COURSE STRUCTURE

&

SYLLABUS
(3rd – 8th SEMESTER)

FOR B.TECH PROGRAMME
IN
MECHANICAL ENGINEERING

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY ORISSA,
ROURKELA

2007 - 2008

COURSE STRUCTURE
SECOND YEAR B.TECH PROGRAMME
MECHANICAL ENGINEERING

3rd Semester				**4th Semester**			
Theory		*Contact Hrs.*	*Credit*	*Theory*		*Contact Hrs.*	*Credit*
		L-T-P				**L-T-P**	
BSCM 2201	Mathematics - III	3-1-0	4	BSCM 2202	Mathematics - IV	3-1-0	4
BENG 1201	Electrical Machines	3-1-0	4	CPME 6203	Fluid Machanics & Hydraulic Machines	3-1-0	4
	or				or		
CPME 6203	Fluid Machanics & Hydraulic Machines			BENG 1201	Electrical Machines		
BSCP 2201	Physics - II	2-0-0	2	BSCC 2202	Material Sciences	2-0-0	2
	or				or		
BSCC 2202	Material Sciences			BSCP 2202	Physics - II		
BCSE 3201	Object Oriented Programming UsingC++	3-0-0	3	BCSE 3202	Relational Database Management System	3-0-0	3
HSSM 4201	Engineering Economics & Costing	3-0-0	3	HSSM 4202	Org. Behaviour	3-0-0	3
	or				or		
HSSM 4202	Organisational Behaviour			HSSM 4201	Engineering Economics & Costing		
CPME 6201	Machine Dynamics - I	3-1-0	4	CPME 6202	Mechanics of Materials-I	3-1-0	4
Total			**20**	**Total**			**20**
Practicals/Sessionals		*Contact Hrs.*	*Credit*	*Practicals/Sessionals*		*Contact Hrs.*	*Credit*
BENG 9202	Basic Electronics Laboratory	0-0-3	2	BENG 9201	Basic Electrical Engineering Laboratory	0-0-3	2
	or				or		
BENG 9201	Basic Electrical Engineering Laboratory			BENG 9202	Basic Electronics Laboratory		
BCSE 9201	Computer Lab (OOP)	0-0-3	2	BCSE 9202	Computer Lab (RDBMS)	0-0-3	2
BENG 9203	Mechanical Engineering Laboratory	0-0-3	2	CPME 9203	Workshop - III	0-0-3	2
	or				or		
CPME 9203	Workshop - III			BENG 9203	Mechanical Engineering Lab.		
CPME 9201	Machine Dynamics Hydraulic Machine Lab.	0-0-3	2	CPME 9202	Material Testing & Heat Power Lab.	0-0-3	2
Total			**8**	**Total**			**8**
			28				**28**

L-LECTURE **T-TUTORIAL** **P-PRACTICAL**

3rd Semester

BSCM 2201 MATHEMATICS – III (3-1-0)

Module – I (9 Lectures)

Partial differential equations : The vibrating string. The wave equation & its solution.

The Heat equation and its solution

Module – II (10 Lectures)

Two – dimensional wave equation and its solution.

Laplace equation in polar, cylindrical and spherical coordinates. Potential.

Module – III (13 Lectures)

Complex analysis : Complex numbers and functions conformal mappings

Complex integration. Cauchy's Theorem Cauchy's integral formulas.

Module – IV (8 Lectures)

Taylor's and Laurent's series, Residue theorem, evaluation of real integrals.

The Course covered by : Advance Mathematics by E. Kreyszig, John Wiley & Son's (P) Ltd. (8th Edition)
Chapter 11 (except 11.6)
Chapter 12, 13, 14, 15

BENG 1201 ELECTRICAL MACHINES (3-1-0)

Module I (10 Lectures)

D.C Mechanics :

D.C Generator – construction and principle of operation, E.M.F. equation ; types of generator; no load and load characteristics; Voltage build-up of shunt

Generator; voltage regulation, Application.

D.C Motor –construction and principle of operation ; back E.M.F; torque and speed equations; characteristics and performance curves; speed control of series and shunt motors; motor starters; industrial application.

Losses and Efficiency of D.C machines.

Module II (10 Lectures)

Transformer:

Single phase – construction and principle of operation; E.M.F. equation; Phasor diagram; actual and approximate equivalent circuits; open and short circuit tests, voltage regulation; losses and efficiency.

Three Phase – Construction and principle of operation; connection of three single –phase units in wye, delta, open delta configurations; Autotransformer; conventional transformer connected as Autotransformer. Special Transformers – induction heating and high impedance and high frequency transformer.

Module III (10 Lectures)

Synchronous Machines :

Three- phase alternators – construction and principle of operation; E.M.F. equation; distribution and pitch factors; Synchronous reactance; performance of alternators on no-load and load; Phasor diagram; voltage regulation, power calculations of turbine and hydro-generators,; synchronization of a generator.

Three-Phase Synchronous Motor- construction and principle operation; V- curves; Phasor diagram; methods of starting; applications.

Module IV (10 Lectures)

Three-Phase induction Motor- construction of slip ring and squirrel cage type induction motors; Phasor diagram and equivalent circuit; torque-slip characteristics; maximum torque calculations; open and short-circuit tests; losses and efficiency; starting of induction motors; speed control; Induction generator.
Single-Phase Induction Motor- construction and principle of operation; capacitor- start and capacitor-run motors; Universal motor; Stepper motors.

Books :

1. Electrical Machines, Drives and Power Systems, 5th edition by Theodore Wildi (Pearson) : Text.
2. Electrical Machinery by A.E. Fitzerald and Charles Kingsley, Jr., and S.D. Umans, Tata McGraw Hill Publication.
3. Principles of Electric Machines by V.K Meheta and R. Meheta , S. Chand Publication.

CPME 6203 FLUID MECHANICS AND HYDRAULIC MACHINES (3-1-0)

1. Introduction : Scope of fluid mechanics and its development as a science
2. Physical property of Fluid

   Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.
3. Fluid static

   Pressure, Pascal's Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, monometer.

L. Hydrostatic process on submerged surface, force on a horizontal submerged plane surface, force on a vertical submerged plane surface.

Buoyancy and flotation, Archimedes' principle, stability of immersed and floting bodies, determination of metacentric height.

Fluid kinematics : Introduction, description of fluid flow, classification of fluid flow. Acceleration of fluid particles, flow rate and continuity equation, differential equation of continuity.

Fluid dynamics : Introduction, Euler's equation analog a streamline, energy equation, Bernoulli's equation, Analysis of finite control volumes and its application to siphon, venture, office

Turbine : Classification, reaction, Impulse, outward flow, inward flow and mixed flow turbines, Francis & Kaplan turbines, Pelton wheel, Physical description and principle of operation, Governing of Turbine.

Centrifugal Pump : Principles of classification, Blade angles, Velocity triangle, efficiency, specific speed, characteristics curve.

Reciprocating Pump : Principles of working, slip, work done, effect of acceleration and frictional resistance, separation

Tex Books :

1. Fluid Mechanics, A.K. Mohanty, PHI

2. Introduction to Fluid Mechanics and Fluid Machines, S.K. Som and G. Biswas, TMH
3. Fluid Mechanics, Modi & Seth

BSCP 2201 PHYSICS – II (2-0-0)

This one semester Physics course is divided into four units. The unit – I deals with some aspects of nuclear physics, unit – II introduces certain features of condensed matter physics, unit – III deals with certain aspects of semiconductors and superconductors and unit – IV introduces Opto-electronic devices and fibre-optic communication system.

Unit – 1

This unit covers the basic principles and applications of different types of accelerators and their important applications.

Detailed constructional features of accelerators are not necessary.

1. Need for nuclear accelerators.
2. D.C. Accelerators : Cockcroft – Walton, Van de Graff, Tandem accelerators.
3. RF accelerators : Linear accelerator, cyclotron, electron accelerator, betatron.
4. Application of nuclear accelerators – production of radioisotopes, radiation processing of materials, medical applications.

Unit – 2

This Unit deals with diffraction in crystals and its role in determining crystal structure.

Study of crystal structure by diffraction methods, Bragg's condition for crystal diffraction, Lau condition, Miller indices, Reciprocal lattice, Geometrical structure factor, Atomic form factor.

Unit – 3

This unit deals with certain features of semiconductors and superconductors.

1. Energy bands in solids: Kronig – Penny model, allowed bands and forbidden gaps, elemental and compound semiconductors.
2. Superconductivity : Superconductors and their properties, Meisner effect, Type – I and Type – II Superconductors, Thermodynamic properties of superconductors, London equation, Application of superconductors.

Unit – 4

This unit introduces some Opto – electronic devices and fibre – optic communication system.
Laser : Principle of lasing, properties of Laser, construction and working of semiconductor laser, Application of laser.
LED : Principle construction of operation and application, Introduction to fibre optics, basic characterstics of optical fibres, optical fibre communication system.

Books Recommended :

1. Nuclear Physics, P. R. Roy & B. P. Nigan
2. Particle Accelerators, M. S. Livingston & J. P. Blewett
3. Concepts of Modern Physics, A. Beiser
4. Introduction to Solid State Physics, C. Kittel
5. Introduction to Lasers, A. Avadhnulu
6. Physics – II, B. B. Swain and P. K. Jena.

