Turbines: Francis turbine and Kaplan turbine, velocity triangle and efficiencies, performance curve. Function of draft tube and casing cavitation

Module IV (06 Lectures)

Centrifugal Pump: constructional features, vane shape, velocity triangles, Efficiencies, Multi stage centrifugal pumps, Pump Characteristic, NPSH and Cavitation.

Positive displacement pumps: Reciprocating Pump, Working principle, Discharge, work done and power requirement, Slip, Indicator diagram

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Text Books

1. Fluid Mechanics, Y A Cengel, TMH
2. Fluid Mechanics and Hydraulic Machines, Modi& Seth
3. Fluid Mechanics, A.K. Mohanty, PHI
4. Fluid Mechanics and Machinery, Mohd. Kareem Khan, OXFORD

Reference Books:

1. Fluid Mechanics and Machinery, CSP Ojha and P.N. Chandramouli, OxfordUniversity Press
2. Fluid Mechanics and Fluid Machines by A.K.Jain, Khanna Publishers
3. Introduction to Fluid Mechanics and Fluid Machines, S.K. Som and G. Biswas,TMH
4. Introduction to Fluid Mechanics, Fox, McDonald, Willey Publications
5. Fluid Mechanics by Kundu, Elsevier
6. An Introduction to Fluid Dynamics, G.K.Batchelor, Cambridge University Press
7. Engineering Fluid Mechanics by Gardeet. al., Scitech
8. First course in Fluid Mechanics by Narasimhan, University press
9. Fluid Mechanics by J.F.Douglas, J.M.Gasiorek, J.A.Swaffield and L.B.Jack, PearsonEducation
10. Fluid Mechanics and Machines, SukumarPati, TMH

	PME3I103 ENGINEERING THERMODYNAMICS (C204) *Theory L/T (Hours per week): 3/0, Credit: 3*	
ETD (C204)	C204.1	Knowledge about 1st law and 2nd law of Thermodynamics.
	C204.2	Solve problem on vapour power cycles.
	C204.3	Analyse and solve problem on gas power cycles.
	C204.4	Solve problem on refrigeration cycle.
	C204.5	Understand the thermodynamic property relations.
	C204.6	Solve problem on reciprocating air compressor.

Module-I (10 Lectures)

1. Review of First and Second laws: First law analysis of unsteady flow control volumes, Entropy generation ,Entropy balance for closed systems and steady flow systems, Available energy, Quality ofenergy, Availability for non flow and flow process, Irreversibility, Exergy balance, Second law efficiency.

Module- II (12 Lectures)

2. Vapour Power Cycles: The Carnot vapor cycle and its limitations, The Rankine cycle, Means ofincreasing the Rankine cycle efficiency, The reheat cycle, The regenerative feed heating cycle, Cogeneration (Back pressure and Pass-out turbines), Combinedcycle power generation systems, Binary vapour cycles.

3. Gas Power Cycles: Air standard cycles- Otto, Diesel, Dual Combustion and Brayton cycles, TheBrayton cycle with non-isentropic flow in compressors and turbines, The Brayton cycle with regeneration, reheating and intercooling, Ideal jet propulsion cycles.

Module- III (12 Lectures)

4. Refrigeration cycles: Reversed Carnot cycle, Reversed Brayton cycle (Gas refrigeration system), The vapor compression cycle, The vapor absorption cycle.

5. General Thermodynamic property relations: The Maxwell relations, The Clapeyron equation, The TdS relations, Isothermal compressibility and volume expansivity, The Joule-Thomson coefficient.

Module- IV (06 Lectures)

6. Reciprocating Air Compressors: Introduction (Uses of compressed air), The reciprocating cycle neglecting and considering clearance volume, Volumetric efficiency and its effect on compressor performance, Limitations of single stage compression, Multistage compression and intercooling, Optimum intercooler pressure, Performance and design calculations of reciprocating compressors, Air motors.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Contents beyond Syllabus

1. Stoichiometric analysis
2. Energy exergy analysis of CI engine
3. Analysis of CI engine fuelled with Bio fuel

Text Books

1. Engineering Thermodynamics by P. K. Nag, Publisher: TMH
2. Engineering Thermodynamics by P. Chattopadhyay, OXFORD
3. Fundamentals of Thermodynamics by Sonntag, Borgnakke, Van Wylen, John Wiley & Sons
4. Fundamentals of Engineering Thermodynamics by E. Rathakrishnan, PHI

Reference

1. Engineering Thermodynamics by M. Achyuthan, PHI
2. Engineering Thermodynamics by Y.V.C. Rao, University Press
3. Thermodynamics and Thermal Engineering by Kothandaraman & Domkundwar, DhanpatRai
4. Applied Thermodynamics by P.L.Ballaney, Khanna Publishers
5. Steam Tables in SI Units by Ramalingam, Scitech
6. Steam Tables by C. P. Kothandaraman, New Age International

	PME3I104 KINEMATICS AND DYNAMICS OF MACHINES (C205) *Theory L/T (Hours per week): 3/1, Credit: 4*	
KDM (C205)	C205.1	**Understanding** the mechanisms with kinematics of motion.
	C205.2	**Description** of gear terminology and determination of speed ratio of gear train
	C205.3	**Determination** of inertia and engine force analysis
	C205.4	**Calculation** of different types of friction effects
	C205.5	**Learn** about different friction drives for power transmission
	C205.6	**Analyze** different types of brake and dynamometer

Module – I : (10 Lectures)

1. Kinematic fundamental: Basic Kinematic concepts and definitions, Degrees of freedom, Elementary Mechanism : Link, joint, Kinematic Pair, Classification of kinematic pairs, Kinematic chain and mechanism, Gruebler's criterion, Inversion of mechanism, Grashof criteria, Four bar linkage and their inversions, Single slider crank mechanism, Double slider crank mechanism and their inversion. Transmission angle and toggle position, Mechanical advantage.

2. Kinematic Analysis : Graphical analysis of position, velocity and acceleration of four bar and Slider crank mechanisms. Instantaneous centre method, Aronhold-Kennedy Theorem, Rubbing velocity at a Pin-joint.Coriolis component of acceleration.

Module – II : (10 Lectures)

3. Mechanism Synthesis : Graphical methods of synthesis, Chebychev spacing for precision positions, Freudenstein's equation applicable to four bar linkages.

4. Mechanism Trains: Gear Terminology and definitions, Analysis of mechanism Trains: Simple Train, Compound train, Reverted train, Epicyclic train and their applications.

Module – III : (8 Lectures)

5. **Combined Static and Inertia Force Analysis:** Inertia forces analysis**,** velocity and acceleration of slider crank mechanism by analytical method, engine force analysis - piston effort, force acting along the connecting rod, crank effort. dynamically equivalent system, compound pendulum, correction couple.

6. Friction Effects: Screw jack, friction between pivot and collars, single, multi-plate and cone clutches, anti friction bearing, film friction, friction circle, friction axis,

Module – IV : (8 Lectures)

7. Flexible Mechanical Elements: Belt, rope and chain drives, initial tension, effect of centrifugal tension on power transmission, maximum power transmission capacity, belt creep and slip.

8. Brakes &Dynamometers : Classification of brakes, Analysis of simple block, Band and internal expanding shoe brake, Braking of a vehicle. Absorption and transmission dynamometers, Prony brake, Rope brake dynamometer, belt transmission, epicyclic train, torsion dynamometer.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Beyond syllabus

1. Automatic Control

Text Books

1. Kinematics and Dynamics of Machinery by R L Norton, Tata McGraw Hill
2. Theory of Machines and Mechanisms by John J. Uicker Jr., Gordon R. Pennock and Joseph E. Shigley, Oxford University Press
3. Theory of Machines by S.S.Rattan, Tata McGraw Hill

Reference

1. Theory of Machines by Thomas Bevan, CBS Publications
2. Kinematics and Dynamics of Machinery by Charles E. Wilson and J. Peter Saddler, Pearson Education
3. Mechanism and Machine Theory by J.S. Rao and R.V. Dukipatti, New Age International.
4. Theory of Mechanisms and Machines by A. Ghosh& A. K. Mallick, East West Press.
5. Kinematics and Dynamics of Machines by G.H. Martin, McGraw-Hill.
6. Theory of Machines and Mechanisms by P.L.Ballaney, Khanna Publishers
7. Theory of Mechanisms and Machines by C.S.Sharma and K.Purohit, PHI.

	PEK3E001 ENGINEERING ECONOMICS (C206) *Theory L/T (Hours per week):2/1, Credit: 3*	
Engineering Economics (C206)	C206.1	Understand general concepts of micro and macro-economic including theory of demand, Law of demand, elasticity of demand etc.
	C206.2	Distinguish between Micro economics and Macro Economics.
	C206.3	Solve cost and revenue based problems using Break Even Analysis approach.
	C206.4	Analyse the functioning of Banks and concepts of Inflation.
	C206.5	Discuss banking structures and various financial systems.
	C206.6	Calculate the depreciation using different methods like Straight line method, Declining balance method.

Module I (12 hours)

Engineering Economics- Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics.Demand- Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand & its measurement (Simple numerical problems to be solved), Supply-Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to be solved).

Production-Production function, Laws of returns: Law of variable proportion, Law of returns to scale

Module II (12 hours)

Cost and revenue concepts, Basic understanding of different market structures, Determination of equilibrium price under perfect competition (Simple numerical problems to be solved), Break Even Analysis-linear approach (Simple numerical problems to be solved).Banking -Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank.Inflation-Meaning of inflation, types, causes, measures to control inflation.National Income-Definition, Concepts of national income, Method of measuring national income.

Module III (12 hours)

Time value of money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.Evaluation of engineering projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects.Depreciation- Depreciation of capital assert, Causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method), After tax comparison of project.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		2	3	3

Text Books

1. Riggs, Bedworth and Randhwa, “Engineering Economics”, McGraw Hill Education India
2. Principles of Economics, DevigaVengedasalam; KarunagaranMadhavan, Oxford University Press.
3. Engineering Economy by William G.Sullivan, ElinM.Wicks, C. PatricKoelling, Pearson
4. R.PaneerSeelvan, “ Engineering Economics”, PHI
5. Ahuja,H.L., “Principles of Micro Economics” , S.Chand& Company Ltd
6. Jhingan,M.L., “Macro Economic Theory”
7. Macro Economics by S.P.Gupta, TMH

	PME3l101MECHANICS OF SOLID LABORATORY (C207) *Practical L/T/P (Hours per week): 2, Credit: 1*	
MOS LAB (C207)	C207.1	Determine tensile strength, compressive strength , bending strength and double shear test by using a UTM machine.
	C207.2	Determine the impact strength and hardness strength of a material.
	C207.3	Determine the modulus of rigidity modulus and fatigue strength of a given material.
	C207.4	Estimate the spring constant under tension and compression.
	C207.5	Measurement of stress and strain by using strain gauge & strain rosette.

Laboratory Experiments

1. Determination of tensile strength of materials by Universal Testing Machine
2. Determination of compressive strength of materials by Universal Testing Machine
3. Determination of bending strength of materials by Universal Testing Machine
4. Double shear test in Universal Testing Machine
5. Determination of Impact strength of material (Charpy and Izod)
6. Determination of Hardness strength of materials (Brinnel, Rockwell and Vickers)
7. Determination of Rigidity modulus of material
8. Determination of Fatigue strength of material
9. Estimation of Spring Constant under Tension and Compression.
10. Load measurement using Load indicator, Load Cells.
11. Strain measurement using Strain Gauge.
12. Stress measurement using strain rosette.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	2	3	3	2	3	3		3	3	3

Experiment beyond syllabus:

1. Brinel hardness Test
2. Shear strength Test

	PME3l102 FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY (C208) *Practical (Hours per week): 2, Credit: 1*	
FMHM LAB (C208)	C208.1	Determine metacentric height & analyse stability of floating bodies.
	C208.2	Determine Cv& Cd of orifices.
	C208.3	Determine Force exerted on stationary plate held normal to jet.
	C208.4	Estimate performance parameters of a given Centrifugal and Reciprocating pump by conducting test.
	C208.5	Determine performance parameters of a given pelton & Francis turbine and experiments on flow through pipes.

Laboratory Experiments (Minimum 8 experiments)

1. Determination of Metacentric Height and application to stability of floating bodies.

2. Determination of Cv and Cd of Orifices.

3. Experiments on impact of Jets

4. Experiments on performance of Pelton Turbine

5. Experiments on performance of Francis Turbine

6. Experiments on performance of Kaplan Turbine

7. Experiments on performance of centrifugal pump

8. Experiments on performance of reciprocating pump

9. Experiments on Reynold's Apparatus

10. 12 Experiments on Flow through pipes

11. Experiments on performance of Gear pump

12. Verifications of momentum equation

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	2	3	3		3	3	3

Experiment Beyond Syllabus

1. Verification of Bernoulli Theorem
2. Experiments on Flow through Notch
3. Study of energy relationship among KE, PE and datum energy when fluid flowing through a pipe
4. Study of bourdan tube pressure gauge

	PME3l103 ENGINEERING THERMODYNAMICS LABORATORY(C209) *Practical (Hours per week): 2, Credit: 1*	
ETD LAB (C209)	C209.1	Study of cut section 2-stroke and 4-stroke petrol and diesel engine.
	C209.2	Study of steam power plant, refrigeration system and gas turbine power plant.
	C209.3	Performance analysis of reciprocating air-compressor and centrifugal compressor.
	C209.4	Performance characteristics of gear pump.
	C209.5	Measurement of steam quality using calorimeter.

Laboratory Experiments: (Minimum 8 experiments)

1. Study of Cut-Sections of 2 stroke and 4 stroke Diesel Engine.
2. Study of Cut-Sections of 2 stroke and 4 stroke Petrol Engine.
3. Study of steam power plant.
4. Study of refrigeration system.
5. Study of gas turbine power plant.
6. Performance analysis of reciprocating air-compressor.
7. Performance analysis of Centrifugal / Axial Flow compressor.
8. Determination of performance characteristics of gear pump.
9. Measurement of steam quality using calorimeter
10. Verification of Joule-Thomson coefficient.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	2	3	2	3	2	3	3		3	3	3

Experiment Beyond Syllabus

1. Measurement of dryness fration by separating Calorimeter, Throttling Calorimeter, Separating and Throttling Calorimeter.
2. Measure the Joule-Thomson Coefficient of Carbon Dioxide. Compare the Calculated value with that calculated from the equation of state.

	PME3l104-KINEMATICS AND DYNAMICS OF MACHINES LABORATORY(C210) *Practical (Hours per week): 2, Credit: 1*	
KDM LAB (C210)	C210.1	Design of working model related to kinematics of Mechanisms and dynamics of machinery.
	C210.2	Determine the radius of gyration of connecting rod and Moment of Inertia of any irregular shaped body by using TRI –FILAR / BI-FILAR System.
	C210.3	Conduct experiment on screw jack and epicyclical gear train.
	C210.4	Conduct experiment on simple / compound/reverted gear train.
	C210.5	Experiment on brake and dynamometer.

Laboratory Experiments: (Minimum 8 experiments)

1. Design of any one working model related to Kinematics of Mechanisms i.e., Module I and II.
2. Design of any one working model related to Dynamics of Machinery i.e., Module III and IV.
3. Radius of gyration of compound pendulum
4. Radius of gyration of connecting rod
5. TRI –FILAR / BI-FILAR System
6. Experiment on Screw Jack
7. Experiment on Journal Bearing Apparatus
8. Experiment/Study on clutches
9. Experiment on Epicyclic Gear Train
10. Experiments on Simple/Compound/Reverted Gear trains
11. Experiment on Dynamometer
12. Experiment on Brake
13. Experiment on Coriolis component of acceleration

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	2	3	3		3	3	3

Beyond syllabus:

1. To study various types of steering mechanism

B.Tech (Mechanical Engineering) detail Syllabus for Admission Batch 2015-16

Fourth Semester								
	Theory					Practical		
Code	Course Name	Hours/ week L/T	Credit Theory	University Marks	Internal Evaluation	Hours/ Week L/T	Credit Practical	Marks
HS	Applied Mathematics - III	3-0	3	100	50			
PC	Mechanisms & Machines	3-0	3	100	50			
PC	Basic Manufacturing Process	3-0	3	100	50	2	1	50
PC	IC Engine & Gas Turbine	3-0	3	100	50	2	1	50
PC	Mechanical Measurement, Metallurgy & Reliability	3-0	3	100	50	2	1	50
HS	Engineering Economics/ Organizational Behavior	2-1	3	100	50			
PC	Data Structure using 'C'					2	1	50
	Mechanisms & Machines					6	3	100
Total		18	18	600	300	14	7	300
Total Marks: 1200								
Total Credits: 25								

	PME3D001-APPLIED MATHEMATICS-III (C211) *(L/T: 3/0, Credit: 3)*	
Applied Mathematics-III (C211)	C211.1	Understand the concepts of Analytic functions, Complex integrations and Cauchy-Riemann equations.
	C211.2	Evaluate real integrals and learn residue integration method.
	C211.3	Explain the errors of numerical results and different types of interpolations.
	C211.4	Implement different Numerical Integration methods and find solution to ordinary differential equations.
	C211.5	Analyse Random variables and different Probability Distributions.
	C211.6	Apply Correlation analysis, Regression Analysis and Statistical hypothesis.

Module-I (15 Hours)

Probability: Probability, Random variables, Probability distributions, Mean and variance of distribution, Binomial, Poisson, and Hyper-geometric distributions, Normal and exponential distribution, Distribution of several random variables.

Statistics: Random sampling, Estimation of Parameters, Confidence Intervals, Testing of hypothesis, Acceptance sampling, Regression Analysis, Fitting Straight Lines, Correlation analysis

Module-II (15 Hours)

Partial Differential Equation: Partial differential equation of first order, Linear partial differential equation, Nonlinear partial differential equation, Homogenous and non-homogeneous partial

differential equation with constant co-efficient, Cauchy type, Monge's method, Second order partial differential equation The vibrating string, the wave equation and its solution, the heat equation and its

solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates.

Module-III (08 Hours)

Complex Analysis: Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping,

Complex integration: Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions

Module-IV (06 hours)

Power Series, Taylor's series, Laurent's series, Singularities and zeros, Residue integration method, evaluation of real integrals.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Text books:

1. E. Kreyszig," Advanced Engineering Mathematics:, Eighth Edition, Wiley India
2. B.V. Ramana, " Higher Engineering Mathematics", Tata McGraw Hill

Reference books:

1. E.B. Saff, A.D.Snider, " Fundamental of Complex Analysis", Third Edition, Pearson
2. Jay L. Devore, "Probability and Statistics for Engineering and Sciences", SeventhEdition, Thomson/CENGAGE Learning India Pvt. Ltd
3. P. V.O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi
4. Mathematical Methods by Potter Goldberg Publisher: PHI

	PME4l101-MECHANISMS AND MACHINES(C212) *(L/T: 3/0, Credit: 3)*	
M&M (C212)	C212.1	Understand the mechanisms with lower pairs and cams design.
	C212.2	Analyse turning moment diagram and flywheel.
	C212.3	Understand about governors and gyroscope.
	C212.4	Knowledge about gear.
	C212.5	Gather Knowledge about balancing of rotating components.
	C212.6	Understand the mechanisms with lower pairs and cams design.

MODULE – I (8 HOURS)

1. Mechanisms with lower pairs : Motor Vehicle Steering Gears - Davis Steering Gear &Ackermann Steering Gear, Hooke's Joint.

2. Cams Design: Fundamental law of Cam, Cam Terminology, Classification of Cams and followers, Analysis of follower motions (Displacement, velocity, Acceleration and jerk) – Simple Harmonic, Uniform Velocity and Constant Acceleration & Retardation Types, Generation of Cam Profiles by Graphical Method, Introduction on Cams with specified contours.

MODULE – II (8 HOURS)

3. Turning Moment Diagram and Flywheel: Turning moment diagram. Turning moment diagrams for different types of engines, Fluctuation of energy and fluctuation of speed.Dynamic Theory of Flywheel, Flywheel of an internal combustion engine and for a punch machine.Determination of flywheel size from Turning Moment Diagram.**4. Gears :** Theory of shape and action of tooth properties and methods of generation of standard tooth profiles, Standard proportions, Force analysis, Path of contact, Arc of contact, Contact ratio, Interference and Undercutting, Methods for eliminating Interference, Minimum number of teeth to avoid interference.

MODULE III (8 HOURS)

5. Mechanism for Control (Governors): Governors - Watt, Porter, Proell, Hartnell, Wilson-Hartnell Governor. Performance parameters: Sensitiveness, Stability, Hunting, Isochronism. Governor Effort and Power, Controlling Force & Controlling Force Curve, Friction & insensitiveness, Comparison between governor and flywheel.**6. Mechanism for Control (Gyroscope):** Introduction to Gyroscopes. Gyroscopic forces and Couple.Effect of Gyroscopic Couple on Aeroplanes, Gyroscopic stabilization of ship, Stability of Two Wheelers and Four Wheelers. Rigid disc at an angle fixed to rotating shaft.

MODULE IV (8 HOURS)

7. Balancing of rotating components and linkages: Static and Dynamic Balancing, Balancing of Single Rotating Mass by Balancing Masses in Same plane and in Different planes. Balancing of Several Rotating Masses rotating in same plane and in Different planes.Effect of Inertia Force due to Reciprocating Mass on Engine Frame, Partial balance of single cylinder engines.Primary and Secondary Balance of Multi-cylinder In-line Engines. Balancing of locomotive: variation of tractive force, swaying couple, hammer blow. Direct and Reverse Crank method of balancing for radial engines. Balancing of V-engine. Balancing machines: Pivoted-Cradle Balancing Machine.

8. Vibrations: Introduction to Mechanical Vibration – Definitions, elements of vibratory system,Longitudinal, Torsional & Transverse Systems. Differential equations and solutions of motion for a coupled spring mass system. Determination of natural frequency of vibratory systems using energy method, equilibrium method and Rayleigh's method, Free and Forced Vibration of Un-damped and Damped Single Degree Freedom Systems, Logarithmic decrement, Magnification factor, Vibration isolation and transmissibility, whirling of shafts and Evaluation of Critical Speeds of shafts.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

TEXT BOOKS

1. Theory of Machines by S.S.Rattan, Tata MacGraw Hill
2. Theory of Machines and Mechanisms (India Edition) by John J. Uicker Jr., Gordon R. Pennock and Joseph E. Shigley, Oxford University Press
3. Mechanism and Machine Theory by J.S.Rao and R.V.Dukipatti, New Age International.
4. Theory of Mechanisms and Machines by A. Ghosh& A. K. Mallick, East West Press.

REFERENCE

1. Theory of Machines by Thomas Bevan, CBS Publications.
2. Kinematics and Dynamics of Machinery by R.L.Norton, Tata MacGraw Hill
3. Kinematics & Dynamics of Machinery-Charles E. Wilson &J.PeterSaddler,Pearson Ed.
4. Theory of Mechanisms and Machines by C.S.Sharma and K.Purohit, PHI
5. Theory of Machines by Shah Jadwani, DhanpatRai
6. Theory of Machines by Abdulla Shariff, DhanpatRai
8. Theory of Machines by Sadhu Singh, Pearson Education.

	PME4l102-BASIC MANUFACTURING PROCESS(C213) *(L/T: 3/0, Credit: 3)*	
BMP (C213)	C213.1	Knowledge about the basic concept of foundry.
	C213.2	Distinguish between welding, cutting, brazing and soldering.
	C213.3	Understand about powder metallurgy process.
	C213.4	Distinguish plastic deformation in metals, rolling and forging process.
	C213.5	Distinguish between extrusion and wire drawing processes.
	C213.6	Understand about the sheet metal working and explosive forming processes.

MODULE - I (10 LECTURES)

1. Foundry :

a. Types of patterns, pattern materials and pattern allowances.

b. Molding Materials - sand molding, metal molding, investment molding, shell molding.

c. Composition of molding sand, Silica sand, Zircon sand, binders, additives, Binders - clay, binders for CO2 sand, binder for shell molding, binders for core sand.

d. Properties of molding sand and sand testing.

e. Melting furnaces - cupola, resistance furnace, induction and arc furnace.

f. Solidification of castings, design of risers and runners, feeding distance, centre line freezing resistance chills and chaplets.

g. Degasification and inoculation of metals.

h. Casting methods like continuous casting, centrifugal casting, disc casting.

i. Casting defects.

MODULE – II (8 LECTURES)

2. Welding and cutting: Introduction to gas welding, cutting, Arc welding and equipment's. TIG (GTAW) and MIG (GMAW) welding, resistance welding and Thermitwelding.Weldablity Modern Welding methods like plasma Arc, Laser Beam, Electron Beam, Ultrasonic, Explosive and friction Welding, edge preparation in butt welding. Brazing and soldering, welding defects. Destructive and non-destructive testing of castings and welding.

MODULE – III (08 LECTURES)

3. Brief introduction to powder metallurgy processes.

4. Plastic deformation of metals: Variables in metal forming and their optimization. Dependence of stress strain diagram on Strain rate and temperature. Hot and cold working of metals, classification of metal forming processes.

5. Rolling: Pressure and Forces in rolling, types of rolling mills, Rolling defects.

6. Forging: Smith Forging, Drop and Press forging, M/c forging, Forging defects.

MODULE – IV (08 LECTURES)

7. Extrusions: Direct, Indirect, Impact and Hydrostatic extrusion and their applications, Extrusion of tubes.

8. Wire drawing methods and variables in wire-drawing, Optimum dies shape for extrusion and drawing.

9. Brief introduction to sheet metal working: Bending, Forming and Deep drawing, shearing.

10. Brief introduction to explosive forming, coating and deposition methods.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Beyond syllabus:

1. Application of non-traditional Machining process
2. Application of 3-D printing
3. Alumina refining, smelting casting process

TEXT BOOKS

1. Manufacturing technology by P.N.Rao, Tata McGraw Hill publication.
2. Welding Technology by R.A. Little, TMH
3. Manufacturing Science by A.Ghosh and A K Malick, EWP

REFERENCE BOOKS

1. Fundamentals of metal casting technology by P.C. Mukherjee, Oxford PIBI.
2. Mechanical Metallurgy by Dieter, Mc-Graw Hill
3. Processes and Materials of Manufacture by R.A Lindberg, Prentice hall (India)
4. A Text Book of Production Engineering by P.C.Sharma, S.Chand

	PME4l103-INTERNAL COMBUSTION ENGINES AND GAS TURBINES(C214) *(L/T: 3/0, Credit: 3)*	
IC&GT (C214)	C214.1	Understand the basic of IC engine..
	C214.2	Analyze Thermodynamics cycles of IC engine
	C214.3	Learn about types of fuels, air fuel mixture, fuel injection, combustion and ignition in IC engines
	C214.4	Knowledge about Super charging and scavenging, cooling and lubrication systems, emission and control.
	C214.5	Solve problem on engine testing and performance.
	C214.6	Differentiate and solve problem on gas power cycle, air craft propulsion, axial flow and centrifugal compression.

MODULE - I (11 HOURS)

Introduction :Classification, Engine nomenclature, engine operating and performance parameters, Valve timing diagram of SI & CI Engines, Comparison of SI and CI engine.**Thermodynamic Analysis of cycles** :Significance of Fuel-Air & Actual cycles of I.C. engines. Comparison with Air Standard Cycles. Analysis of Fuel-Air & Actual cycles (Effect of chemical equilibrium and variable specific heats. Effect of air fuel ratio and exhaust gas dilution. Time Loss Factor, Heat Loss Factor, Exhaust Blow down, Loss Due to Gas Exchange Processes, Volumetric Efficiency, Loss due to Rubbing Friction)**Fuels :**Fuels of SI and CI engine, Fuel additives, Properties, potential and advantages of alternative liquid and gaseous fuels for SI and CI engines (biofuels, LPG and CNG) Fuel Induction Techniques in IC engines : Fuel induction techniques in SI and CI engines, Mixture Requirements at Different Loads and Speeds.**Carburetion:** Factors Affecting Carburetion, Principle of Carburetion, Simple Carburetor and its drawbacks, Calculation of the Air–Fuel Ratio, Modern Carburetors.