BSCC 2202 MATERIAL SCIENCES (2-0-0)

MODULE – I (10 Lectures)

1. Classification of Engineering Materials. Engineering properties of materials. Selection of Materials.
2. Electron theory of solids : Free electron theory of metals. Electrical conductivity; Thermal conductivity, Quantum theory of free electrons. Band theory of solids, Conductivity of metals
3. Conductors, Insulators, Semiconductors, Intrinsic and extrinsic semiconductors, Band theory of semi conductors Hall effect.
4. Super Conductors – Zero resistivity, Critical magnetic field and critical current density. Type I and II super conductors. Applications of Supercoductors.

MODULE – II (10 Lectures)

5. Dielectric Materials : Microscopic Displacement of atoms and molecules in an external dc electric field, Polarization and dielectric constant, Dielectric nitially lity. Temperature dependence, Dielectric Breakdown. Ferro electric material Piezoelectrics, Pyroelectrics, Dielectric Materials as electrical isulators.
6. Magentic Properties of Materials : Dia, Para and Ferro magenetic materials. Theory of magnetism, Ferro magnetic materials or Ferrites, Comparison of magnetic behaviour and magnetic parameters of Dia, Para and Ferro magnetic materials.
7. Optical Properties of Materials : Scattering, Refraction, Theory of Refraction and absorption, Atomic Theory of optical properties. Lasers, Optical fibres – Principle, structure, application of optical fibre.

MODULE – III (10 Lectures)

8. Organic Materials : Polymers – Mechanism of Polymerization : Addition, condensation and co-polymerisation, applications.

   Plastics – Types : Thermosetting and thermoplastics. Transfer moulding, injection moulding, extension moulding, Blow moulding, Welding of plastics; Rubber types, application.
9. Ceramics : Types, Structure, Mechanical properties, applications

MODULE – IV (10 Lectures)

10. Composite Materials : Agglomerated Materials : Cermets, Reinforced Materials : Reinforced Concrete. Glass fibre reinforced plastics, Carbon fibre reinforced plastics. Whiskers, fibre reinforced plastics, Laminated plastic sheets. Tufnol, Properties of composites. Metal matrix composites, manufacturing procedure for fibre reinforced composites.
11. Performance of Materials in Service : Service performance, failure, design considerations, Corrosion – types, (Atmospheric, Pitting, Stress Corrosion), Control & prevention, protective coating, Performance of metals and Ceramics at high temperature.

Text Books :

1. Callister W.D., Materials Science and Engineering, John Wiley & Sons.
2. Vijaya M. S., Rangarajan G, Materials Science, TMH
3. Rajendra V., Marikani A., Materials Science, TMH
4. Van Vlack L. H., Elements of Material Science and Engineering, Addison Wesley
5. Material Science, Raghavan

6. Processes and Material of manufacture : Lindberg, PHI.

BCSE 3201 OBJECT ORIENTED PROGRAMMING USING C++ (3-0-0)

Module I (10 Hours)

Introduction to object oriented programming, user defined types, polymorphism, and encapsulation. Getting started with C++ -syntax, data-type, variables, strings, functions, exceptions and statements, namespaces and exceptions, operators. Flow control, functions, recursion. Arrays and pointers, structures.

Module II (10 Hours)

Abstraction mechanisms: Classes, private, public, constructors, member functions, static members, references etc. Class hierarchy, derived classes.
Inheritance: simple inheritance, polymorphism, object slicing, base initialization, virtual functions.

Module III (12 Hours)

Prototypes, linkages, operator overloading, ambiguity, friends, member operators, operator function, I/O operators etc.
Memory management: new, delete, object copying, copy constructors, assignment operator, this input/output.
Exception handing: Exceptions and derived classes, function exception declarations, Unexpected exceptions, Exceptions when handling exceptions, resource capture and release etc.

Module IV (8 Hours)

Templates and Standard Template library: template classes, declaration, template functions, namespaces, string, iterators, hashes, iostreams and other type.
Design using C++ design and development, design and programming, role of classes.

Text Books:

1. Bhave & Patekar- Object oriented Programming with C++, Pearson Education
2. Ashok N. Kamthane- Object oriented Programming with ANSI & Turbo C++, Pearson Education.
3. Robert Lafore- Object oriented programming in Microsoft C++.
4. Balguru Swamy-C++, TMH publication

HSSM 4201 ENGINEERING ECONOMICS AND COSTING(3-0-0)

Module I (10 Hours)

Present worth comparisons, Comparisons of assets with equal, unequal and infite lives, comparison of deferred investments, Future worth comparison, pay back period comparison.

Module II (10 Hours)

Projects : Benefit/ Cost analysis, quantification of project, cost and benefits, benefit/ cost applications, Cost –effectiveness analysis.

Module III (10 Hours)

(12 Hours)

Text Book

1. Horn green, C.T., Cost Accounting, Prentice Hall of India

2. Riggs, J.L ., Dedworth, Bedworth, D.B, Randhawa, S.U. Engineering Economics, McGraw Hill International Edition, 1996 (Chapter 2,3,4,5,7,8,9,11,12)

HSSM 4202 ORGANIZATIONAL BEHAVIOUR (3-0-0)

Module I (8 Hours)

The Study of Organizational Behaviour : Learning objectives, Definition and Meaning, Why Study OB, An OB Model, New Challenges for OB Manager.

Learning – Nature of Learning, How Learning occurs, Learning and OB.

Case Analysis

Module II (10 Hours)

Foundations of Individual Behaviour : Personality – Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB.

Perception – Meaning and Definition, Perceptual Process, Importance of Perception in OB. Motivation – Nature and Importance, Hertzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations.

Case Analysis

Module III (12 Hours)

Organizational Behaviour Process : Communication – Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving Interpersonal Effectiveness. Groups in Organizations – Nature, Types, Why do people join groups, Group Cohesiveness and Group Decision-making Managerial Implications, Effective Team Building. Leadership – Leadership & Management, Theories of Leadership – Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Follwership, How to be an effective Leader. Conflict – Nature of Conflict and Conflict Resolution.

An Introduction to Transactional Analysis (TA).

Case Analysis

Module IV (10 Hours)

Organization : Organizational Culture – Meaning and Definition, Culture and Organizational Effectiveness. Introduction to Human Resource Management – Selection, Orientation, Training and Development, Performance Appraisal, Incentives Organizational Change – Importance of Change, Planned Change and OB techniques. International Organizational Behaviour – Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global Perspective.

Case Analysis

TEXTBOOKS :

Keith Davis, Organizational Behaviour, McGraw – Hill.

K.Aswathappa, Organizational Behaviour, Himalaya Publishing House.

REFERENCE BOOKS :

Stephen P. Robbins, Organizational Behaviour, Prentice Hall of India.

Pradip N. Khandwalla, Organizational Behaviour, McGraw – Hill, New Delhi.

CPME 6201 MACHINE DYNAMICS – I (3-1-0)

MODULE – I (12 Hours)

1. Mechanisms : Basic Kinematic concepts and definitions, Mechanism, Link, Kinematic Pair, Classification of kinematic pairs, Degrees of freedom, Kinematic chain, Binary Ternary and Quaternary joints and links, Degrees of freedom for plane mechanism, Grubler's Equation, Inversion of mechanism, Four bar chains and their inversions, Single slider crank chain, Double slider crank chain and their inversion.

2. Kinematic Analysis : Determination of velocity using graphical and analytical techniques, Instantaneous centre method, Relative velocity method, Kennedy theorem, Velocity in four bar mechanism, Slider crank mechanism, Rubbing velocity at a Pin-joint.

   Acceleration Diagram for a slider – crank mechanism, Corili's component of acceleration and its application.

MODULE – II (10 Hours)

3. Inertia forces in reciprocating Parts : Velocity and acceleration of piston by analytical method, Angular velocity and angular acceleration of connecting rod by analytical method and by graphical metho, Piston effort, force acting along the connecting rod, Crank effort, Turning moment on crank – shaft.

4. Dynamically equivalent system, compound Pendulum, correction couple.

   Turning moment diagrams for different types of engines, Fluctuation of energy and fluctuation of speed.

MODULE – III (9 Hours)

5. Friction of a screw and nut, Square threaded screw, V-threaded screw, Pivot and collar friction, friction circle, Friction axis, Friction clutches, Transmission of power by single plate, mutiplate and cone clutches.

6. Brakes & Dynamometers : Classification of brakes, Analysis of simple block, Band and internal expanding shoe brake, Braking of a vehicle.

   Absorbing and transmission dynamometers, Prony brake, Rope brake, Band brake dynamometer, Belt transmission dynamometer, Torsion dynamometer.

MODULE – IV (9 Hours)

7. Gear Trains : Simple Train, Compound train, Reverted train, Epicyclic train and their applications.

8. Belt, rope and chain drives, Initial tension, Effect of centrifugal tension on power transmission, Maximum power transmission capacity, Belt creep and slip.

TEXT BOOKS

L. A Textbook of Theory of Machines (In S. I. units) – R. K. Bansal, Laxmi Publication

Chapter : 1, 3, 4, 7, 8, 10, 11, 12.