MODULE II (12 HOURS)

Fuel Injection: Functional Requirements of an Injection System, Classification of Injection Systems, Fuel Feed Pump, Injection Pump, Injection Pump Governor, Mechanical Governor,Pneumatic Governor, Fuel Injector, Nozzle, Injection in SI Engine, Electronic Injection Systems, Multi-Point Fuel Injection (MPFI) System, Functional Divisions of MPFI System, Injection Timing, Group Gasoline Injection System, Electronic Diesel Injection System.**Ignition :**Energy requirement for ignition, requirements of an ignition system, conventional ignition systems, modern ignition systems (TCI and CDI), firing order, Ignition timing, Spark advance mechanism,**Combustion :**Stages of combustion in SI and CI engines, effects of engine variables on flame propagation and ignition delay, Abnormal combustion, Preignition& Detonation, Theory of Detonation. Effect of engine variables on Detonation, control of Detonation. Diesel Knock & methods to control diesel knock, Requirements of combustion chambers. Features of different types of combustion chambers system for S.I. engine. (I-head, F-head combustion chambers), C.I. engine combustion chambers -Open and divided type, Air swirl turbulence-M. type combustion chamber. Comparison of various types of combustion chambers.**Super Charging &Scavenging :**Thermodynamics Cycles of supercharging. Effect of supercharging,Efficiency of supercharged engines.Methods of super charging, supercharging and scavenging of 2-stroke engines.

Module-III (8 hours)

Testing and Performances : Power, fuel & air measurement methods, Performance characteristiccurves of SI & CI engines, variables affecting performance and methods to improve engineperformance.**Cooling & Lubricating Systems, Engine Emission &Controls :**Air cooling & water coolingsystems, Effect of cooling on power output & efficiency, Properties of lubricants and different typesof lubricating system.Modern developments in IC Engines, EGR, MPFI, CRDI, GDI, HCCI, dual fuel engine, Lean burnengine, Stratified engine (basic principles).**Engine Emission and control :**Mechanism of pollutant formation and its harmful effects. Methods of measuring pollutants andcontrol of engine emission.

Module-IV (9 hours)

Gas Turbines : Introduction, Open and closed cycle gas turbines, Analysis of practical gas turbinecycle.**Air Craft Propulsion :**Analysis of Turbo Jet, Turbo Prop, Turbo fan & Ram jet engines.**Axial Flow & Centrifugal Compressor :**Basic construction of centrifugal and axial flowcompressor, Velocity diagram, performance characteristics of centrifugal and axial flowcompressor, effects of slip, surging and stalling on compressor.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	2	2	2	3	3	3		3	3	3

Content beyond syllabus

1. Cryogenic fuel
2. Emission analysis of CI engine
3. Stoichiometric analysis

Text Books:

1. IC Engines, Mathur& Sharma
2. Internal Combustion Engines, V. Ganesan, TMH, 3rd edition
3. Gas Turbines, V.Ganesan, TMH, 3rd edition

Reference books:

1. Fundamentals IC Engines, J.B.Heywood, McGraw Hill
2. A course in IC Engines, V.M.Domkundwar, Dhanpatrai and sons
3. Gas Turbines, Cohen and Roser
4. An Introduction to Energy Conversion, Vol.III, V.Kadambi and Manohar Prasad, New Age International
5. Fundamentals of Internal Combustion Engines, H.N.Gupta, PHI
6. Internal Combustion Engines, K.K.Ramalngam, Scitech Publications

	PME4I104-MECHANICAL MEASUREMENT, METROLOGY & RELIABILITY(C215) *(L/T: 3/0, Credit: 3)*	
MMM&R (C215)	C215.1	Distinguish between methods of measurement, classification of measuring instruments, Measuring systems.
	C215.2	Understand on Transducer Elements: Analogue Transducers, Digital Transducers, Basic detector transducer elements
	C215.3	Knowledge about Measurement of low pressures, Temperature , Force, Power, Speed and Torque Measurement.
	C215.4	Knowledge on Line and End & optical Standards, Measurement of Surface Roughness, Limits, Fits and Gauges.
	C215.5	Distinguish between Limits, Fits, Gauges & geometric tolerances.
	C215.6	Knowledge about the system reliability, reliability improvement, maintainability and availability, Markov model, Life tests, acceptance sampling.

MODULE – I (16 HOURS)

Definition and methods of measurement, classification of measuring instruments, Measuring systems, performance characteristics of measuring devices, types of errors. Functional elements of measuring system. Static and Dynamic Characteristics of Instruments: Static Performance Parameters, Impedance Loading and Matching, Selection and Specifications of Instruments, Dynamic Response, Compensation. Transducer Elements: Analog Transducers, Digital Transducers, Basic detector transducer elements : Electrical transducer, Sliding Contract devices, Variable-inductance transducer elements, the differential transformer, Variable-reluctance transducers, Capacitive transducers. The piezoelectric effect, photo-electric transducer, electronic transducer element. Intermediate Elements: Amplifier, Operational Amplifier, Diffential and Integrating Elements, Filters, A-D and D-A Converters

Strain Measurement The electrical resistance strain gauge. The metallic resistance strain gauge, Selection and

Installation factors for metallic strain gauge, Circuitry, metallic strain gauge. The strain gauge ballast circuit, the staring gauge bridge circuit, Temperature compensation.Measurement of Pressure: Pressure measurement systems, Pressure measurement transducers, Elastic diaphragms, strain gauge pressure cells, measurement of high pressure, Measurement of low pressures, dynamic characteristics of pressure measuring systems. Measurement of Fluid Flow. Flow characteristics obstruction meters, Obstruction meter for compressible fluids- Orifice, Venturi meter and Pitot tube, The variable-area meter, Turbine Flow meters.Temperature Measurement: Use of bimetals pressure thermometers, Thermocouples, Pyrometry, Calibration of temperature measuring devices. Force, Power, Speed and Torque Measurement : Load Cell, Dynamometers, Tachometer and Tacho-generator, Stroboscope, The seismic instrument.- Vibrometers and accelerometers

MODULE – II (10 HOURS)

Principles of Measurements, Line and End & optical Standards, Calibration, accuracy and Precision, Random error and systemic error.Measurement of Surface Roughness, Screw Thread and Gears.Limits, Fits and Gauges, Assembly by full, partial and group interchangeability, geometric tolerances.Measurement of straightness, Flatness and circularity.

MODULE – III (10 HOURS)

Definition, bath-tub-curve, system reliability, reliability improvement, maintainability and availability, Availability of single repairable system using Markov model, Life tests, acceptance sampling plan based on life tests, Sequential acceptance sampling plan based on MTTF & MTBF.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Beyond syllabus

1. Practical application of non-destructive testing, equipment testing

TEXT BOOKS :

1. Engineering Metrology & Measurement, N.V.Raghavendra and L. Krishnamurthy,
OXFORD University Press
2. Instrumentation Measurement and Analysis, B.C.Nakra and KK.Chaudhry, Tata McGraw
Hill, Third Edition.
3. Engineering Metrology,R.K. Jain, Khanna Publisher, Delhi
4. Reliability Engg. And Terotechnology , A.K. Gupta, Macmillan India.

Reference Books:

1. Metrology & Measurement, A. K. Bewoor and V.A.Kulkarni, McGraw hill
2. Mechanical Measurements, T.G. Beckwith and N. Lewis Buck, Oxford and IBH Publishing Co.
3. A text book of Engineering Metrology I.C. Gupta, DhanpatRai& sons, Delhi.
4. Introduction to /reliability and MaitainabilityEngg E. Ebeling, MC-Graw Hill.

	POB3E002 ORGANIZATIONAL BEHAVIOUR(C216) *(L/T: 2/1, Credit: 3)*	
OB (C216)	C216.1	Discuss the development of the field of organizational behaviour and explain the micro and macro approaches.
	C216.2	Analyse and compare different models used to explain individual behaviour related to motivation and rewards.
	C216.3	Explain group dynamics and demonstrate skills required for working in groups (team building).
	C216.4	Identify the various leadership styles and the role of leaders in a decision making process.
	C216.5	Explain organizational culture and describe its dimensions and to examine various organizational designs.
	C216.6	Discuss the implementation of organizational change.

MODULE – I (6 HOURS)

01 Fundamentals of OB: Definition, scope and importance of OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework (cognitive), behavioristic and social cognitive), Limitations of OB.

MODULE – II (10 HOURS)

Attitude: Importance of attitude in an organization, Right Attitude, Components of attitude, Relationship between behavior and attitude, Developing Emotional intelligence at the workplace, Job attitude, Barriers to changing attitudes. **Personality and values:** Definition and importance of Personality for performance, The Myers-Briggs Type Indicator and The Big Five personality model, Significant personality traits suitable to the workplace (personality and job – fit theory), Personality Tests and their practical applications. **Perception:** Meaning and concept of perception, Factors influencing perception, Selective perception, Attribution theory, Perceptual process, Social perception (stereotyping and halo effect).

Motivation: Definition & Concept of Motive & Motivation, The Content Theories of Motivation (Maslow's Need Hierarchy & Herzberg's Two Factor model Theory), The Process Theories (Vroom's expectancy Theory & Porter Lawler model), Contemporary Theories – Equity Theory of Work Motivation.

MODULE – III(9 HOURS)

Foundations of Group Behavior: The Meaning of Group & Group behavior & Group Dynamics, Types of Groups, The Five – Stage Model of Group Development. **Managing Teams:** Why Work Teams, Work Teams in Organization, Developing Work Teams, Team Effectiveness & Team Building. **Leadership:** Concept of Leadership, Styles of Leadership, Trait Approach Contingency Leadership Approach, Contemporary leadership, Meaning and significance of contemporary leadership, Concept of transformations leadership, Contemporary theories of leadership, Success stories of today's Global and Indian leaders.

MODULE – IV (8 HOURS)

Organizational Culture : Meaning & Definition of Organizational Culture, creating & Sustaining Organizational Culture, Types of Culture (Strong vs. Weak Culture, Soft Vs. Hard Culture & Formal vs. Informal Culture), Creating Positive Organizational Culture, Concept of Workplace Spirituality.

MODULE – V (10 HOURS)

Organizational Change: Meaning, Definition & Nature of Organizational Change, Types of Organizational Change, Forces that acts as stimulants to change. Implementing Organizational Change : How to overcome the Resistance to Change, Approaches to managing Organizational Change, Kurt Lewin's-Three step model, Seven Stage model of Change &Kotter's Eight-Step plan for Implementing Change, Leading the Change Process, Facilitating Change, Dealing with Individual & Group Resistance, Intervention Strategies for Facilitating Organizational Change, Methods of Implementing Organizational Change, Developing a Learning Organization.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	2	2	3	3	3	3	3	3	3	3	3	3		2	2	2

Reference Books

1. Understanding Organizational Behaviour, Parek, Oxford
2. Organizational Behaviour, Robbins, Judge, Sanghi, Pearson.
3. Organizational Behaviour, K. Awathappa,HPH.
4. Organizational Behaviour, VSP Rao, Excel
5. Introduction to Organizational Behaviour, Moorhead, Griffin, Cengage.
6. Organizational Behaviour, Hitt, Miller, Colella, Wiley

	PME4l201-Data Structure using 'C'(C217) *Practical (Hours per week): 2, Credit: 1*	
Data Structure using 'C' (C217)	C217.1	Knowledge about basic terminology and searching techniques.
	C217.2	Analysis of algorithms and applications of stacks and queues.
	C217.3	Analysis of linked lists.
	C217.4	Learn about sorting and hashing
	C217.5	Knowledge about basic tree terminologies.
	C217.6	Knowledge about basic terminology and searching techniques.

Module - I (12 Hrs.) Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. **Searching:** Linear Search and Binary Search Techniques and their complexity analysis.

Module – II (08 Hrs.) Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Module - III (08 Hrs.) Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Module - IV (10 Hrs.) Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Module - V (07 Hrs.) Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexityanalysis.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Books:

• "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

• Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark AllenWeiss, Addison-Wesley Publishing Company

• "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.

	PME4l101-MECHANISMS AND MACHINES LABORATORY(C218) *Practical (Hours per week): 6, Credit: 3*	
M&M LAB (C218)	C218.1	Design working model related to Mechanisms and Machines Module I and II
	C218.2	Design of any one working model related to Mechanisms and Machines module III and IV
	C218.3	Determine the gyroscopic couple using gyroscopic test rig and Performance characteristics of a spring loaded governor.
	C218.4	Determine the critical speed of rotating shaft and conduct experiments on static and dynamic balancing.
	C218.5	Evaluate Cam Profile of a Cam Analysis Apparatus and evaluation of damping in a vibrating system.

LIST OF EXPERIMENTS:

1. Design of any one working model related to Mechanisms and Machines i.e., Module I and II.
2. Design of any one working model related to Mechanisms and Machines i.e., Module III andIV.
3. Determination of gyroscopic couple using gyroscopic test rig.
4. Performance characteristics of a spring loaded governor
5. Determination of critical speed of rotating shaft
6. Experiment on static and dynamic balancing apparatus
7. Determination of natural frequencies of un-damped as well as damped vibratingsystems.
8. Study of interference and undercutting for gear drives
9. Experiment on Cam Analysis Apparatus.
10. Experiment on evaluation of damping in a vibrating system

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	2	2	2	3	2	3	3		3	3	3

Experiment beyond syllabus

1. To study various types of steering mechanisms

	PME4l102-BASIC MANUFACTURING PROCESS LABORATORY (C219) *Practical (Hours per week): 2, Credit: 1*	
BMP Lab (C219)	C219.1	Determination of grain size, clay content, permeability and compressive strength of moulding sand.
	C219.2	Preparation of wood pattern and Practices in foundry.
	C219.3	Determination of strength of brazed and solders joints.
	C219.4	Practice and preparation of job in TIG / MIG welding, sheet metal processs and deep drawing.
	C219.5	Demonstration of different rolling mills and extrusion process.