REFERENCE BOOKS :

L. The Theory of Machines – Thomas Bevan.

PRACTICALS

BENG 9202 BASIC ELECTRONICS LAB. (0-0-3)

(At least 8 experiments including 1 – 7 and any one from 8 – 10)

1. Familiarity with electronics components and Devices

Testing of a semiconductor Diode and a Transisitor. IC pins connection (Digital Multimeter should be used should be used in testing components and devices).

2. Study and use of Oscilloscope to view waveforms and measure its amplitude and frequency.
3. V – I Characterstic of a semiconductor diode. Determining DC and AC resistance.
4. Half wave and Full wave rectifiers without and with capacitor filter. Record of waveforms, Measurement of Average and rms values.
5. V – I Characterstics of anpn or pnp transistor. DC Biasing and measurement of dc voltages and currents.
6. Gain – frequency response of JFET common source R-C coupled amplifier/BJT CE RC coupled Amplifier.
7. Op amp in Inverting, non inverting, Integrating and Differentiating configuration, Record of wave forms.
8. Truth Tables of logic gates.
9. Study and experiment using MUX – DEMUX Ics / Shift Register IC.
10. Study on CMOS logic Inverter.

BENG 9201 BASIC ELECTRICAL ENGINEERING LAB. (0-0-3)

List of Experiment (Any 8 of the following)

1. Study and measurement the armature and field resistance of a DC machine.
2. Calibration of ammeter, voltmeter and wattmeter with the help of sub-standard instrument.
3. Verification of circuit theorems. Thevenin's and Superposition theorems (with DC source only).
4. Voltage-current characteristics of incandescent lamps and fusing time-current characteristics of fuse wire.
5. Measurement of current, voltages and power in R-L-C series circuit excited by Single Phase AC supply.
6. Connection and starting of a three phase induction motor using direct online (DOL). Or star-delta starter.
7. Connection and measurement of power consumption of a fluorescent lamp.
8. Determination of open circuit characteristics (OCC) of DC machine.
9. Starting and speed control of a DC shunt motor.
10. Connection and testing of a single phase energy meter (unity power factor load only)
11. Study of fan motor

BCSE 9201 COMPUTER (OOP) WITH C++ LAB. (0-0-3)

(10 classes for 10 different programs)

1. Programs on concept of classes and objects.(1 class)
2. Programs using inheritance.(1 class)
3. Programs using polymorphism.(1 class)
4. Programs on use of operator overloading.(1 class)
5. Programs on use of memory management.(1 class)
6. Programs on exception handling and use of templates.(1 class)

7. Programs on File handling in C++.(1 class)
8. Design problem on stock and accounting of a small organization, railway reservation, payroll preparation and optimization problem.(3 classes)

BENG 9203 MECHANICAL ENGINEERING LAB. (0-0-3)

Group A (Mechanics / Material Testing Lab.

1. Determination of equilibrium of coplanar forces.
2. Determination of Moment of Intertia of Flywheel
3. Determination of tensile strength of materials by Universal Testing Machine.

Group B

4. Determination of Metacentric Height and application to stability of floating bodies.
5. Verification of Bernoulli's Theorem and its application to Venturimeter.
6. Determination of Cd and Cd of Orifices.

Group C

7. Calibration of Bourden Type Pressure gauj and measurement pressure using manometers.
8. Study of Cut-Sections of 2 stroke and 4 stroke Diesel Engine.
9. Study of Cut-Sections of 2 stroke and 4 stroke Petrol Engine.

CPME 9203 WORKSHOP – III (0-0-3)

1. A job on lathe with taper turning, thread cutting, knurling and groove cutting
2. Gear cutting (with index head) on milling m/c
3. Working with shaper, planer and slotting m/c
4. Working with surface/ cylindrical grinding
5. TIG/ MIG welding, gas cutting

CPME 9201 MACHINE DYNAMICS AND HYDRAULIC MACHINE LAB. (0-0-3)

Machine Dynamics

1. Determination of Efficiency of screw –jack
2. Experiment of Ripe brake / Band brake, dynamometer
3. Experiment on Epicyclic gear tram

Fluid Machinery

4. Experiment on impact of Jets
5. Experiment of on performance reciprocating pump
6. Experiment on performance of centrifugal pump
7. Experiment on performance of francis turbine
8. Experiment on performance of Petrol Wheel

4th Semester

BSCM 2202 MATHEMATICS – IV (3-1-0)

Module – I

Solution of equations by iteration, Newton's method, Secant method, Interpolation
Numerical integration and nitially lity

Module – II

Gauss Siedel iteration method for solving a system of linear equations, Ruage Kutta Methods, Introductory Linear Programming, Introductory Programming

Module – III

Probability, Random variables, Probability distribution, mean & variance of distribution
Binomial, Poisson, hyper-geometric and normal distributions

Module – IV

Random sampling, estimation of parameters, confidence intervals, Testing of hypothesis, acceptance sampling, correlation and regression

Course covered by : Advance Mathematics by E. Kreyszig (8th Edition)
Chapter 17 (17.1 – 17.3, 17.5), Chapter 18 (18.4), Chapter 19 (19.1), Chapter 20, Chapter 21, Chapter 22

CPME 6203 FLUID MECHANICS AND HYDRAULIC MACHINES (3-1-0)

1. Introduction : Scope of fluid mechanics and its development as a science
2. Physical property of Fluid

   Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.
3. Fluid static Pressure, Pascal's Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, monometer.
4. Hydrostatic process on submerged surface, force on a horizontal submerged plane surface, force on a vertical submerged plane surface.

   Buoyancy and flotation, Archimedes' principle, stability of immersed and floting bodies, determination of metacentric height.

   Fluid kinematics : Introduction, description of fluid flow, classification of fluid flow. Acceleration of fluid particles, flow rate and continuity equation, differential equation of continuity.

   Fluid dynamics : Introduction, Euler's equation analog a streamline, energy equation, Bernoulli's equation, Analysis of finite control volumes and its application to siphon, venture, office

   Turbine : Classification, reaction, Impulse, outward flow, inward flow and mixed flow turbines, Francis & Kaplan turbines, Pelton wheel, Physical description and principle of operation, Governing of Turbine.

   Centrifugal Pump : Principles of classification, Blade angles, Velocity triangle, efficiency, specific speed, characteristics curve.

   Reciprocating Pump : Principles of working, slip, work done, effect of acceleration and frictional resistance, separation

Tex Books

1. Fluid Mechanics, A.K. Mohanty, PHI
2. Introduction to Fluid Mechanics and Fluid Machines, S.K. Som and G. Biswas, TMH
3. Fluid Mechanics, Modi & Seth

BENG 1201 ELECTRICAL MACHINES (3-1-0)

Module I (10 Lectures)

D.C Mechanics :
D.C Generator – construction and principle of operation, E.M.F. equation ; types of generator; no load and load characteristics; Voltage build-up of shunt
Generator; voltage regulation, Application.

D.C Motor –construction and principle of operation ; back E.M.F; torque and speed equations; characteristics and performance curves; speed control of series and shunt motors; motor starters; industrial application.
Losses and Efficiency of D.C machines.

Module II (10 Lectures)

Transformer:
Single phase – construction and principle of operation; E.M.F. equation; Phasor diagram; actual and approximate equivalent circuits; open and short circuit tests, voltage regulation; losses and efficiency.
Three Phase – Construction and principle of operation; connection of three single –phase units in wye, delta, open delta configurations; Autotransformer; conventional transformer connected as Autotransformer. Special Transformers – induction heating and high impedance and high frequency transformer.

Module III (10 Lectures)

Synchronous Machines :
Three- phase alternators – construction and principle of operation; E.M.F. equation; distribution and pitch factors; Synchronous reactance; performance of alternators on no-load and load; Phasor diagram; voltage regulation, power calculations of turbine and hydro-generators,; synchronization of a generator.
Three-Phase Synchronous Motor- construction and principle operation; V- curves; Phasor diagram; methods of starting; applications.

Module IV (10 Lectures)

Three-Phase induction Motor- construction of slip ring and squirrel cage type induction motors; Phasor diagram and equivalent circuit; torque-slip characteristics; maximum torque calculations; open and short-circuit tests; losses and efficiency; starting of induction motors; speed control; Induction generator.
Single-Phase Induction Motor- construction and principle of operation; capacitor- start and capacitor-run motors; Universal motor; Stepper motors.

Books :

1. Electrical Machines, Drives and Power Systems, 5th edition by Theodore Wildi (Pearson) : Text.
2. Electrical Machinery by A.E. Fitzerald and Charles Kingsley, Jr., and S.D. Umans, Tata McGraw Hill Publication.
3. Principles of Electric Machines by V.K Meheta and R. Meheta , S. Chand Publication.

BSCC 2202 MATERIAL SCIENCES (2-0-0)

MODULE – I (10 Lectures)

1. Classification of Engineering Materials. Engineering properties of materials. Selection of Materials.
2. Electron theory of solids : Free electron theory of metals. Electrical conductivity; Thermal conductivity, Quantum theory of free electrons. Band theory of solids, Conductivity of metals
3. Conductors, Insulators, Semiconductors, Intrinsic and extrinsic semiconductors, Band theory of semi conductors Hall effect.
4. Super Conductors – Zero resistivity, Critical magnetic field and critical current density. Type I and II super conductors. Applications of Supercoductors.