LIST OF EXPERIMENTS:

1. Determination of grain size, clay content, permeability and green compressive strength of Moulding sand. (2 to 3 experiments)
2. Foundry Practices
3. Preparation of a wood pattern.
4. Determination of strength of brazed and solder joints
5. Practice and preparation of job in TIG/MIG welding
6. Practice and preparation of job in sheet metal using processes like forming and deep drawing.
7. Demonstration of different rolling mills
8. Demonstration of Extrusion processes

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	2	3	3		3	3	3

	PME4l103-I.C. ENGINE LABORATORY(C220) I. *Practical (Hours per week): 2, Credit: 1*	
ICEGT Lab (C220)	C220.1	Study of Valve timing diagram of an IC engine.
	C220.2	Study of modern Carburettor and injection system of diesel engine.
	C220.3	Study of different cooling system and lubrication system.
	C220.4	Load test on 4S single cylinder CI and SI engine.
	C220.5	Load test on variable compression ratio of S.I. engine Load test and Heat balance on 2 stroke S.I. Engine

LIST OF EXPERIMENTS:

1. Valve timing diagram of an IC engine
2. Study of a modern carburettor (e.g.Solex Carburettor)
3. Study of fuel injection system of a diesel engine
4. Analysis of exhaust gas of automobile
5. Study of different cooling systems in automobiles (Air cooling and water cooling).
6. Study of lubrication systems in automobiles.
7. Load test on 4-stroke single cylinder C.I. engine.
8. Load test on 4-stroke single cylinder S.I. engine.
9. Morse Test on multi-cylinder S.I. or C.I. engine
10. Load test on variable compression ratio S.I. engine
11. Load test and Heat balance on 2 stroke S.I. Engine

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	2	3	2	3	3	2	3	3		3	3	3

Experiment beyond syllabus

1. Analysis of exhaust gases from two stroke single cylinder petrol engine by Orsat Apparatus

	PME4l104-MECHANICAL MEASUREMENT, METROLOGY & RELIABILITY LABORATORY(C221) *Practical (Hours per week): 2, Credit: 1*	
MMM& R Lab (C221)	C221.1	Calibration of LVDT / CRO & load cell.
	C221.2	Calibration of a Rota meter & thermo couples.
	C221.3	Calibration of Burden Tube Pressure Gauge and measurement of pressure using manometer.
	C221.4	Conduct experiment on Pneumatic trainer & Hydraulic trainer.
	C221.5	Measurement of straightness and flatness & roughness of the surface using slip gauges and sine bar.

LIST OF EXPERIMENTS:

1. Calibration of LVDT using indicator / CRO
2. Calibration of load cell using electrical resistance strain gauge
3. Calibration of a Rotameter for fluid flow measurement
4. Calibration of thermo couples
5. Calibration of Bourden Tube Pressure Gauge and measurement of pressure using manometer
6. Experiment on Pneumatic trainer
7. Experiment on Hydraulic trainer
8. Determination of damping coefficient of vibration absorbing materials using vibration measuring equipment.
9. Strain measurement using resistant strain gauge
10. Measurement of straightness and flatness
11. Measurement of roughness of the surface
12. Experiment on slip gauges and sine bar

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	2	2	2	3	3	3	3		3	3	3

B.Tech (Mechanical Engineering) detail Syllabus for Admission Batch 2015-16

Third Year Engineering

Fifth Semester								
	Theory					Practical		
Code	Course Name	Hours/ week L/T	Credit Theory	University Marks	Internal Evaluation	Hours/ week L/T	Credit Practical	Marks
PC	Design of Machine Elements	3-0	3	100	50	2	1	50
PC	Machining Science & Technology	3-0	3	100	50	2	1	50
PC	Heat Transfer	3-0	3	100	50	2	1	50
PE	Optimization in Engg./Project Management/Quality Management & Reliability	3-1	4	100	50			
OE	Energy Conversion Techniques/Human Resources Management/Marketing Management/ C++ & Object Oriented Programming/Internet & Web Technology/Analog & Digital Electronics/Digital Signal Processing	3-1	4	100	50			
PC	Advance Lab-I					8	4	200
Total		17	17	500	250	14	7	350
Total Marks: 1100								
Total Credits: 24								

	PME5l001-DESIGN OF MACHINE ELEMENTS (C301) *(L/T: 3/0, Credit: 3)*	
DME (C301)	C301.1	Knowledge about mechanical engineering design and fundamental of machine design.
	C301.2	Design of joints.
	C301.3	Design of keys, shaft and couplings.
	C301.4	Design of Mechanical springs.
	C301.5	Design of sliding contact bearing, journal bearing, foot step bearing.
	C301.6	Knowledge about dynamic and static load rating.

MODULE-I (8 HOURS)

1. Mechanical engineering design: Introduction to design procedure, Stages in design, Code and Standardization, Interchange ability, Preferred numbers, Fits and Tolerances, Engineeringmaterials: Ferrous, Non-ferrous, Non-metals, design requirements – properties of materials,Material selection, Use of Data books.

2. Fundamentals of Machine Design: Types of load, Modes of failure, factor of safety concepts,Theories of Failure, concept and mitigation of stress concentration, Fatigue failure and curve,endurance limit and factors affecting it, Notch sensitivity, Goodman, Gerber and Soderberg criteria.

MODULE-II (8 HOURS)

3. Machine Element Design: Design of Joints: Rivets, welds and threaded fasteners based ondifferent types of loading, Boiler joints, cotter joints and knuckle joints.

MODULE-III (10 HOURS)

4. Design of Keys, Shaft and Couplings: Classification of keys and pins, Design of keys and pins,Theories of failure, Design of shafts: based on strength, torsional rigidity and fluctuating load, ASMEcode for shaft design, Design of couplings: Rigid coupling, Flexible coupling.

5. Design of Mechanical Springs: Types of helical springs, Design of Helical springs, bulking ofspring, spring surge, end condition of springs, Design of leaf springs: nipping.

MODULE-IV (6 HOURS)

6. Bearings: Types and selection of ball and roller bearings, Dynamic and static load ratings,Bearing life, Design of sliding contact bearings, Journal bearing, foot step bearing.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Beyond Syllabus

1. Design and manufacturing of high pressure vesel
2. Design of crane hook
3. Design of C bracket

TEXT BOOKS:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill
2. Mechanical Engineering Design, J.E.Shigley, C.R.Mischke, R.G.Budynas and K.J.Nisbett, TMH

REFERENCE BOOKS:

1. Machine Design, P.Kanaiah, Scietech Publications
2. Fundamentals of Machine Component Design by R.C.Juvinall and K.M.Marshek, John Wiley & Sons
3. Machine Drawing by N.Sidheswar, McGraw-Hill
4. Machine Design, P.C.Sharma and D.K.Agrawal, S.K.Kataria& Sons
5. Machine Design, Pandya and Shah, Charotar Book Stall
6. Machine Design, Robert L. Norton, Pearson Education Asia.
7. Design of Machine Elements by C. S. Sharma and K. Purohit, PHI

DESIGN DATA HAND BOOKS:

1. P.S.G. Design Data Hand Book, PSG College of Tech Coimbature
2. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
3. Design Hand Book by S.M.Jalaluddin ;Anuradha Agencies Publications
4 .Design Data Hand Book by K.Mahadevan and B.Reddy,CBS Publishers

	PME5I101 -MACHINING SCIENCE AND TECHNOLOGY(C302) *(L/T: 3/0, Credit: 3)*	
MST (C302)	C302.1	Knowledge about the fundamentals of Machining and Machine Tools.
	C302.2	Calculate the cutting force and velocity of a tool.
	C302.3	Knowledge about Conventional machining process and machine tools.
	C302.4	Principles of machine tools.
	C302.5	Knowledge about Production machine tools.
	C302.6	Knowledge about Non-traditional Machining processes.

MODULE – I (13 HOURS)

Geometry of cutting tools in ASA and ORS, Effect of Geometrical parameters on cutting force andsurface finish, Mechanics of chip formation, Merchant's theory, Force relationship and velocityrelationship, Cutting tool materials, Types of Tool Wear: Flank wear, Crater wear, Wearmeasurement, Cutting fluid and its effect; Machinability Criteria, Tool life and Taylor's equation,Effect of variables on tool life and surface finish, Measurement of cutting force, Lathe tooldynamometer, Drill tool dynamometer. Economics of machining.

MODULE – II (13 HOURS)

Conventional machining process and machine tools – Turning, Drilling, Shaping, Planning, Milling,Grinding. Machine tools used for these processes, their specifications and various techniques used.Principles of machine tools : Kinematics of machine tools, speed transmission from motor to spindle, speed reversal mechanism, mechanism for feed motion, Tool holding and job holding methods in different Machine tools, Types of surface generated, Indexing mechanism and thread cuttingmechanism, Quick return mechanism,. Production Machine tools – Capstan and turret lathes, single spindle and multi spindlesemiautomatics, Gear shaper and Gear hobbing machines, Copying lathe and transfer machine

MODULE – III (10 HOURS)

Non-traditional Machining processes :Ultrasonic Machining, Laser Beam Machining, Plasma Arc Machining, Electro Chemical Machining,Electro Discharge Machining, Wire EDM , Abrasive Jet Machining

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Beyond Syllabus

1. CNC coding and Programming
2. 3-D technology

TEXT BOOKS:

1. Fundamentals of Machining and Machine Tools, G.Boothroyd and W.A.Knight, CRC Press
2. Metal Cutting Principles, M.C.Shaw, Oxford University Press
3. Metal Cutting Theory and Practice, A.Bhattacharya, Central Book Publishers

REFERENCE BOOKS:

1. Manufacturing Technology – by P.N.Rao, Tata McGraw Hill publication.
2. Modern Manufacturing Processes, P.C.Pandey, H.S.Shan, Tata McGraw Hill
3. Manufacturing Science, Ghosh and Mallik, East West Press.
4. Metal Cutting Theory and Practice, D.A.Stephenson and J.S.Agapiou, CRC Press
5. Machining Technology; Machine Tools and Operation, H.A.Youssef and H. El-Hofy, CRC Press
6. Machine Tools and Manufacturing Technology, Krar, Rapisarda and Check, CengageLearning
7. Technology of Machine Tools, Krar, Gill and Smidt, Tata McGraw Hill
8. Principles of Metal Cutting, G.Kuppuswamy, Universities Press
9. Metal Cutting and Machne Tools, G.T.Reddy, Scitech
10. Fundamentals of tool Engineering Design, S.K.Basu, S.K.Mukherjee, R. Mishra , Oxford & IBHPub Co.
11. Machine Tools, R.N.Datta, New Central Book Agency

	PME5I102- HEAT TRANSFER (C303) *(L/T: 3/0, Credit: 3)*	
HT (C303)	C303.1	Basic concept of heat transfer and heat conduction.
	C303.2	Analysis and solve problem of convective heat transfer.
	C303.3	Analysis and solve problem of radiative heat exchange.
	C303.4	Solve problem on Heat transfer for boiling liquids and condensing vapours.
	C303.5	Knowledge about Radiation heat transfer process.
	C303.6	Analyse of different types of heat exchangers.

MODULE-I (12 HOURS)

1. Introduction: Modes of heat transfer: conduction, convection, and radiation ,Mechanism & basic lawsgoverning conduction, convection, and radiation heat transfer; Thermal conductivity,Thermal conductance &Thermal resistance, Contact resistance, convective heat transfercoefficient, radiation heat transfer coefficient , Electrical analogy, combined modes of heattransfer. Initial conditions *and* Boundary conditions of 1st, 2nd and 3rd Kind.

2. Heat Conduction:

The General heat conduction in Cartesian, polar-cylindrical and polar-spherical coordinates,Simplification of the general equation for one and two dimensional steady/transient conduction with constant/ variable thermal conductivity with / without heatgeneration. Solution of the one dimensional steady state heat conduction problem in case ofplane walls, cylinders and spheres for simple and composite cases. Critical insulationthickness, Heat transfer in extended surfaces (pin fins) without heat generation, Long fin,short fin with insulated tip and without insulated tip and fin connected between two heatsources. Fin efficiency and fin effectiveness. Conduction in solids with negligible internaltemperature gradient (Lumped heat analysis).

MODULE-II (12 HOURS)

3. **Convective Heat Transfer:**Introduction to convective flow - forced and free. Dimensional analysis of forced and freeconnective heat transfer. Application of dimensional analysis, physical significance ofGrashoff , Reynolds, Prandtl, Nusselt and Stanton numbers.Conservation equations for mass, momentum and energy for 2-dimensional convectiveheat transfer in case of incompressible flow, Hydrodynamic and thermal boundary layersfor flow over a flat plate. Critical Reynolds number; general expressions for drag coefficientand drag force Reynolds-Colbourn analogy.Thermal boundary layer; general expression forlocal heat transfer coefficient; Average heat transfer Coefficient; Nusselt number. Flowinside a duct- velocity boundary layer, hydrodynamic entrance length and hydrodynamically developed flow; flow through tubes (internal flow). Use of empirical relationsfor solving turbulent conditions for external and internal flow.Mechanism of heat transfer during natural convection, Experimental heat transfercorrelations for natural convection in the following cases(a) Vertical and horizontal plates(b) Inside and outside flows in case of tubes

Module-III (8 hours)

4. Radiative heat exchange : Introduction, Radiation properties, definitions of various terms used in radiation heattransfer; Absorptivity,reflectivity&transmissivity.Emissive power & emissivity, Kirchhoff'sidentity, Planck's relation for monochromatic emissive power of a black body, Derivation ofStefan-Boltzmann law and Wien's displacement law from Planck's relation, Radiation shapefactor, Relation for shape factor and shape factor algebra. Heat exchange between blackbodies through non-absorbing medium. Gray bodies and real bodies, Heat exchangebetween gray bodies.Radiosity and Irradiation, Electrical analogy and radiation networks

Module-IV (8 hours)

5. Heat transfer for boiling liquids and condensing vapours :

Types of condensation, use of correlations for condensation on vertical flat surfaces,horizontal tube and; regimes of pool boiling, pool boiling correlations. Critical heat flux,concept of forced boiling. Numerical problems.