MODULE – II (10 Lectures)

5. Dielectric Materials : Microscopic Displacement of atoms and molecules in an external dc electric field, Polarization and dielectric constant, Dielectric nitially lity. Temperature dependence, Dielectric Breakdown. Ferro electric material Piezoelectrics, Pyroelectrics, Dielectric Materials as electrical isulators.

6. Magentic Properties of Materials : Dia, Para and Ferro magenetic materials. Theory of magnetism, Ferro magnetic materials or Ferrites, Comparison of magnetic behaviour and magnetic parameters of Dia, Para and Ferro magnetic materials.

7. Optical Properties of Materials : Scattering, Refraction, Theory of Refraction and absorption, Atomic Theory of optical properties. Lasers, Optical fibres – Principle, structure, application of optical fibre.

MODULE – III (10 Lectures)

8. Organic Materials : Polymers – Mechanism of Polymerization : Addition, condensation and co-polymerisation, applications.

   Plastics – Types : Thermosetting and thermoplastics. Transfer moulding, injection moulding, extension moulding, Blow moulding, Welding of plastics; Rubber types, application.

9. Ceramics : Types, Structure, Mechanical properties, applications

MODULE – IV (10 Lectures)

10. Composite Materials : Agglomerated Materials : Cermets, Reinforced Materials : Reinforced Concrete. Glass fibre reinforced plastics, Carbon fibre reinforced plastics. Whiskers, fibre reinforced plastics, Laminated plastic sheets. Tufnol, Properties of composites. Metal matrix composites, manufacturing procedure for fibre reinforced composites.

11. Performance of Materials in Service : Service performance, failure, design considerations, Corrosion – types, (Atmospheric, Pitting, Stress Corrosion), Control & prevention, protective coating, Performance of metals and Ceramics at high temperature.

Text Books :

1. Callister W.D., Materials Science and Engineering, John Wiley & Sons.
2. Vijaya M. S., Rangarajan G, Materials Science, TMH
3. Rajendra V., Marikani A., Materials Science, TMH
4. Van Vlack L. H., Elements of Material Science and Engineering, Addison Wesley
5. Material Science, Raghavan
6. Processes and Material of manufacture : Lindberg, PHI.

BSCP 2202 PHYSICS –II (2-0-0)

Module I (9 Hours)

An appreciation of Quantum Mechanics in determining electrical properties of semiconductor.

The Semiconductor in Equilibrium :

Equilibrium distribution of electrons & holes, the n0 and p0 equation, intrinsic carrier concentration; Do pant atoms and energy levels, ionization energy; the extrinsic semiconductor, the n0 p0 product, position of Fermi-energy level, variation of EF with doping concentration and temperature.

Carrier Transport Phenomena :

Carrier drift: mobility, conductivity, velocity saturation:

Carrier Diffusion: Diffusion current density. Total current density. The Einstein relation.

Module II (9 Hours)

Non-equilibrium Excess Carrier in Semiconductor

The Pn junction and Diode

Pn junction Diode : Ideal – current voltage relationship, Minority Carrier distribution, Ideal Pn junction currents under forward and reverse bias.

Module III (9 Hours)

Pn junction diode (contd.):

Metal-Oxide- Semiconductor FET (MOSFET)

The basic MOSFET operation, Current –Voltage relation (Concepts)

Frequency limitation : Small signal Equivalent circuit.

The CMOS Technology.

Module IV (8 Hours)

The Bipolar Transistor

Current gain,. Non-ideal effects –Base width Modulation, Breakdown Voltage. Equivalent Circuit Models –Eber's –Moll Model, Hybrid- Pi model. Frequency limitation. Large Signal Switching characteristics.

Text Book :

1. Semiconductor Physics and Devices- Basic Principles BY Donald A. Neamen, 3rd Edition, Tata McgrawHill Edition. (Selected portion from chapters 2,4,4,6,7,8,10 &11.)

For additional reading

L. Solid state Electronics Devices – y Ben G. Strectman and Sanjay Benerjee, 5th Edition, Pearson Edu.

BCSE 3202 RELATIONAL DATABASE MANAGEMENT SYSTEMS (3-0-0)

Module I (10 Hours)

Database System Architecture – Data Abstraction, Data Independence, Data Definitions and Data Manipulation Languages.

Data models – Entity Relationship(ER), Mapping ER Model to Relational Model, Network .Relational and Object Oriented Data Models, Integrity Constraints and Data Manipulation Operations.

Module II (10 Hours)

Relation Query Languages, Relational Algebra, Tuple and Domain Relational Calculus, SQL and QBE.

Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design, Comparison of Oracle & DB2

Module III (8 Hours)

Query Processing and Optimization: Evaluation of Relational Algebra Expressions, Query Equivalence, Join strategies, Query Optimization Algorithms.

Module IV (12 Hours)

Storage Strategies: Indices, B-Trees, Hashing, Transaction processing: Recovery and Concurrency Control, Locking and Timestamp based Schedulers, Multiversion and Optimistic Concurrency Control Schemes.

Advanced topics: Object-Oriented and Object Relational databases. Logical Databases, Web Databases, Distributed Databases, Data Warehouse and Data Mining.

Text Books :-

1. Elmaski & Navathe –Fundamentals of Database Systems, 4th Edition, Pearson Education
2. C.J.Date – An introduction to Database Systems, Pearson Education
3. Bipin Desai –An introduction to Database System, Galgotia Publication.

HSSM 4202 ORGANIZATIONAL BEHAVIOUR (3-0-0)

Module I (8 Hours)

The Study of Organizational Behaviour : Learning objectives, Definition and Meaning, Why Study OB, An OB Model, New Challenges for OB Manager.
Learning – Nature of Learning, How Learning occurs, Learning and OB.
Case Analysis

Module II (10 Hours)

Foundations of Individual Behaviour : Personality – Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB.
Perception – Meaning and Definition, Perceptual Process, Importance of Perception in OB. Motivation – Nature and Importance, Hertzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations.
Case Analysis

Module III (12 Hours)

Organizational Behaviour Process : Communication – Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving Interpersonal Effectiveness. Groups in Organizations – Nature, Types, Why do people join groups, Group Cohesiveness and Group Decision-making Managerial Implications, Effective Team Building. Leadership – Leadership & Management, Theories of Leadership – Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Follwership, How to be an effective Leader. Conflict – Nature of Conflict and Conflict Resolution.
An Introduction to Transactional Analysis (TA).
Case Analysis

Module IV (10 Hours)

Organization : Organizational Culture – Meaning and Definition, Culture and Organizational Effectiveness. Introduction to Human Resource Management – Selection, Orientation, Training and Development, Performance Appraisal, Incentives Organizational Change – Importance of Change, Planned Change and OB techniques. International Organizational Behaviour – Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global Perspective.
Case Analysis

TEXTBOOKS:

Keith Davis, Organizational Behaviour, McGraw – Hill.
K.Aswathappa, Organizational Behaviour, Himalaya Publishing House.

REFERENCE BOOKS:

Stephen P. Robbins, Organizational Behaviour, Prentice Hall of India.

Pradip N. Khandwalla, Organizational Behaviour, McGraw – Hill, New Delhi.

HSSM 4201 ENGINEERING ECONOMICS AND COSTING(3-0-0)

Module I (10 Hours)

Present worth comparisons, Comparisons of assets with equal, unequal and infite lives, comparison of deferred investments, Future worth comparison, pay back period comparison.

Module II (10 Hours)

Benefit/ Cost analysis, quantification of project, cost and benefits, benefit/ cost applications, Cost – effectiveness analysis.

Module III (10 Hours)

Hours) Fixe

1. Horn green, C.T., Cost Accounting, Prentice Hall of India
2. Riggs, J.L ., Dedworth, Bedworth, D.B, Randhawa, S.U. Engineering Economics, McGraw Hill International Edition, 1996 (Chapter 2,3,4,5,7,8,9,11,12)

CPME 6202 MECHANICS OF MATERIALS – I (3-1-0)

MODULE – I (10 Hours)

1. Analysis of Axially Loaded Members :

   Composite bars in tension and compression – temperature stresses in composite rods – statically inderterminate problem.

   L. Members in Biaxial State of Stress :

   Stresses in thin cylinders, thin spherical shells under internal pressure – wire winding of thin nitially.

MODULE – II (12 Hours)

3. Strain Deformation :

   Two dimensional state of strain, Principal strains and peincipal axes of strain measurements, Calculation of principal stresses from principal strains.

   L. Shear Force and Bending Moment Diagrams for Simple Beams :

   Support reactions for statically determinate beams, relationship between bending moment and sheer force. Sheer force and Bending Moment diagrams.

MODULE – III (12 Hours)

5. Simple Bending of Beams :

   Theory of simple bending of nitially straight beams, distribution of normal and sheer stress, beams of two materials, Composite beams.

   L. Deflection of Beams :

   Slope and delection of beams by integration method and area – moment method.

MODULE – IV (6 Hours)

7. Torsion in solid and hollow circular shafts, Twisting moment, strength of solid and hollow circular shafts. Strength of shafts in combined bending and twisting.
8. Close – Coiled helical springs.