6. Heat Exchangers :

Introduction, Types of heat exchanger, The overall heat transfer coefficient and foulingfactors, LMTD and _ - NTU analysis of heat exchangers.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	2	2	3	3	2	3		3	3	3

Beyond syllabus:

1. Heat transfer application and load calculation in Captive power plant.
2. Measurement of thermal conductivity of metal rod

1. Heat Transfer Incropera and Dewitt, Willey publications
2. Heat Transfer :J.P.Holman, TMH Publications
3. Heat Transfer: P.S.Ghosdastidar, Oxford University Press
4. Fundamentals of Engineering Heat and Mass Transfer: R.C.Sachdeva, New Age International Publishers, 4th Edition

References :

1. Heat Transfer by P.K. Nag, TMH
2. Heat Transfer by S.P. Sukhatme, TMH
3. Heat Transfer: A.F.Mills and V.Ganesan, Pearson Education, 2nd Edition
4. Heat and Mass Transfer: Domkundwar and Arora, Danpatrai and sons

5. Heat Transfer :R.K.Rajput, Laxmi Publications
6. Heat and Mass Transfer: A Practical Approach, Y.A.Cengel, Tata Macgraw Hills EducationPrivate Limited

	PME5J103-QUALITY MANAGEMENT AND RELIABILITY (C304) *(L/T: 3/1, Credit: 4)*	
QM&R (C304)	C304.1	Knowledge about quality assurance, illustrating the concept of quality inspection and identify the costs need to carried out.
	C304.2	Solve different sampling inspection, OC curve and can explain about producer and consumer risk.
	C304.3	Draw chart related to X, r, np, c and can describe about process capability, graph of signal to noise ratio.
	C304.4	Determine reliability and its factors and different time dependent failure models.
	C304.5	Interpret the economic analysis and life cycle cost and illustrating maintainability and availability.
	C304.6	Knowledge about the quality improvement fundamentals related with philosophy and concept of ISO:9000 series.

Module- I (8 hours)

Attributes of quality, Evolution of philosophy of Quality Management: Inspection, Quality Control, Quality Assurance, Total Quality Management, Cost of quality Acceptance sampling: Design of single sampling plan. Double, multiple and sequential sampling plans, O.C. curve, Producer‟s risk and consumer‟s risk, AOQ, AOQL

Module-II (10 hours)

Statistical process control, Use of control charts and process engineering techniques for implementing quality plan, X-Chart, R-Chart, p-chart, np-chart, c-chart, cusum-chart, Process capability analysis, statistical tolerance analysis Experimental designs and factorial experiments: 2 k factorial experiments, Taguchi philosophy; Loss function; Signal to noise ratio, Orthogonal arrays for parameter and tolerance design.

Module-III (6 hours)

Definition – Reliability vs quality; Reliability function – MTBF, MTTR, availability; Bath tub curve – time dependent failure models – distributions – normal, weibull; Reliability of system and models – serial, parallel and combined configuration; Economic analysis and life cycle cost; Proactive, preventive, predictive maintenance; Maintainability and availability

Module-IV (8 hours)

Quality Improvement: Fundamentals of TQM; Some important philosophies and their impact on quality (Deming, Juran, Crossby); Quality circle, QC Tools;Service Quality; Quality Standard: Product and Process Standard, Introduction to ISO 9000 and 14000 standards; Concept of Six Sigma, Lean Management and TPM

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Beyond Syllabus

1. Part Production approval process
2. 6-Sigma Approval Process

Books

1. Quality Planning and Analysis, Juran J M and Gryna F M, TMH
2. Statistical Process Control and Improvement, A. Mitra, Pearson.
3. Introduction to Statistical Quality control, D.C. Montgonery, John Wiley & sons.
4. Introduction to /reliability and MaitainabilityEngg E. Ebeling, MC-Graw Hill.
5. Quality control and Application ,B.L. Hansen and P.M. Ghare, Prentice Hall of India.
6. Statistical Quality Control, M. Mahajan, DhanpatRai& Sons.
7. K C Jain and A K Chitale, Quality Assurance and Total Quality Management, Khanna Publishers
8. K.S. Krishnamoorthi& V. Ram Krishnamoorthi, “A First Course in Quality Engineering” CRC Press

	PME5H002-HUMAN RESOURCE MANAGEMENT (C305) *(L/T: 3/1, Credit: 4)*	
HRM (C305)	C305.1	Get the concept, scope and objective of HRM.
	C305.2	Knowledge about the Recruitment, selection and tests.
	C305.3	Concept and objective of of career planning, performance management, management and objectives.
	C305.4	Assess the feedback and Appraisal errors.
	C305.5	Knowledge about the management by objective.
	C305.6	Evaluate the effectiveness of training program.

Module I:

Concept scope and objectives of HRM.Relationship between HRM and HRD.The challenges for HRM – Environmental, organizational and Individual.Role and functions of HR managers in the changing business scenario. Human Resources Planning – overview, Recruitment – concept, objectives, legal framework regulating recruitment in India, Selection – Objectives and methods, Test and interviews, Induction and orientation, validity and reliability of Tests and interviews.

Module II:

Career Planning – concept, objectives. Different stages of career and its implications, Methods of career planning and development, Promotion – types and process, Transfer – types. Separations including lay off and retrenchment. Performance Management – concept and objectives. Performance Appraisal – concept objectives and methods – management by objectives (MBO), Assessment centre, 360 degree feedback. Appraisal errors.Competency mapping – concept, objectives and the process.

Module III:

Compensation Management – objectives and principles. wage& salary. Wage concept –minimum wage, Fair wage, living wage. nominal wage and real wage. Components of wages, methods of wage determination, job evaluation – methods wage differentials and its functions. Training and Development – Training need Assessment, Types of Training Programs – on the job and off the job training programs, Evaluation of effectiveness of training programs.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		2	2	2

Beyond syllabus:

1. Digital empowered human resource

Books Recommended

1. Personnel & HRM – P. subhaRao, Himalaya Publishing House.

2. HRM - Text and cases – Aswathappa, THM

3. Managing Human Resources – Gomez, Belkin&Cardy, PHI. HRM – Snell, Bohlander,

Vohra – Cengage Publication

	PME5l201-Advance Lab-1(C 306) *Practical (Hours per week): 8, Credit: 4*	
Advance Lab-1 (C306)	C306.1	Concept of the fundamentals of Auto CAD Software (Layers, Dimension& Annotations, Assembly Drawing concept, Bill of material etc.)
	C306.2	Draw the Orthographic Drawings of Machine Components.
	C306.3	Draw the Sectional views from Orthographic Drawings of Machine Components.
	C306.4	Draw the Projection of Solids by using Auto CAD Software.
	C306.5	Analyse and draw different machine components (Ex- Screw Fastening, Shaft coupling, cotter joint etc.)by using Auto CAD.

Orthographic and Sectional drawing of Machine components: (Any seven)
Screw threads, Screwed fastenings, Turn Buckle, Keys, Cotter joints and Knuckle joints; Pulley;
Flanged coupling, Pedestal Bearing or Plummer Block.
Fundamentals of AutoCAD (Two classes)
1. Dimension & annotations
2. Use of Layers
3. Working with constraint in dimension
4. Creating assembly
5. Axi-symmetrical parts
6. Creating surface features
7. Working with bill of material
Drawing of the following using AUTOCAD: (Any two)
1. Projection of solids
2. Nut & bolt and Fasteners
3. Cotter joint
4. Expansion joint
5. Shaft coupling

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	2	2	3	3	3	3		3	2	3

TEXT BOOKS:

1. Machine Drawing by N.D.Bhatt, V.M.Panchal, Charotar Publishing House.

2. Machine Drawing by N.D.Junarkar, Pearson Education

3. Machine Drawing with AutoCAD by Goutam Pohit and Goutam Ghosh, Pearson

1. Education

4. Machine Drawing includes AutoCAD by Ajeet Singh, Tata MacGraw Hill

REFERENCE BOOKS:

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

International

2. Engineering Drawing and Graphics using AUTOCAD by T.Jayapoovan, Vikas

Publishing

	PME5l001-DESIGN OF MACHINE ELEMENTSLABORATORY(C307) *Practical (Hours per week): 2, Credit: 1*	
DME Lab (C307)	C307.1	Design of working model.
	C307.2	Design and drawing of riveted joints, cotter joint.
	C307.3	Design and drawing of knuckle joint and flange coupling.
	C307.4	Design of spring.
	C307.5	Design of bearing.

LIST OF EXPERIMENTS:

1. Design of any one working model related to

Design of machine elements i.e., Module I and II. Compulsory

2. Design of any one working model related to

Design of machine elements i.e., Module III and IV- Compulsory

3. Design & drawing of Riveted joint
4. Design and drawing of Cotter joint
5. Design and drawing of Knuckle joint
6. Design of shafts subjected to combined loading
7. Design and drawing of Flange coupling
8. Design of spring
9. Design of bearing

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	2	2	2	3	2	3	3		3	3	3

	PME5l101-MACHINING SCIENCE AND TECHNOLOGYLABORATORY(C308) *Practical (Hours per week): 2, Credit: 1*	
MST Lab (C308)	C308.1	Operate lathe and milling machine.
	C308.2	Operate shaper, slotting and grinding machine.
	C308.3	Determine cutting force using lathe tool dynamometer and drill tool dynamometer.
	C308.4	Knowledge about non-traditional machining process.
	C308.5	Making job on CNC lathe and CNC machining process.

LIST OF EXPERIMENTS:

1. Job on lathe with tapper turning, thread cutting, knurling and groove cutting (3 experiments).
2. Gear cutting (with index head) on milling machine
3. Working with shaper, Planner and slotting machine.
4. Working with surface and cylindrical grinding.
5. Determination of cutting force using Lathe tool dynamometer.
6. Determination of cutting force in drilling using drill tool dynamometer.
7. Study of Non-traditional machining processes.(USM, AJM, EDM, ECM)
8. Study of CNC Lathe and demonstration of making job in CNC lathe.
9. Study of CNC Milling machine and demonstration of making job in CNC Milling machine

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	2	2	3	2	3	3		3	3	3

	PME5l102-HEAT TRANSFER LABORATORY(C309) *Practical (Hours per week): 2, Credit: 1*	
HT Lab (C309)	C309.1	Determination of thermal conductivity of composite lab and heat transfer coefficient in natural/forced convention.
	C309.2	Determination of surface emissivity.
	C309.3	Determination of Critical heat flux during boiling heat transfer.
	C309.4	Performance test on parallel flow and counter flow heat exchanger.
	C309.5	Determination of Efficiency and effectiveness of fins (Natural / Forced convection) and verification of Verification of Stefan Boltzmann's law.

LIST OF EXPERIMENTS:

1. Determination of Thermal conductivity of composite slab
2. Determination of heat transfer coefficient in natural/forced convention.
3. Determination of surface emissivity
4. Performance test on parallel flow and counter flow heat exchanger
5. Efficiency and effectiveness of fins (Natural / Forced convection)
6. Determination of Critical heat flux during boiling heat transfer.
7. Verification of Stefan Boltzman's law.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	2	2	2	2	3	3		3	3	3

Beyond syllabus:

1. Determination of thermal conductivity of insulating power
2. Measurement of thermal conductivity of metal rod

B.Tech (Mechanical Engineering) detail Syllabus for Admission Batch 2015-16

Sixth Semester								
	Theory					Practical		
Code	Course Name	Hours/ week L/T	Credit Theory	University Marks	Internal Evaluation	Hours/ week L/T	Credit Practical	Marks
PC	Production & Operation Management	3-0	3	100	50	2	1	50
PC	Refrigeration & Air Conditioning	3-0	3	100	50	2	1	50
PE	Product Design & Production Tooling/Computer Integrated Manufacturing & FMS/CAD & CAM	3-1	4	100	50			
PE	Compressive Flow & Gas Dynamics/Automobile Engg./ Non-Conventional Energy Sources	3-1	4	100	50			
MC & GS	Green Technology	3-0	3	100	50			
OE	Industrial Lecture #					3	2	100
HS	Presentation Skill & Skill for Interview # #					4	3	100
Total		17	17	500	250	13	7	300
Total Marks: 1050								
Total Credits: 24								

	PME6l101-PRODUCTION AND OPERATION MANAGEMENT(C310) *(L/T: 3/0, Credit: 3)*	
POM (C310)	C310.1	**Describe** the concept of operations management and productivity. **Differentiate** between manufacturing vs service operation.
	C310.2	**Design** of products and processes.
	C310.3	**Differentiate** between work study and method study. **Calculate** Standard Time.
	C310.4	**Understand** different methods of Forecasting,**Solve and Analyse** problems using different forecasting Techniques. **Evaluate** and rank location and layout.
	C310.5	**Develop** aggregate capacityplan and Production **Schedule**. **Understand** different Dispatching Rules. Able to **Balance** Assembly Lines.
	C310.6	**Describe** the concept of operations management and productivity. **Differentiate** between manufacturing vs service operation.