TEXT BOOKS

L. Elements of Strength of Materials by Timoshenko & Young (Fifth Edition)
Chapter : 1, 2, 3, 4, 5, 6, 7 ,8 (Relevant articles only)

REFERENCE BOOKS :

L. Strength of Materials by G. H. Ryder

PRACTICALS

BENG 9201 BASIC ELECTRICAL ENGINEERING LAB. (0-0-3)

List of Experiment (Any 8 of the following)

1. Study and measurement the armature and field resistance of a DC machine.
2. Calibration of ammeter, voltmeter and wattmeter with the help of sub-standard instrument.
3. Verification of circuit theorems. Thevenin's and Superposition theorems (with DC source only).
4. Voltage-current characteristics of incandescent lamps and fusing time-current characteristics of fuse wire.
5. Measurement of current, voltages and power in R-L-C series circuit excited by Single Phase AC supply.
6. Connection and starting of a three phase induction motor using direct online (DOL). Or star-delta starter.
7. Connection and measurement of power consumption of a fluorescent lamp.
8. Determination of open circuit characteristics (OCC) of DC machine.
9. Starting and speed control of a DC shunt motor.
10. Connection and testing of a single phase energy meter (unity power factor load only)
11. Study of fan motor

BENG 9202 BASIC ELECTRONICS LAB. (0-0-3)

(At least 8 experiments including 1 – 7 and any one from 8 – 10)

1. Familiarity with electronics components and Devices

   Testing of a semiconductor Diode and a Transisitor. IC pins connection (Digital Multimeter should be used should be used in testing components and devices).
2. Study and use of Oscilloscope to view waveforms and measure its amplitude and frequency.
3. V – I Characterstic of a semiconductor diode. Determining DC and AC resistance.
4. Half wave and Full wave rectifiers without and with capacitor filter. Record of waveforms, Measurement of Average and rms values.
5. V – I Characterstics of anpn or pnp transistor. DC Biasing and measurement of dc voltages and currents.
6. Gain – frequency response of JFET common source R-C coupled amplifier/BJT CE RC coupled Amplifier.
7. Op amp in Inverting, non inverting, Integrating and Differentiating configuration, Record of wave forms.
8. Truth Tables of logic gates.
9. Study and experiment using MUX – DEMUX Ics / Shift Register IC.

10. Study on CMOS logic Inverter.

BCSE 9202 COMPUTER (RDBMS) LAB. (0-0-3)

(10 Classes for 10 Different Programs)

1. Use of SQL syntax : Insertion, Deletion, Join), Updation using SQL. (1 class)
2. Program segments in embedded SQL using C as host language to find average grade point of a student, etc.. (1 class)
3. Program for Log based data recovery technique. (1 class)
4. Program on data recovery using check point technique. (1 class)
5. Concurrency control problem using lock operations. (1 class)
6. Use of package (ORACLE) for programming approaches(2 classes)
7. Use of package (DB2) for programming approaches(2 classes)
8. Programs on JDBC/ODBC to print employee's / student's information of a particular department. (1 class)

CPME 9203 WORKSHOP – III (0-0-3)

1. A job on lathe with taper turning, thread cutting, knurling and groove cutting
2. Gear cutting (with index head) on milling m/c
3. Working with shaper, planer and slotting m/c
4. Working with surface/ cylindrical grinding
5. TIG/ MIG welding, gas cutting

BENG 9203 MECHANICAL ENGINEERING LAB. (0-0-3)

Group A (Mechanics / Material Testing Lab.

1. Determination of equilibrium of coplanar forces.
2. Determination of Moment of Intertia of Flywheel
3. Determination of tensile strength of materials by Universal Testing Machine.

Group B

4. Determination of Metacentric Height and application to stability of floating bodies.
5. Verification of Bernoulli's Theorem and its application to Venturimeter.
6. Determination of Cd and Cd of Orifices.

Group C

7. Calibration of Bourden Type Pressure gauj and measurement pressure using manometers.
8. Study of Cut-Sections of 2 stroke and 4 stroke Diesel Engine.
9. Study of Cut-Sections of 2 stroke and 4 stroke Petrol Engine.

CPME 9202 MATERIAL TESTING AND HEAT POWER LAB. (0-0-3)

(Any Eight)

Material Testing

1. Impact strength
2. Hardness strength
3. Rigidity modulus
4. Compression / Bending strength
5. Fatigue strength

Thermodynamics

6. Testing of Diesel Engine (single cylinder)
7. Testing of Petrol Engine (single cylinder)
8. Study of cut model of water tubes and fire tube boilers
9. Determination of effy of compressor
10. Valve timing diagram of IC engines

COURSE STRUCTURE
THIRD YEAR B.TECH PROGRAMME
MECHANICAL ENGINEERING

5th Semester				6th Semester			
Theory		*ContactHrs.*	*Credit*	*Theory*		*ContactHrs.*	*Credit*
		L-T-P				**L-T-P**	
HSSM 4301	Optimisation in Engineering	3-0-0	3	HSSM 4302	Production & Operation Mgmt.	3-0-0	3
CPMF6301	Manufacturing Science – I	3-1-0	4	CPME 6304	Internal Combustion Engines & Gas Turbines	3-1-0	4
CPME 6301	Engineering Thermodynamics	3-1-0	4	CPME 6305	Mechanics of Materials – II	3-0-0	3
CPMT 6201	Introduction to Physical Metallurgy	3-1-0	4	CPME 6306	Machine Design – II	3-1-0	4
CPME 6302	Machine Dynamics –II	3-0-0	3	CPME 6307	Heat Transfer		3
CPME 6303	Machine Design – I	3-0-0	3	CPME 6308	Manufacturing Science – II	3-0-0	3
	Total		**21**		**Total**		**20**
Practicals/Sessionals		*Contact Hrs.*	*Credit*	*Practicals/Sessionals*		*ContactHrs.*	*Credit*
CPME 9301	Hydraulic Machines & Production Lab.	0-0-3	2	CPME 9304	IC Engine & Dynamics Lab.	0-0-3	2
CPME 9302	Material Testing & Heat Power Lab	0-0-3	2	CPME 9305	Heat Transfer & Production Lab.	0-0-3	2
CPME 9303	Design Project – I	0-0-3	2	CPME 9306	Design Project – II	0-0-3	2
	Total		**6** **27**		**Total**		**6** **26**

L-Lecture **T-Tutorial** **P-Practical**

5th Semester

MECHANICAL ENGINEERING

HSSM 4301 OPTIMIZATION IN ENGINEERING (3-0-0)

Course Objective : The course aims at acquainting the students to mathematical modeling of engineering design, operation and maintenance problems and their optimization algorithms.

Module – I (10 hours)

Formulation of engineering optimization problems : Decision variables, objective function and constraints. Example of typical design, operation and maintenance problems in engineering : Design of a water tank, design of a truss, design of a network (electrical, communication sewerage and water supply networks), product mix problem, transportation and assignment problems, shift scheduling of employees, design of reliable devices, design of reactors, shortest route problem, set covering problem, traveling salesman problems. Only physical problems and their mathematical models to be discussed.

Linear Programming Problem : Formulation, Graphical solution, Simplex method, Duality theory, Dual simplex method, Formulation and solution of engineering problems of planning and scheduling.

Module – II (10 hours)

Sensitivity Analysis, Transportation Problem, Assignment Problem, Network Models : Minimal Spanning Tree Problem, Maximal Flow Problem, Shortest Route Problem, Minimum Cost Flow Problem. Algorithms and applications to be covered.

Module – III (10 hours)

Integer Linear Programming Problem. Branch and Bound and Cutting Plane Methods. Zero-one Programming Problem, Knapsack Problem, Set covering Problem, Set Partitioning Problem, Traveling Salesman Problem. Deterministic Dynamic Programming Problems. Applications and algorithms to be discussed.

Module – IV (12 hours)

Queueing theory, Game theory, Simulation, Decission theory & Sequencing Problem

REFERENCES :

1. H. A. Taha – Operations Research, Prentice Hall of India, 2004.
2. D. T. Phillips, A Ravindran and J.J. Solaberg, Principles of Operation Research, John Wiley and Sons
3. S. Kalavathi, Operations research, Vikash Publication.
4. B.E Gillett, Introduction to operations research, TMH

CPMF 6301 MANUFACTURING SCIENCE – I (3-1-0)

Module – I

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 moulding, binders for core said.

(d) Properties of moulding 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.

(12 hours)

Module – II

2. Welding and cutting: Introduction to gas welding, cutting, Arc welding and equipment's. TIG (GTAW) and MIG (GMAW) welding, resistance welding and Thermit welding. Weldablity

   Newer 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.

3. Brief introduction to powder metallurgy processes.

(12 hours)

Module – III

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

(8 hours)

Module – IV

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.

(8 hours)

Text Books :

1. Manufacturing technology – by P.N.Rao, Tata McGraw Hill publication.
2. Welding Technology – R.A. Little, TMH
3. Mechanical Metallurgy – Dieter, Mc-Graw Hill
4. Processes and Materials of Manufacture - R.A Lindberg, Prentice hall (India)

Reference Books

1. Fundamentals of metal casting technology, P.C. Mukherjee, Oxford PIBI.

CPME 6301 ENGINEERING THERMODYNAMICS (3-1-0)

Module-I (8 Hours)

1. Review of First and Second laws:

   First law analysis of unsteady flow control volumes, Entropy generation, Reversible work, Availability, and Irreversibility.

2. General Termodynamic property relations:

   The Maxwell relations, The Clapeyron equation, The TdS relations, Isothermal compressibility and volume expansivity, The Joule-Thomson coefficient.

Module- II (10 Hours)

3. Vapor Power Cycles:

   The Carnot vapor cycle and its limitations, The Rankine cycle, Means of increasing the Rankine cycle efficiency, The reheat cycle, The regenerative feed heating cycle, The binary vapor cycle, The gas-vapor coupled cycles, Cogeneration (Back pressure and Pass-out turbines).

Module- III (12 Hours)

4. Gas Power Cycles:

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

5. Refrigeration cycles:

   Reversed Carnot cycle, Reversed Brayton cycle (Gas refrigeration system), The vapor compression cycle, The vapor absorption cycle.

Module- IV (10 Hours)

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.

Text Books

1. Fundamentals of Thermodynamics, Sonntag, Borgnakke, Van Wylen (John Wiley & Sons)
2. Fundamentals of Engineering Thermodynamics, E. Rathakrishnan (PHI)
3. Engineering Thermodynamics, Y.V.C. Rao (Univ. Press)

CPMT 6201 INTRODUCTION TO PHYSICAL METALLURGY(3-1-0)

Module I (10 Hours)

1. Characteristic property of metals, bonding in solids, primary bonds like ionic, covalent and metallic bond, crystal systems, common crystal structure of metals, representations of planes and directions in crystals, atomic packing in crystals, calculation of packing density, voids in common crystal structures and imperfections in crystals.

2. Solidification of pure metals, homogenous and heterogeneous nucleation processes, cooling curve, concept of supercooling, microstructures of pure metals, solidification of metal in ingot mould.

Module II (10 Hours)

1. Concept of plastic deformation of metals, critical resolve share stress, dislocation theory, deformation by slip and twin, plastic deformation in polycrystalline metals, yield point phenomenon and related effects, concept of cold working, preferred orientation. Annealing: recovery; recrystalization and grain growth; hotworking.
2. Concept of alloy formation, types of alloys, solid solutions, factors governing solid solubility viz. size factor, valency factor, crystal structure factor and chemical affinity factor; order-disorder transformation.

Module III (13 Hours)

1. Binary phase diagrams: (a) Isomorphous system, (b) Eutectic system, (c) Peritectic system, (d) Eutectoid system and (e) Peritectoid system. Allotropic transformation. Lever rule and its application, Interpretation of solidification behaviour and microstructure of different alloys belonging to those systems, Effect of non equilibrium cooling, coring and homogenization.
2. Iron-cementite and iron-graphite phase diagrams, microstructure and properties of different alloys (both steels and cast irons), types of cast iron, their microstructures and typical uses.
3. T-T-T diagram: Concept of heat treatment of steels i.e. annealing, normalizing, hardening and tempering; microstructural effects brought about by these processes and their influences on mechanical properties.

Module IV (11 Hours)

1. Effect of common alloying elements on the equilibrium and T-T-T diagrams, concept of hardenability, factors affecting hardenability.
2. Common ally steels, stainless steel, tool steel, high speed steel, high strength low alloy steel, microalloyed steel, specification of steels.
3. Physical metallurgy of common nonferrous alloys: Cu-Zn, Cu-Sn, Cu-Al systems, Microstructures and heat treatment of common alloys of these systems.

REFERENCES :

1. Introduction to Physical Metallurgy by S. H. Avner, 2nd edition, Tata McGraw Hill Publishing Co. Ltd.
2. Engineering Physical Metallurgy and Heat Treatment by Y. Lakhtin, Mir Publisher, Moscow.
3. Materials Science and Engineering by W. D. Callister, Wiley and Sons Inc.
4. Principles of Materials Science and Engineering by W. F. Smith, McGraw Hill International edition.
5. Materials Science and Engineering by V. Raghavan, Prentice Hall of India Pvt. Ltd.

CPME 6302 MACHINE DYNAMICS – II (3-0-0)

Module – I (8 Hours)

1. Mechanism : Motor Vehicle Steering Gears : The Davis Steering Gear, The Ackermann Steering Gear, Hooke's Joint.
2. Gyroscope : Gyroscopic Coupte –Plane Disc, Two Bladed air Screw, Analysis of the Force on bearings due to the Forced Processing of Rotating Disc mounted on Shafts, Gyroscopic Stabilisation.

Module II (8 Hours)

3. Toothed gears : Theory of shape and action of tooth properties and methods of generation of standard Tooth profiles, Standard proportions, Interference and Under –Cutting, method for Eliminating Interference, minimum Number of teeth to avoid interference.
4. Cams : Simple Harmonic, Constant –Velocity and Constant Acceleration, Types, Displacement, velocity and Acceleration of Follower, Cams with specified Contours.

Module III (10 Hours)

5. Governors : Centrifugal Governors-watt and Porter Governors, Spring Loaded Governor-Hartnell Governor, sensitiveness, Stability, Isochronism, Hunting, Governor Effort and Power, Curves of Controlling Force, effect of Friction.
6. Dynamics of Machine : Inertia Force, Inertia Torque, Inertia Force in the Reciprocating Engines, Turning Moment Diagrams, Flywheel.

Module IV (12 Hours)

7. Balancing : Balancing of revolving masses in one plane and different planes, partial balance of single cylindrical engine.
8. Free and forced vibration of a spring-mass system with damping, Vibration isolation and transmissibility, transverse vibration of shafts carrying a point load, Uniformity distributed load and several loads, Dunkerly's method and energy method, Whirling of shafts, Two rotor systems, three rotor system, Geared system.

Textbooks :

1. Theory of Mechanics, S.S. Ratan, Tata McGraw Hill
2. Mechanism and Machine Theory, Rao & Dukkipati, Wiley Eastern Ltd
3. Theory of Machines, Thomas Beven

CPME 6303 MACHINE DESIGN – I (3-0-0)

[Only specified data book as given in reference is permitted]

Machine Design is concerned with the development of new or improved machine element to perform the desired function efficiently using scientific principles, technical information, creative thinking based on requirement of strength, Kinematics, manufacturing considerations and economics.

Module-I (10 Hours)

Stages in design, Standardization, Interchangeability, Preferred numbers, Engineering materials, Ferrous, Non-ferrous, Non-metals, Indian standard specifications for Ferrous materials, Fundamentals of Machine Design, Allowable stress, Factor of safety.

Design of Joints: Reveted, Welded and bolted joints based on different types of loading. Illustrative problems with solutions.

Module-II (12 Hours)

Design of Cotter joints with socket and spigot, with a Gib. Design of knuckle joint. Illustrative problems with solutions.

Design of shafts, solid and hollow based on strength and on rigidity. Illustrative problems with solutions.

Design of keys and pins, Suck key, Feather key, Taper pin. Illustrative problems with solutions.

Module-III

(10 Hours)

Design of shaft couplings : Rigid Flange coupling, Flexible Flange coupling.

Design of circular section, Helical, Tension and compression springs, Design of leaf springs : Cantilever and semi-elliptical types. Illustrative problems with solutions.

Module-IV (8 Hours)

Levers, classification, Design of levers – Foot lever, Hand lever, Cranked lever, Lever of lever loaded – safety - valve.

Power screw design with square thread, such as screw jack. Illustrative problems with solutions.

Text Books

1. Machine Design by P.Kannaiah; Scitech Publications (India) Pvt.Ltd.,
2. Elements of Machine Design by Pandya, N.C.E. Shah, C.S.:, Charotar Book Stall.
3. Design Hand Book by S.M.Jalaluddin; Anuradha Agencies Publications Vidayal Karuppu

PRACTICALS

CPME 9301 HYDRAULIC MACHINES AND PRODUCTION LAB. (0-0-3)

(a) Hydraulic Machine Lab :

1. Model study of different types of pump impellers and turbine runners
2. Determination of performance characteristics of gear pump
3. Load test on Francis/ Caplan turbine

(b) Production Lab :

1. Determination of grain size, clay content, Permeability and green compressive strength of molding sand. (2 -3 experiments)
2. Study of advanced welding processes such as TIG/ MIG welding.
3. Brazing and soldering practice.

CPME 9302 MATERIAL TESTING AND HEAT POWER LAB. (0-0-3)

(a) Material Testing Lab :

1. Determination of fatigue strength
2. Strain measurement using resistance- strain gauge
3. Determination of torsional strength
4. Study of micro structure of steel specimen.

(b) Heat Power Lab :

1. Performance characteristics of reciprocating air-compressor
2. Heat balance of I C. Engine
3. Study of power plant
4. Study of power transmission system of automobiles

CPME 9303 DESIGN PROJECT – I (0-0-3)

1. Assembly drawing of tail-stock of lathe with bill of materials
2. Assembly drawing of screw jack with bill of materials
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 lever

Total number of Design : 6 nos.