MODULE I

1. Operations Function in an Organization, Manufacturing Vrs Service Operations, System view ofOperations, Strategic Role of Operations, Operations Strategies for Competitive Advantage,Operations Quality and Productivity Focus, Meeting Global Challenges of Production andOperations Imperatives. **(3 Hours)**

2. Designing Products, Services and Processes: New Product Design- Product Life Cycle, ProductDevelopment Process, Process Technology : Project, Jobshop, Batch, Assembly Line, ContinuousManufacturing; Process Technology Life Cycle, Process Technology Trends, FMS, CIM, CAD, CAM;Design for Services, Services Process Technology. **(4 Hours)**

3. Work Study: Methods Study- Techniques of Analysis, recording, improvement andstandardization; Work Measurement : Work Measurement Principles using Stopwatch TimeStudy, Predetermined Motion Time Standards and Work Sampling, Standard Time Estimation. **(4Hours)**

MODULE II

4. Location and Layout Planning : Factor Influencing Plant and Warehouse Locations, Impact ofLocation on cost and revenues. Facility Location Procedure and Models : Qualitative Models,Breakeven Analysis, location Model, centroid method.Layout Planning: Layout Types : Process Layout, Product Layout, Fixed Position Layout Planning,block diagramming, line balancing, computerized layout planning- overview.Group Technology **(4 Hours)**

5. Forecasting : Principles and Method, Moving Average, weighted Moving Average, ExponentialSmoothing, Winter's Method for Seasonal Demand, Forecasting Error.**(4 Hours)**

6. Manufacturing Planning and Control : The Framework and Components : Aggregate Planning,Master Production Scheduling, Rough-cut-Capacity Planning, Material Requirements Planning,Capacity Requirements Planning. **(5 Hours)**

MODULE III

7. Sequencing and Scheduling : Single Machine Sequencing : Basics and Performance EvaluationCriteria, Methods for Minimizing Mean Flow Time, Parallel Machines : Minimization ofMakespan, Flowshop sequencing : 2 and 3 machines cases : Johnson's Rule and Job shop Scheduling : Priority dispatching Rules. **(3 Hours)**

8. Inventory Control : Relevant Costs, Basic EOQ Model, Model with Quantity discount, EconomicBatch Quantity, Periodic and Continuous Review Systems, Safety Stock, Reorder Point and OrderQuantity Calculations. ABC Analysis.**(4 Hours)**

9. Modern Trends in Manufacturing : Just in Time (JIT) System : Shop Floor Control By Kanbans,Total Quality Management, Total Productive Maintenance, ISO 9000, Quality Circle, Kaizen, PokaYoke, Supply Chain Management. **(4 Hours)**

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		2	3	3

Contents beyond syllabus

1. Supply chain Management

REFERENCE BOOK:

1. S.N.Chary, "Production and Operations Management", Tata McGraw Hill.
2. R. Paneerselvam, "Production and Operations Management, Prentice Hall of India.
3. Aswathappa& Bhatt – Production & Operations Management, HPH.
4. Gaither & Frazier - Operations Management, Cengage Publication
5. Russell & Taylor - Operations Management, PHI Publication
6. Chase, Aquilanno, Jacob &Agarwal - Operations Management, TMH Publication.
7. E.E. Adam and R.J. Ebert "Production and Operations Management", Prentice Hall of India

	PME6I102-REFRIGERATION AND AIR CONDITIONING(C311) *(L/T: 3/0, Credit: 3)*	
RAC (C311)	C311.1	Analyse and solve problem on air refrigeration system, vapour compression system, multi-stage compression and multi evaporator system.
	C311.2	Solve problem on vapour absorption system
	C311.3	Acquire Knowledge about thermoelectric refrigeration and refrigerants.
	C311.4	Obtain Knowledge about different psychometric processes and Solve problem on psychometrics.
	C311.5	Understand about requirement of Comfort air Conditioning.
	C311.6	Acquire knowledge about different types of Air Conditioning systems.

MODULE I (12 HOURS)

1. Air Refrigeration System : Introduction, Unit of refrigeration, Coefficient of performance,Reversed Carnot Cycle, Temperature limitations, maximum COP, Bell Coleman air cycle,Simple Air Cycle System for Air-craft with problems.
2. Vapour Compression System : Analysis of theoretical vapour compression cycle,Representation of cycle on T - S and p - h diagram, Simple saturation cycle, sub-cooled cycleand super-heated cycle, Effect of suction and discharge pressure on performance, Actualvapour compression cycle. Problem illustration and solution.
3. Multi-stage compression and Multi-evaporator systems : Different arrangements ofcompressors and inter-cooling, Multistage compression with inter-cooling, Multievaporatorsystem, Dual compression system. Simple problems

MODULE II (12 HOURS)

4. Vapour Absorption System : Simple Ammonia - absorption system, Improved absorptionsystem, Analysis of vapour absorption system (Specifically of analyzingcoloumn andrectifier), Electrolux / Three fluid system, Lithium-bromide-water vapour absorptionsystem, comparison of absorption system with vapour compression system. SimpleProblems and solution.
5. Thermoelectric Refrigeration: Basics and Principle. Defining the figure of Merit. (NoProblem)
6. Refrigerants ; Classification of refrigerants and its degignation- Halocarbon (compounds,Hydrocarbons, Inorganic compounds, Azeotropes, Properties of refrigerants, comparison ofcommon refrigerants, uses of important refrigerants, Brines. Alternative refrigerants(Organic and inorganic compounds).

MODULE III (10 HOURS)

7. Psychometrics: Properties of air-vapour mixture, Law of water vapour-air mixture,Enthalpy of moisture, Psychrometric chart, simple heating and cooling, Humidification, Dehumidification,Mixture of air streams. Review question and discussionsRequirements of comfort air conditioning: Oxygen supply, Heat removal, moisture removal,air motion, purity of air, Thermodynamics of human body, comfort and comfort chart,effective temperature, factors governing optimum effective temperature

MODULE IV (06 HOURS)

8. Air Conditioning System: Process in air conditioning : Summer air conditioning, Winter airconditioning and year round air conditioning, Cooling load calculations. Review questionand discussions.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	2	2	3	2	3	3		3	3	3

Contents beyond syllabus

1. Load calculation for CPP, Cooling tower, boiler
2.

TEXT BOOKS :

1. Refrigeration and Air Conditioning by R.C. Arora , PHI Publication
2. Refrigeration and Air conditioning by C.P. Arora, Tata McGraw Hill.
3. 2Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, DhanpatRai& Sons.
Chapters ; 3,4,5,6,7,11,16,17,19,20
4. Refrigeration and Airconditioning Data book by Manohar Prasad

REFERENCE BOOKS :

1. Refrigeration and Air conditioning by P.L. Ballney, Khanna Publishers.
2. Refrigeration and Air conditioning by ManoharPrasad,New Age international publishers.

	PME6J001-PRODUCT DESIGN AND PRODUCTION TOOLING(C312) *(L/T: 3/1, Credit: 4)*	
PDPT (C312)	C312.1	Acquire knowledge about product design and process planning.
	C312.2	Obtain knowledge about process planning and time & cost estimation.
	C312.3	Design dies for drop forging, upset forging and flash and gutter.
	C312.4	Design die for sheet metal operation, shearing, blanking, piercing, deep drawing operation, progressive and compound sheet metal working.
	C312.5	Design of jigs and fixtures and gather knowledge on principle of location and clamping and clamping methods.
	C312.6	Design of single point cutting tool, broach and form tool, limit gauges, tooling for turret lathe.

MODULE – I (14 HOURS)

Product Design-Product design considerations, product planning, product development, valueanalysis, product specification. Role of computer in product design.

Process Planning – selection of processes, machines and tools. Design of sequence of operations,Time & cost estimation

MODULE – II (14 HOURS)

Forging design- allowances, die design for drop forging, design of flash and gutter, upset forging diedesign.Sheet metal working-

Design consideration for shearing, blanking piercing, deep drawing operation,

Die design for sheet metal operations, progressive and compound die, strippers , stops, strip layout.

MODULE – III (16 HOURS)

Design of jigs and fixtures, principle of location and clamping, clamping methods, locating methods,

Drill Jig bushing, Indexing type drilling Jig.

Design of single point cutting tool, broach and form tool. Tooling design for turret lathe andautomats.Design of limit gauges.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Beyond syllabus

1. Design and application of jigs and fixtures
2. Casting product design
3. Role of CAD/CAM for sheet metal product design

TEXT BOOKS :

1. Product Design & Manufacturing, A K Chitale, R C Gupta, Eastern Economy Edition, PHI.

2. Product Design & Development, Karl T Ulrich, Steven D Eppinger, Anita Goyal, McGraw Hill.

3. A Textbook of Production Engineering, P.C. Sharma, S. Chand & Co

REFERENCE BOOKS:

1. Fundamentals of Tool Engineering design, S.K. Basu, S.N. Mukherjee, R. Mishra, Oxford &IBH Publishing co.

2. Technology of Machine Tools, Krar, Gill, Smid, Tata McGraw Hill

3. Jigs & Fixture Design, Edwrd G Hoffman, Cengae Learning.

	PME6J005-AUTOMOBILE ENGG(C313) *(L/T: 3/1, Credit: 4)*	
Automobile Engineering (C313)	C313.1	Acquire knowledge about the main units of automobile.
	C313.2	Learn about the power for propulsion and breaking systems.
	C313.3	Know about the transmission systems and gear box.
	C313.4	Analyse the front wheel geometry and steering systems.
	C313.5	Gain knowledge about the Front wheel Geometry and steering systems.
	C313.6	Learn about different electrical vehicles and the electrical system of an automobile.

MODULE I (14 HOURS)

Introduction

Main units of automobile chassis and body, different systems of the automobile, description of themain parts of the engine, motor vehicle act.

Power for Propulsion

Resistance to motion, rolling resistance, air resistance, gradient resistance, power required forpropulsion, tractive effort and traction, road performance curves.

Breaking systems

Hydraulic breaking system, breaking of vehicles when applied to rear, front and all four wheel,theory of internal shoe brake, design of brake lining and brake drum, different arrangement ofbrake shoes, servo and power brakes.

MODULE II (12 HOURS)

Transmission Systems

Layout of the transmission system, main function of the different components of the transmissionsystem, transmission system for two wheel and four wheel drives. Hotchkiss and torque tubedrives.

Gear box : Sliding mesh, constant mesh and synchromesh gearbox, design of 3 speed and 4 speedgear box, over drive, torque converter, semi and fully automatic transmission.

Hookes joint, propeller shaft, differential, rear axles, types of rear axles, semi floating, there quarterfloating and full floating types.

MODULE III (14 HOURS)

Front wheel Geometry and steering systems : Camber, castor, kingpin inclination, toe-in and toeout,centre point steering condition for true rolling, components of steering mechanism, powersteering.

Electrical system of an automobile : Starting system, charging system, ignition system, otherelectrical system.

Electrical vehicles:

History, electrical vehicles and the environment pollution, description of electric vehicle,operational advantages, present EV performance and applications, battery for EV, Battery types andfuel cells, Solar powered vehicles, hybrid vehicles.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

TEXTBOOKS:

1. Automobile Mechanics ,N.K.Giri, Khanna publishers

2. Automobile Engineering, K.M. Gupta, VolI& II, Umesh Publication

REFERENCE BOOKS

1. Automotive mechanics: William h. Crouse and Donald L. Anglin, TMH

2. The motor vehicle, Newton and Steeds

3. Automobile Mechanics, J. Heitner, East West Press

4. Automobile Engineering, Jain and Asthana, Tata McGraw Hill

5. Automobile Engineering, K.K.Ramalingam, Scitech

6. Automobile Engineering, Vol. I & II, Kirpal Singh, Standard Publications

7. A Text Book of Automobile Engineering, R.K.Rajput, Laxmi Publishers

	PME6J006-Green Technology (C314) *(L/T: 3/0, Credit: 3)*	
GT (C314)	C314.1	Understand about the ecosystem process and cycles.
	C314.2	Learn about environmental law and soil chemistry.
	C314.3	Elaborate water treatment, and active sludge treatment, pollution and pollutant.
	C314.4	Discuss Solid Waste Management, MSW, Hazardous Waste Management and their generation.
	C314.5	Gather knowledge about waste treatment & Control Measures and Occupational Safety and Health Acts.
	C314.6	Implement Fire prevention, electrical safety, management.

MODULE I:- Global Warming and its effect:- Introduction and physical definition of global warming, the New Carbon Problem: Accumulation, Long Half-Life, Heating Potential, Carbon Emission Factors, Carbon Absorption in Nature, The Global Emission Situation and its effect in India, The Kyoto and Other Protocols and its view in India, Effect of climate change and its impact. Planning for the Future to reduce global warming:- Steps taken to Control Carbon Emissions universally, Use of Promotional and Punitive Mechanisms for Reducing Carbon in Atmosphere, The General Approach in Planning for the Future, Developing Countrywide Adaptive Measures for Safety of Local People, Developing Mitigative Measures for Global Reduction of Carbon, India's National Action Plan on Climate Change (NAPCC) till date, National Mission for a Green India, The MRV Debate.

MODULE II:- Opportunities in Control of Carbon Emissions and Accumulation:- Essential Steps for Control of Carbon Emissions and Accumulation, Procedure to develop own Priorities and Business Opportunities in India for control of carbon emissions and accumulation, Needs a Mix of Green and Traditional Power Sources in India, A Logical Approach for Carbon Reduction, Need in India —More Forests, Less Deforestation and payment rates procedure for controlling carbon emissions and its Promotional Mechanisms at India. Green Technologies for Energy Production :- Various Technologies Available for Energy Production, Cost Comparison of a Few Typical Systems for Power Generation, Sources of Energy Production Already in Use, Alternative Methods Ready for Use, Green Technologies Needing some Prior R&D Work.

MODULE III:- Green Technologies for Personal and Citywide Application :- Measures to be taken for Green city, Carbon Emission Reduction at Personal Level, Carbon Emission Reduction at Local Authority and Citywide Level, Carbon Emissions from Imports. Green Technologies for Specific Applications:- Promotion of 'Green' Buildings, Guidelines, The Energy Conservation Building Code (ECBC), Green Hotels and Hospitals, Green Technologies for Transport, Green Roads, Ports and Harbors, Industries, Carbon, Carbon Emissions from a Few Selected Industries in India, The Changing Scenario in Cities, Need for Wider Application to Town Planning and Area Re-Development Projects ,'Green' Infrastructure for Municipal Services, Bringing up Indian Villages, Green Services for Crematoria, Spreading Message to all Stakeholders.