Total No. of Drawing : 4 sheets (Two sheets for assembly drawing as per Sl no. 1 and 2 and two sheets for design, under Sl. No. 3, 4, 5 and 7)

6th Semester

HSSM 4302 PRODUCTION AND OPERATIONS MANAGEMENT (3-0-0)

Objective : The course aims at acquainting all engineering graduates irrespective of their specializations the basic issues and tools of managing production and operation functions of an organization.

Module I

1. Operation Function in an Organization, Manufacturing Vrs Service Operation, System view of Operations, Strategic Role of Operations, Operations Strategies for Competitive Advantages, Operations Quality and Productivity Focus, Meeting Global Challenges of Production and Operations Imperatives.

(3 Hours)

2. Designing Products, Services and Processes New Product Design : Product Life Cycle, Product Development Process, Product Quality and Reliability Design, Process Technology : Project, Jobshop, Batch, Assembly Line, Continuous Manufacturing, Process Technology Life Cycle, Process Technology Trends, FMS, CIM, CAD, CAM, GT, Design for Services, Services Process Technology, Services Automation, Value Engineering, Standardization, Make or buy Decision.

(4 Hours)

3. Job Design and Work Measurement, Method Study : Techniques of Analysis, recording, improvement and standardization, Work Measurement : Work Measurement Principles using Stopwatch Time Study, Predetermined Motion Time Standards and Work Sampling, Standard Time Estimation.

(4 Hours)

Module II

4. Location and Layout Planning : Factor Influencing Plant and Warehouse Locations, Impact of Location on cost and revenues. Facility Location Procedure and Models : Qualitative Models, Breakeven Analysis, Single Facility, Location Model, Multi-facility Location Model, Mini max Location, Total and Partial Covering Model.

   Layout Planning : Layout Types : Process Layout, Product Layout, Fixed Position Layout Planning, Systematic Layout Planning, CRAFT.

   Group Technology and Cell Formation, Rank Order Clustering Method for Machine – Component Assignment, Line Balancing : Basic concepts, General Procedure, Rank Positional Weight Method.

(7 Hours)

5. Forecasting : Principles and Method, Moving Average, Double Moving Average, Exponential Smoothing, Double Exponential Smoothing, Winter's Method for Seasonal Demand, Forecasting Error Analysis.

(4 Hours)

Module III

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

Capacity Requirements Planning, Shop Order System and Purchase Order System, Transportation Method for Aggregate Production Planning, Material Requirement Planning, Scheduling and Dispatching Functions, Progress Monitoring and Control.

(4 Hours)

7. Sequencing and Scheduling : Single Machine Sequencing : Basics and Performance Evaluation Criteria, Methods for Minimizing Mean Flow Time, Parallel Machines : Minimization of Makespan, Flowshop sequencing : 2 and 3 machines cases : Johnson's Rule and CDS heuristic. Jobshop Scheduling : Priority dispatching Rules.
8. Inventory Control : Relevant Costs, Basic EOQ Model, Model with Quantity discount, Economic Batch Quantity, Periodic and Continuous Review Systems for Stochastic Systems, Safety Stock, Reorder Point and Order Quantity Calculations. ABC Analysis.

(4 Hours)

Module IV

9. Project Management : Project Management through PERT / CPM. Network Construction, CPM, Network Calculation, Crashing of Project Network, Project Scheduling with Limited Resources. Line of Balance.

(5 Hours)

10. 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, Poke Yoke, Supply Chain Management.

(6 Hours)

Reference

1. J.L.Riggs : Production Systems : Planning Analysis and Control, John Viley.
2. E.E. Adam and R.J. Ebert "Production and Operation Management", Prentice Hall of India,2004.
3. S.N.Chary, "Production and Operations Management", Tata McGraw Hill.
4. R.Paneerselvam, "Production and Operation Management, Prentice Hall of India,2005.

CPME 6304 IC ENGINES & GAS TURBINES (3-1-0)

Module-I (12 Hours)

1. **Introduction**

   Classification, engine components, working principle & Valve timing diagram of SI & CI Engines, composition of CI & CI Engine.

2. **Fuel-Air & Actual Cycles of I.C. Engines**

   Significance of Duel-Air & Actual cycles of I.C. engines & analysis. Comparison with Air Standard Cycles. Effect of engine operating variables on pressure and temp. in Fuel-Air Cycles. Losses in I.C. engines and loss factors.

3. **Fuel, Combustion & Fuel injection**

   Structure and composition of I.C. engine fuel. Fuel rating, properties of fuel, Fuel additive and non petroleum fuels. Fuel-air requirement for ideal normal operation, maximum Power & quick acceleration. Simple carburetor & its draw backs. Practical carburetor. Petrol injection, Requirements & types of diesel injection system, fuel pumps, injector & nozzles.

Module-II (8 Hours)

4. **Ignation & Combustion in IC Engines.**

Battery, magneto & electronic ignition systems, Ignition timing, Spark advance mechanism, Stages of SI engine combustion, effect of engine variables on Ignition lag & flame front progation. Abnormal combustion, Preignition & Detonation, Theory of Detonation. Effect of engine variables on Detonation, control of Detonation, Requirement of good combustion chambers for SI engines. Stages of CI engine combustion. Effect of engine variables on delay period, Diesel Knock & methods of control. CI engine combustion chambers.

5. 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 (12 Hours)

6. Testing and Performances

Power, fuel & air measurement methods, Performance of SI & CI engines, charactgeristic curves, variables affecting performance and methods to improve engine performance.

7. Cooling & Lubricating Systems, Engine Emission & Controls

Air cooling & water cooling systems, Effect of cooling on power output & efficiency, Properties of lubricants and different types of lubricating system. Engine emissions and its harmful effects. Methods of measuring pollutants and control of engine emission.

8. Gas Turbines

Introduction, Open cycle, Single shaft & twinshaft arrangement, Multispool arrangement, closed cycle, Gas turbine, Methods of accounting component losses.

Module-IV (8 Hours)

9. Air Craft Propulsion

Criteria of Performance, Analysis of Turbo Jet, Turbo Prop, Turbo fan & Ram jets.

10. Axial Flow & Centrifugal Compressor

Basic operating, Elementary theory, Blockage in Compressor annulus, degree of reaction, Axial compression characteristics, Basic operation, static & total head, Elementary theory & velocity diagram, impeller & diffuser blade width, Slip factor & Pressure coefficient.

Text Books:

IC Engines, V. Ganesan (TMH)

Gas Turbines, Cohen & Rogers

REFERENCES :

IC Engines, Mathur & Sharma

IC Engines, Ferguson (John-Wiley)

IC Engines, Hewitt (McGraw Hill)

Gas Turbines, V. Ganesan (TMH)

CPME 6305 MECHANICS OF MATERIAL – II (3-0-0)

Module – I (8 hours)

1. **Energy Method based on strain energy due to bending :** strain energy due to axial load, bending moment and twisting moment, principle of virtual work, Castigliano's theorem, Maxwell's theorem of reciprocal relations, Unit load and couple method for determining deflection and slope, Rayleigh-Ritz method.

Module II (10 hours)

2. **Thick Walled cylinders :**

Thick cylinders subjected to internal and external pressures compound cylinders, Application of computer in analyzing stresses in thick cylinders.

3. **Unsymmetrical bending :**

Properties of beam cross selection, slope of neutral axis, stresses and deflection in unsymmetrical bending, shear centre.

Module III (10 Hours)

4. Curved Beam :

Bending of beam with large initial curvature, Stress distribution in beam with rectangular, circular and trapezoidal cross section, stresses in crane hooks, ring and chain links.

5. Elementary concept of elasticity, stresses in three dimensional, equation of equilibrium and compatibility, plane stress, computer analysis of two dimensional state of stress or strain at a point.

Module – IV (12 Hours)

Advanced topics in strength of materials

6. Repeated stresses and fatigue in metals, concept of stress, Concentration, notch and stress concentration factors.

7. Experimental stress analysis :

Resistance strain gauges, strain Rosettes, Two dimensional photoelastic methods of stress analysis, stress optic law, light and dark field in a polariscope, Isoclinic and Isochromatic fringe patterns, Computer Analysis of strain from strain rosette measurement.

Textbook :

1 Advanced Mechanics of Solids, L.S. Srinath, TMG,

2.Advanced Mechanics of Materials, Kumar & Ghai, Khanna Publisher

3. Advanced Mechanics of Materials : Seely and Smith, John Willey, New York

CPME 6306 MACHINE DESIGN-II (3-1-0)

(Only specified data book as given in reference is permitted)

Module I (10 Hours)

1. Theories of Failure, Application of Practical problems.
2. Variables stresses (Fatigue), Endurance limit, o - N curve, Fatigue stress concentration factor, Goodman and Soderberg criteria, Application to Practical problems.
3. Design of Pressure vessels : Thin cylindrical shell, thick cyclindrical shell, thin spherical shell, Application to PRA

Module II (10 Hours)

1. Design of clutch (Friction & Centrifugal type)
2. Design of Brake : Block & Band brake, Internal expanding shoe brake.
3. Design of sliding contact bearings, Journal bearing, foot step bearing, Illustrative problems with solution.