MODULE IV:- Some High-tech Measures for Reducing Carbon Emissions :- Use of Solar Power with Satellite-Based Systems ,Use of Carbon Capture and Storage (Sequestration) ,Microorganisms, A Quick SWOT Analysis. Recommended Plan of Action :- India's National Action Plan Take Us to a Low-Carbon Path, The Missions Help Develop Awareness, Few case studies on Projects undertaken by Various Countries, Adaptive Measures Essential for Indian People to Cope with Climate Change

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Text Book

1. Green Technologies, Soli J. Arceivala, Mc Graw Hill Education

Reference Book : 1. Green Technologies and Environmental Sustainability edited by Ritu Singh, Sanjeev Kumar 2.

http://cpcbenvis.nic.in/greentechnology.html#

	PME6H301-INDUSTRIAL LECTURE LABARATORY(C315) *Practical (Hours per week): 3, Credit: 2*	
Industrial Lecture Lab (C315)	C315.1	Demonstrate the applications of engineering concepts and principles learned in classroom.
	C315.2	Illustrate processes and products manufactured in the industries.
	C315.3	Improve interpersonal skill by communicating directly with industrial personnel.
	C315.4	Develop awareness of the engineering and technological aspects.
	C315.5	Aware of the roles and ethics of engineers in the industries, impacts of industrial processes on health, safety, environment and society.

Expert talk on

1. Working culture of Industries
2. Ethics
3. Industries laws and issues
4. Production process and control activities
5. Quality issues and control activites
6. Quality Maintenance activity
7. Materal Management
8. Role of engineers in the industry
9. Iinterpersonal skill development
10. Impacts of industrial processes on health, safety, environment and society.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Reference book:

1.Industrial Organisation and Engineering Economics by T. R. Banga and S. C. Sharma
2. Industrial Engineering and Management by S. C. Sharma and T. R. Banga
3. Organizational Behaviour, K. Awathappa,HPH.
4. Organizational Behaviour, VSP Rao, Excel
5. Introduction to Organizational Behaviour, Moorhead, Griffin, Cengage.
6. Organizational Behaviour, Hitt, Miller, Colella, Wiley

	PME6E101-PRESENTATION SKILL AND SKILL FOR INTERVIEW LABORATORY (C316) *Practical (Hours per week): 3, Credit: 3*	
BC& Skill Lab (C316)	C316.1	Convey thoughts and ideas with clarity and Communicate effectively.
	C316.2	Make effective presentations.
	C316.3	Write different types of reports.
	C316.4	Face interview & group discussion.
	C316.5	Critically think on a particular problem and Handle Engineering Ethics and Human Values.

LIST OF EXPERIMENTS:

Part-A (To be started after completion of module I and to be completed by 30th working day of the semester) 1. Group discussion- create groups of about 10 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation is as follows; (i) Communication skills 10marks (ii) Subject clarity (iii) Group dynamics 10marks (iv) Behaviour & Mannerisms

Part-B (To be started from 31st working day and to be completed before 60th working day of the semester) 2. Presentation skills- Identify a suitable topic and ask the students to prepare a presentation (preferably a power point presentation)for about 10 minutes. Parameters to be used for evaluation are as follows; (i) Communication skills* 10marks (ii) Platform skills* 10marks (iii) Subject clarity/knowledge 10marks (Marks: 30) *Language fluency, auditability, voice modulation, rate of speech, listening, summarizes key learning etc. **Postures/gestures, smile/expressions, movements, usage of floor area etc. **Part-C** (To be conducted before the termination of semester) 3. Sample letter writing or report writing following the guidelines and procedures. parameters to be used for evaluation is as follows; (i) Usage of English & Grammar 10marks (ii) Following the format 10marks (iii) Content clarity 10marks

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	2	2	2	3	2	2	2	3	3	3	3	3		2	3	3

Reference books

1. The Science of Self-Learning: by Peter Hollins Kendle edition
2. Interview Skills : D.S.Paul, Manpreet kaur , Good will Publication
3. How To Succeed At Interviews: Sudhir Andrews,The McGraw-Hill

	PME6l101-PRODUCTION AND OPERATAION MANAGEMENT LABAROTORY (C317) *Practical (Hours per week): 2, Credit: 1*	
POM Lab (C317)	C317.1	Design the layout of an institute after studying the same for an existing institute.
	C317.2	Do work sampling for any work situation.
	C317.3	Compare different parameters for selecting the location for any given type of Industry.
	C317.4	Determine optimum stock of different Items for a consumer store.
	C317.5	Operate MES software.

LIST OF EXPERIMENTS:

Production and Operation Management Practical

1. Do Work Sampling of any work situation and determine how much time is spent in value addition, inspection /checking, communication and idleness.

2. Collect layout of any industry/ institute and design layout of similar industry/ institute to be constructed on a different site.

3. Select two or more possible locations for setting up of an industry/ institute and do comparative evaluation with respect to different parameters.

4. Gather sample data about stock of different items, their consumption pattern and price from any one of the following business firms such as Automobile Repair Shop, Medicine Store, Consumer Store, Production Shop, Service Centre etc and suggest stock that should be maintained for optimizing Inventory.

5. Hands on practice on any Manufacturing Execution System (MES) software/ ERP suit such as NetSuite Manufacturing, IQMS MES Software, Fishbowl Manufacturing, JobBOSS, MES SIMATIC IT, etc.

6. Hands on practice on simulation software for manufacturing/ supply chain/ logistics, such as Arena, Witness, Flexsim, Plant Simulation, AnyLogic, Simio, etc. *Students may do 2 to 3 activities individually or in group

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	2	2	2	2	3	2	3	3		3	3	3

	PME6l102-REFRIGERATION & AIR CONDITIONING LABORATORY(C318) *Practical (Hours per week): 2, Credit: 1*	
RAC Lab (C318)	C319.1	Determine C.O.P on vapour compression system and vapour absorption system.
	C319.2	Performance test of air conditioning test rig of window type.
	C319.3	Performance test of air conditioning test rig of duct type.
	C319.4	Determine C.O.P of Ice plant and heat pump.
	C319.5	Performance analysis of cooling tower.

LIST OF EXPERIMENTS:

1. Determination of C.O. P on vapour compression system
2. Determination of C.O. P on vapour absorption system
3. Performance test on Air conditioning test rig (Window type)
4. Performance test on Air conditioning test rig (Duct type)
5. Determination of C.O.P of ice plant
6. Determination of C.O.P of Heat Pump
7. Performance analysis in an experimental cooling tower.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	2	2	2	2	3	3		3	3	3

Beyond Syllabus:

1. Working principle of steam jet refrigeration system
2. Study of vortex tube refrigeration system

SEVENTH SEMESTER					
Theory / Practical / Sessional					
Subject Code	**Subject Name**	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**
PME7J001/ PME7J002	Mechanical Vibration/ Tribology	3-1	4	100	50
PME7J003/ PME7J004	Robotics/Simulation, Modeling & Control	3-1	4	100	50
PCP7H007/ PCP7H008/ PCP7H009	Internet of Things (IOT)/ Nano Science & Bio Technology/ Intellectual Property Rights (IPR)	3-1	4	100	50
PCP7H010/ PCP7H011/ PCP7H012	Soft Computing/ Introduction to Management & Function/ Marketing Management	3-1	4	100	50
PME7N201	Seminar	0-0-1	4	-	100
PME7N202	Minor Project	0-0-2	4	-	200
TOTAL			24	**900**	

	PME7C001-Nano Science & Biotechnology (C401) *(L/T: 3/1, Credit: 4)*	
NS&BT (C401)	C401.1	Acquire knowledge about the Nano scale materials with different visualization technique.
	C401.2	Learn about structure, classification and physical properties of CNT.
	C401.3	Understand structural and optical properties of Nano materials molecular electronics etc.
	C401.4	Acquire knowledge about bio Nano device and its applications.
	C401.5	Aware of safety and environment aspects of Nano technology.
	C401.6	Learn Nano technology and impact on society and industries.

Module -1(6 Hours) Fundamental and process of fabrication The world of small dimensions, Nano scale Properties (Electrical, Optical, Chemical, Mechanical), Nano scale visualization techniques , Electron microscopy (TEM, SEM, Cryo- SEM), Scanning probe microscopy (AFM, STM), Diffraction techniques (XRD, synchrotron),Top-down and Bottom-Up approach , nanoparticles (synthesis ,properties and applications).

Module-2 (12 Hours) Nano-Device and Components: Structure of carbon nanotube, Classification and physical properties of CNT, Graphene: structure, synthesis and properties, Nano photonis (Photonic crystal in one, two and three dimensions), Quantum dot, quantum wire, Nano fluidics: nano pores and Nano capillaries, Debye length, Nano mechanics (elastic, thermal and kinetic material properties).

Module-3 (10 Hours) Quantum Electronics: Coulomb blockade in nano capacitors and quantum dot circuits. Single Electron Transistor (SET), Quantum information and computing, Sprintonics devices and its classifications, Structural and optical properties of nanomaterials, Molecular Electronics, NEMS, Optical and Magnetic computer.

Module -4 (10 Hours) Biodevice and application Bio-nanostructures (nano fibers, nanotubes, nano cellulose), Biological nano machines Ribosomes, Photosynthesis systems, Near-field Bio imaging, Nanoparticles for optical diagnostics and Targeted Therapy,Protein nanotechnology, DNA nanotechnology, Nano robot and its application, Nano capsule, Nano somes, Medibots, Artificial pancreas, Artificial Muscle,Nano clinic for Gene delivery and photodynamic therapy Nanoparticle in cancer, Bio nano motors. ADDITIONAL MODULE (Terminal Examination-Internal) (05 hr) Nanotechnology safety and the environment, Impact of nanotechnology on society and industry, Biosensors (fabrication, functionalization, applications), Current research on nanotechnology.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Beyond syllabus:

1. Computational simulation of fluids
2. Application of nanotechnology and interdisciplinary research

Books:

1. Rishal Singh, S.M. Gupta, Introduction to nano technology Oxford university press,(2016).

2. Paras N. Prasad, Nano photonics, John Wiley & Sons, (2016).

3. C. M. Niemeyer, C. A. Mirkin, -Nano biotechnology: Concepts, Applications and Perspectives, Wiley-VCH,(2004).

2. 4 T. Pradeep,-Nano: The Essentials, McGraw -Hill education, (2007).

4. Challa, S.S.R. Kumar, Josef Hormes, CarolaLeuschaer, Nanofabrication Towards Biomedical

5. Nicholas A. Kotov, -Nanoparticle Assemblies and Superstructures, CRC, (2006). 6. David S Goodsell, "Bio nano technology, John Wiley & Sons, (2004).

	PME7J001-MECHANICAL VIBRATION(C402) *(L/T: 3/1, Credit: 4)*	
Mech. Vibration (C402)	C402.1	Know the brief history of Mechanical vibration, SHM, Fourier analysis and concept of DOF.
	C402.2	Learn about un-damped free vibration of single degree freedom systems.
	C402.3	Know about damped free vibration of single degree freedom systems.
	C402.4	Understand about the forced vibration of single degree freedom systems.
	C402.5	Learn about multi degree freedom systems.
	C402.6	Identify the vibration like rod ,spring and complex system etc.

MODULE – I [12]

1. INTRODUCTION & IMPORTANCE OF MECHANICAL VIBRATION:Brief history of Mechanical Vibration, Types of Vibration, Simple Harmonic Motion (S.H.M.),Principle of superposition applied to S.H.M., Beats, Fourier Analysis, Concept of degree of freedomfor different vibrating systems.
2. UNDAMPED FREE VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS: Modeling of VibratingSystems, Evaluation of natural frequency – differential equation, Energy & Rayleigh's methods,Equivalent systems.
3. DAMPED FREE VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS: Different types of damping,Equivalent viscous damping, structural damping, Evaluation of damping using free and forcedVibration technique, Concept of critical damping and its importance, study of vibration response ofviscous damped systems for cases of under damping, critical damping and over damping,Logarithmic decrement.

MODULE – II [15]

4. FORCED VIBRATION OF SINGLE DEGREE FREEDOM SYSTEMS: Steady state solution with viscousdamping due to harmonic force, reciprocating and rotating unbalance mass, vibration isolation andtransmissibility due to harmonic force excitation and support motion. Vibration measuringinstruments – vibrometer and accelerometer.Whirling of shaft with single disc and without damping, Concept of critical speed and its effect on the rotating shaft.
5. UNDAMPED VIBRATION OF TWO DEGREE FREEDOM SYSTEMS: Free vibration of spring coupledand mass coupled systems, Longitudial, Torsional and transverse vibration of two degree freedomsystems, influence coefficient technique, Un-damped vibration Absorber.

MODULE – III [13]

6. INTRODUCTION TO MULTI-DEGREE FREEDOM SYSTEMS: Normal mode vibration, Co-ordinatecoupling-close coupled and far coupled systems, Orthogonality of mode shapes, Methods of matrixiteration, Holzer's method and Stodola method. Torsinal vibration of two, three and multi-rotorsystems.Dunkerley's lower bound approximate method.
7. CONTINOUS SYSTEMS: Vibration of strings, longitudinal vibration of rods, torsional vibration ofrods, transverse vibration of Euler-beams.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

TEXT BOOKS:

1. Theory of vibration with Applications: W.T. Thomson and Marie Dillon Dahleh, Pearson Education 5thed. 2007.

2. Introductory Course on theory and Practice of Mechanical Vibrations. J.S. Rao& K. Gupta,New Age International Publication, New Delhi, 2007.

REFERENCE BOOKS:

1. Mechanical Vibrations: S.S. Rao, Prarson Education Inc, 4thed. 2003

2. Mechanical Vibrations: S. Graham Kelly, Schaum's outline series, Tata McGraw Hill, SpecialIndian ed., 2007

3. Mechanical Vibrations: V.P. Singh, DhanpatRai& company Pvt. Ltd. 3rded., 2006

4. Elements of vibration Analysis: Leonard Meirovitch, Tata McGraw Hill, Special Indian ed.,2007

	PME7J004-ROBOTICS (C403) *(L/T: 3/1, Credit: 4)*	
Robotics (C403)	C403.1	Able to know about the fundamental of robotics and do mathematical modelling of a robot.
	C403.2	Calculate the forward kinematics, inverse kinematics & Jacobean for serial and parallel robots.
	C403.3	Obtain the Jacobean matrix &use it to identify singularities.
	C403.4	Identify different types of end effector and sensors required for specific applications.
	C403.5	Generate trajectory planning for motion planning.
	C403.6	Learn about various applications of robots in industry.

MODULE – I

1. Fundamentals of Robotics: Evolution of robots and robotics, Definition of industrial robot, Lawsof Robotics, Classification, Robot Anatomy, Work volume and work envelope, Human armcharacteristics, Design and control issues, Manipulation and control, Resolution; accuracy andrepeatability, Robot configuration, Economic and social issues, Present and future application.
2. Mathematical modeling of a robot: Mapping between frames, Description of objects in space,Transformation of vectors.Direct Kinematic model: Mechanical Structure and notations, Description of links and joints,Kinematic modeling of the manipulator, Denavit-Hartenberg Notation, Kinematic relationship
between adjacent links, Manipulator Transformation matrix.

MODULE – II

3. Inverse Kinematics: Manipulator workspace, Solvable of inverse kinematic model, ManipulatorJacobian, Jacobian inverse, Jacobian singularity, Static analysis.
4. Dynamic modeling: Lagrangian mechanics, 2D- Dynamic model, Lagrange-Euler formulation,Newton-Euler formulation.
5. Robot Sensors: Internal and external sensors, force sensors, Thermocouples, Performancecharacteristic of a robot.

MODULE – III

6. Robot Actuators: Hydraulic and pneumatic actuators, Electrical actuators, Brushless permanentmagnet DC motor, Servomotor, Stepper motor, Micro actuator, Micro gripper, Micro motor, Driveselection.
7. Trajectory Planning: Definition and planning tasks, Joint space planning, Cartesian spaceplanning.
8. Applications of Robotics: Capabilities of robots, Material handling, Machine loading andunloading, Robot assembly, Inspection, Welding, Obstacle avoidance.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

TEXT BOOKS:

1. Robotics and Control**,** R.K. Mittal and I.J. Nagrath, Tata McGraw Hill
2. Introduction to Robotics: Mechanics and control, John J Craig, PHI
3. Robotics Technology and Flexible Automation, S.R.Deb and S. Deb, TMH

REFERENCE BOOKS:

1. Introduction to Robotics, S. K. Saha, Tata McGraw Hill
2. Robotics: Control, Sensing, Vision and Intelligence, K.S.Fu, R.C.Gonzalez and C.S.G.Lee, McGraw Hill
3. Robotics, Appuu Kuttan K.K., I.K. international
4. Robot Dynamics and Control, M.W.Spong and M. Vidyasagar , Wiley India.
5. Industrial Robotics Technology, programming and application, M.P.Groover, TMH.
6. Introduction to Robotics: Analysis, Systems, Applications, S.B.Niku, PHI
7. Robotics: Fundamental Concepts and Analysis, A. Ghosal, Oxford University Press
8. Fundamentals of Robotics: Analysis and Control, R. J. Schilling, PHI
9. Robotic Engineering: An Integrated Approach, R.D. KLAFTER, T. A. Chmielewski, and M. Negin, PHI
10. Robot Technology: Fundamentals: J. G. Keramas, Cengage Learning

	PME5H003-MARKETING MANAGEMENT (C404) *(L/T: 3/1, Credit: 4)*	
Marketing Management (C404)	C404.1	Get the Concept, Process, Functions and relevance of marketing management.
	C404.2	Operate the Internet and gather information about World Wide Web based Information.
	C404.3	Get knowledge about Market Segmentation, Targeting and Positioning.
	C404.4	Learn about the Concept of IMC.
	C404.5	Students would be able to take decision on Pricing.
	C404.6	Know about Supply Chain Management.

Module – I (10 hours)

Marketing Management: Concept, Process, Functions and relevance in the current context.Marketing Environment: Elements of micro and macro environment Competition Analysis:Factors contributing to competition, porter"s five forces model, Identifying and analysing competitors. Marketing Planning : Exploring Opportunity, Product –market selection, MarketingPlanning Process. Market Research and Information Systems: Research Process, The Internetand World Wide Web based Information collection and processing, Database, Data Warehousesand Data Mining, Global Market Research. Consumer Behavior: Factors influencing consumerbehavior, consumer decision process. Organizational buying behavior.

Module II (10 hours)

Market Segmentation, Targeting and Positioning: Definition, Bases of segmenting consumer andIndustrial markets. Target Market strategies: Market Positioning. Market Demand Forecasting:Key Terms, Forecasting Tools: Short term tools: Moving average and Exponential smoothingmethods, Long-term forecasting Tools: Time series analysis, Econometrics methods, Qualitativetools : Buying Intention Survey, Sales Force Opinion and Delphi Techniques. Product Planning :Product Life Cycle, New Product Development Process, Branding Strategy, Positioning a Brand,Brand Equity, Packaging and Labeling, Product-mix and Product Line, Planned Obsolescence.

Module – III (10 hours)

Pricing Decision: Objectives and Factors influencing pricing, Pricing method and strategies.Integrated Marketing Communication(IMC)- Concept of IMC, the marketing communicationprocess, Promotion Mix, elements of promotion mix, Direct marketing. Channels ofDistributions: Types of intermediaries, functions of distribution channels, channel levels,Designing Distribution Channels, Physical Distribution, Supply Chain Management (Basic only).Trends in Marketing: Green Marketing, Customer Relationship Management, Emarketing, RuralMarketing and Service Marketing (concepts only)

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	2	3	3	3	3	3	3	3	3	3	3	3		2	2	2

Text Book:

1. Etzel , Walker ,Stanton and Pandit, Marketing, 14/e, Tata McGraw Hill.
2. Saxena, "Marketing Management" Tata McGraw Hill, 4/e.

Reference

1. Grewal, Levy, „Marketing" Tata McGraw Hill, special Indian edition.
2. Karunakaran "Marketing Management", Himalaya Publishing House, 2010/e.
3. Kotler, Keller,Koshy and Jha, "Marketing Management", 13/e, Pearson Education.

	PME7I202-MINOR PROJECT(C405) *Practical (Hours per week): 8, Credit: 4*	
Project (C405)	C405.1	Identify & undertake projects, which is feasible, cost effective, eco-friendly and safety.
	C405.2	Measure the relation of the project to the literature and how much the project is applicable to the society. (i.e. lab to land)
	C405.3	Plan properly to complete the project within the schedule time.
	C405.4	Conduct all relevant testing after execution of the project and analysed the test results for future research.
	C405.5	Execute any project with proper methodology and in team spirit.
	C405.6	Write thesis / project report as per standard norm.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

	PME7N201-SEMINAR(C406) *Practical (Hours per week): 8, Credit: 4*	
Seminar (C406)	C406.1	Select topics on modern technology; prepare slides for power point presentation.
	C406.2	Able to gain deep knowledge on modern technology by referring the journals/ magazines
	C406.3	Present before a huge audience or any topic without fear and with a voice clarity, good gate up and proper body language
	C406.4	Develop their communication skill.
	C406.5	Write a detail report on any topic related to modern technology in the prescribed format.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

B.Tech (Mechanical Engineering) detail Syllabus for Admission Batch 2015-16 *8th Semester*

Eighth Semester							
Theory							
Sl. No.	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**	**University Marks**	**Internal Marks**
1	PE	PME8J001/ PME8J002/	Fatigue Creep & Fracture/ Mechatronics & MEMs/	3-1-0	4	100	50
2	OE	PCP8H001/ PCP8H002/ PCP8H003	Entrepreneurship Development/E-Commerce & ERP / Business Regulatory Framework	3-1-0	4	100	50
Total Credit (Theory)					8		
Total						**200**	**100**
1	PSI	PME8N201	Seminar	0-0-3	4	100	
2	PSI	PME8N202	Major Project	0-0-6	4	400	
Total Credit (Practical)					8		
Total						**500**	
Total Marks = 800							
Total Semester Credit					16		

	HSSM3401ENTREPRENEURSHIP DEVELOPMENT(C407) *(L/T: 3/1, Credit: 4)*	
ED (C407)	C407.1	Get knowledge about the concept of Entrepreneurship.
	C407.2	Know about the Sustain accelerated economic growth by developing entrepreneurial.
	C407.3	Aware of various industries and financial institutions and their role.
	C407.4	Get information to start their own venture.
	C407.5	Learn about various schemes incentives available to start own business.
	C407.6	Aware of relevant industrial law applicable to run a business.

Module-I

Entrepreneurship: Concept of entrepreneurship and intrapreneurship, Types of Entrepreneur, Nature and Importance, Entrepreneurial Traits and Skills, Entrepreneurial Motivation and Achievement, Entrepreneurial Personality

Module II

Entrepreneurial Environment, Identification of Opportunities, Converting Business Opportunities into reality. Start-ups and business incubation, Setting up a Small Enterprise. Issues relating to location, Environmental Problems and Environmental pollution Act, Industrial Policies and Regulations,

Module III

Need to know about Accounting, Working capital Management, Marketing Management, Human Resources Management, and Labour Laws. Organizational support services – Central and State Government, Incentives and Subsidies.

Module IV

Sickness of Small-Scale Industries, Causes and symptoms of sickness, cures of sickness, Role of Banks and Governments in reviving industries.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Reference Book:

1.Entrepreneurship Development and Management, Vasant Desai, HPH

2.Entrepreneurship Management, Bholanath Dutta, Excel Books

3.Entrepreneurial Development, Sangeeta Sharma, PHI

4.Entrepreneurship, Rajeev Roy, Oxford University Press

	PME75003-FATIGUE CREEP AND FRACTURE(C408) *(L/T: 3/1, Credit: 4)*	
FC&F (C408)	C408.1	Grasp the basics of design philosophy & fatigue.
	C408.2	Learn about to reduce fatigue failure through fatigue design & analysis.
	C408.3	Get knowledge about the fracture of metals particularly brittle & ductile fracture.
	C408.4	Understand the mechanical behaviour of materials under the chemically active environment.
	C408.5	Know the fundamentals of creep deformation & failure in materials.
	C408.6	Design the different materials as per fatigue, fracture, creep strength of materials.

MODULE – I : (12 HOURS)

Design philosophy :(i) Infinite life, (ii) Safe life, (iii) Fail safe and (iv) Damage tolerant designconcepts.

Fatigue Design : Cyclic stress and stress reversals, Fatigue and progressive fracture, Endurancelimit, Fatigue Tests : Cantilever and Beam type of Fatigue Tests, Axial Fatigue Tests. Influence ofmean stress on fatigue : Gerber, Goodman and soderberg's criteria. Effect of compressive cyclicstress on fatigue. Fatigue design formula for axial, bending, torsional and combined loading.Fatigue controlling factors: Effect of frequency, Temperature, size, form, stress concentrationfactors, Notch, sensitivity & surface conditions, residual stresses.

MODULE – II : (12 HOURS)

Improvement of fatigue strength' by chemical/metallurgical processes such as nitrating, flame hardening, case carburizing. Fatigue strength enhancement by mechanical work : cold rolling,peening, shot peening.

Effect of environment : Corrosion Fatigue, Concept of cumulative fatigue damage

Fracture Mechanics : Ductile and brittle fracture Theoretical cohesive strength of metasl, GriffithTheory of brittle Fracture, Oruron's modification to Griffith Theory.

MODULE – III (14 HOURS)

Modes of fracture : Mode I, II and III, fatigue creek growth Behaviour of metals, Linear ElasticFracture Mechanics (LEFM), Stress Intensity Factor(SIF), Stress field near the crack tip, Critical SIFand Fracture Toughness, Experimental determination of fracture toughness KIC, COD gauges andstandard ASTM Tests.Strain Energy Release Rates (SERR), Elasto-Plastic Fracture Mechanics (EPFM), Plastic zone sizeand its evaluation, J-Integral Method.

Creep Analysis :

Definition, Constant stress and constant, strain creep tests. Uniaxial creep tests : Baily's Power Law,Creep relaxation : strain hardening and time hardening creep relaxation. Introduction to Creepbending and deflection of simple problems.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

Text Books:

1. George E. Dieter, Mechanical Metallurgy, - McGraw Hill, NY, 1988
2. Joseph Marin, Mechanical Behaviour of Engg. Materials, - Prentice Hall of India, 1966
3. Stephens, R.I. and Fuchs, H.O., Metal Fatigue in Engg. ,- Wiley, NY 2001
4. Finnie, I. and Heller, W.R., Creep of Engg. Materials, - McGraw Hill Book Co., 1959
5. Prasant Kumar, Fracture Mechanics

Reference Books:

1. L.S. Srinath, Advanced Mechanics of Materials, - Tata McGraw Hill Ltd., ND, 2009.
2. Norman E, Dowling, Mechanical Behaviour of Materials, - Prentice Hall, NJ, 1999.
3. Lessells, J.M., strength and resistance of materials, - John wiley& sons, 1954
4. Peterson, R.E., Stress Concentration Design Factors,- John Wiley & Sons, 1953
5. Meguid, S.A., Fracture Mechanics,- John Wiley & Sons, 1996
6. KareHellan, Introduction to Fracture Mechanics, - McGraw Hill Book Co., 1985

	PME7403-SEMINAR(C409) *Practical (Hours per week): 8, Credit: 4*	
Seminar (C409)	C409.1	Select topics on modern technology; prepare slides for power point presentation.
	C409.2	Able to gain deep knowledge on modern technology by referring the journals/ magazines
	C409.3	Present before a huge audience or any topic without fear and with a voice clarity, good gate up and proper body language
	C409.4	Develop their communication skill.
	C409.5	Write a detail report on any topic related to modern technology in the prescribed format.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3

	PCME7402-PROJECT (C410) *Practical (Hours per week):8 ,Credit: 4)*	
Project (C410)	C410.1	Identify & undertake projects, which is feasible, cost effective, eco-friendly and safety.
	C410.2	Measure the relation of the project to the literature and how much the project is applicable to the society. (i.e. lab to land)
	C410.3	Plan properly to complete the project within the schedule time.
	C410.4	Conduct all relevant testing after execution of the project and analysed the test results for future research.
	C410.5	Execute any project with proper methodology and in a team spirit.
	C410.6	Write thesis / project report as per standard norm.

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
Mapping of CO with PO and PSOs	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3