Module III (10 Hours)

1. Types and selection of ball and roller bearings, Dynamic and static load ratings, Beari9ng life, Problem illustration.

2. Design of straight and Helical spur gears, bevel gears.

Module IV (10 Hours)

Design of Engine components : Piston, Connecting Rod, Crank Shaft, Flywheel, Illustrative problems with solutions.

Text Book

1. Machine Design by P. Kannaiah; Scitech Publications (India) Pvt.Ltd., T-Nagar, Chennai-600017.

   Chapters : 7, 8, 19, 22, 24, 26, 27, 28 (only relevant portions)

Reference Books :

1. Machine Design by R.S.Khurmi, J.K.Gupta ; S.Chand & Co.Ltd, Delhi.
2. Design Hand Book by S.M.Jalaluddin ; Anuradha Agencies Publications Vidayal Karuppur, Tamil Nadu, Pin : 612605.

CPME 6307 HEAT TRANSFER (3-1-0)

Module-I (10 Hours)

1. **Introduction :**

   The three modes of heat transfer, The Fourier heat conduction law, Newton's Law of Cooling and the Stefan-Boltzmann Law for black body radiation.

2. **Governing equation and boundary conditions for heat conduction :**

   The General heat conduction in Cartesian, polar-cylindrical and polar-spherical co-ordinates, Siplification of the general equation for one and two dimensional steady/ transient conduction with constant/ variable thermal conductivity with / without heat generation. Boundary conditions applicable to heat conduction problems.

3. One dimensional steady state that conduction :

Solution of the one dimensional steady state heat conduction problem in case of plane walls, cylinders and spheres for simple and composite cases. Electrical analogy, Critical insulation thickness, Analysis of extended surfaces and fins for various boundary conditions.

Module-II (12 Hours)

4. Two dimensional steady state conditions :

Solution of Cartesian problems in two dimensions (steady state conduction with constant thermal conductivity and no heat generation) by variable separation method. Numerical methods for heat conduction analysis.

5. Convective heat transfer :

(a) Introduction to convective flow - forced and free. Dimensional analysis of forced and free connective heat transfer.

(b) Conservation equations for mass, momentum and energy for 2-dimensional convective heat transfer in case of incompressible flow, Hydrodynamic and thermal boundary layers for flow over a flat plate. Boundary layer equations for 2-dimensional incompressible flow over a flat plate and boundary conditions. Momentum and energy integral equations for flow over a flat plate and their solution (local and average values of drag and heat transfer coefficients).

Module-III (8 hours)

6. Experimental heat transfer correlations for forced and free convection in the following cases

(a) Vertical and horizontal plates

(b) Inside and outside flows in case of tubes

7. Heat transfer form boiling liquids and condensing vapours :

Qualitative study of boiling heat transfer and Nusselt analysis of condensation on vertical plates, vertical tubes and horizontal tubes.

Module-IV (10 Hours)

8. Radiative heat exchange :

Introduction, Radiation properties, Emissive power & emissivity, Kirchoff's identity, Planck's relation for monochromatic emissive power of a black body, Derivation of Stefan-Boltzmann law and Wien's displacement law from Planck's relation, Radiation shape factor, Relation for shape factor and shape factor algebra. Heat exchange between black bodies through non-absorbing medium. Gray bodies and real bodies, Heat exchange between gray bodies. Radiosity and Irradiation, Electrical analogy and radiation network for 2-body and 3-body radiations exchange in non-absorbing medium, Radiation shields.

9. Heat Exchangers :

Introduction, The overall heat transfer coefficient and fouling factors, Types of heat exchangers LMTD and E-NTU analysis of heat exchangers. Heat exchanger design considerations.

Text Books :

Heat Transfer – J.P. Holman

REFERENCES :

1. Basic Heat Transfer by Necati Ozisik
2. Heat Transfer by P.K. Nag
3. Heat Transfer by S.P. Sukhatme

CPME 6308 MANUFACTURING SCIENCE - II (3-0-0)

Module –I (9 Hours)

Geometry of cutting tools in ASA and ORS, Effect of Geometrical parameters on cutting force and surface finish, Mechanics of chip formation , merchants theory, Force relationship and velocity relationship and velocity relationship, measurement of cutting force tool dynamometer, drill dynamometer.

Module – II (9 Hours)

Conventional machining process and machine tools – Turning Drilling , Shaping Planning, Milling . Grinding

Machine tools used for these processes, their specification and various techniques used.

Production Machine tools – Capstan and turret lathes, single spindle and multi spindle semiautomatics gear shaper and gear hobbing machines, copying lathe and transfer machine

Module – III (9 Hours)

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 M/c tools, Types of surfave generated indexing mechanism and thread cutting mechanism, Quick return mechanism

Module – 4 (9 hours)

Non-traditional Metal removal processes :

Ultrasonic machining, laser machining, plasma arc machining , electro chemical machining, electro discharge achining, wire EDM , Abrasive jet machining

Text Books :

1. Fundamentals of tool Engineering Design, S.K.Basu, S.K.Mukherjee, R. Mishra , Oxford & IBH Pub Co.
2. A textbook of Production Engineering, P.C,Sharma, S.chand & Co
3. Workshop Technology, W.A .J. Chapman

PRACTICALS

CPME 9304 IC ENGINE AND DYNAMICS LAB. (0-0-3)

(A) I C Engine and G T (Any four)

1. Morse Test on multi-cylinder petrol engine
2. Study of modern carburettor
3. Study of fuel injection system of Diesel engine
4. Load test on variable compression ratio engine
5. Load test on 2 stroke I.C Engine
6. Analysis of exhaust gas of automobile

(B) Dynamic Lab (Any four)

1. Determination of gyroscopic couple
2. Performance characteristics of spring loaded governor
3. Determination of critical speed of rotating shaft
4. Experiment on static and Dynamic balancing apparatus
5. Determination of natural frequency under damped and un-damped vibration.
6. Study of interference and undercutting for gear drives

CPME 9305 HEAT TRANSFER AND PRODUCTION LAB. (0-0-3)

(A) Heat Transfer Lab (Any four)

1. Determination of Thermal conductivity in composite slab
2. Determination of heat transfer coefficient in forced convention in tubes
3. Determination of surface emissibility
4. Performance testing of parallel flow and counter flow heat exchange
5. Efficiency and effectiveness of fins
6. Heat transfer in forced convention

(B) Production Lab (Any four)

1. Study of non-traditional machining process (ultrasonic machining/ abrasive jet machining/ electro-discharge machining)
2. Determination of cutting force in turning using lathe tool dynamometer
3. Determination of cutting forces in drilling using drilling tool dynamometer
4. Study of Automatics / semiautomatics

5. Study of N.C. Machines

6. Calibration of slip gauge using sine bar

7. Measurement of roughness, straightness, and flatness of surfaces

CPME 9306 DESIGN PROJECT – II (0-0-3)

1. Design of shaft on the basis of theories of failure

2. Design of machine components under dynamic stress

3 Design of thin/ thick cylindrical shells under internal fluid pressure

4. Design of clutch

5. Design of Brake

6. Design of Journal Bearing

7. Design of straight/ helical gears

8. Design of piston

9. Design of connecting rod

10. Design of crank shaft

11. Design of fly wheel

Note : At least 7 to 8designs with relevant drawings should be carried out. Rest of the design problem be given as assignments.

COURSE STRUCTURE
FOURTH YEAR B.TECH PROGRAMME
MECHANICAL ENGINEERING

7th Semester				**8th Semester**			
Theory		*Contact Hrs.*	*Credit*	*Theory*		*ContactHrs.*	*Credit*
		L-T-P				**L-T-P**	
HSSM 4430	Environmental Engineering	3-0-0	3	HSSM 4404	Marketing Management	3-0-0	3
CPME 6401	Metrology, Quality Control & Reliability	3-1-0	4	CPME 9404	Simulation, Modelling & Control	3-1-0	4
CPME 6402	Refrigeration & Air Conditioning	3-1-0	4		**Elective-III** (**Any one**)	3-0-0	3
CPME 6403	Mechanical Measurement & Control	3-0-0	4	PEME 6407	Mechanical Vibration		
	Elective-I (**Any one**)	3-0-0	3	PEME 6408	Composite Materials		
PEME 6401	Automobile Engineering			PEME 6409	Robotics & Robot Applications		
PEME 6402	Power Plant Engineering				**Elective-IV** (**Any one**)	3-0-0	3
PEME 6403	Computer Aided Design / Manufacture			PEME 6410	Tribology		
PEME 6404	Fluid Power & Control			PEME 6411	Finite and Boundary Elements		
	Elective-II (**Any one**)	3-0-0	3	PEME 6412	Mechatronics		
PEME 6405	Management Information Systems			PEME 6413	Rapid prototyping		
PEME 6406	Product Design and Production tooling						
	Total		**21**		**Total**		**13**
Practicals/Sessionals		*Contact Hrs.*	*Credit*	*Practicals/Sessionals*		*Contact Hrs.*	*Credit*
CPME 9401	Project		3	CPME 9404	Project		7
CPME 9402	Seminar		1	CPME 9405	Seminar		1
CPME 9403	Refregeration & Air Conditioning and Mechanical Measument Lab		2	CPME 9406	Entrepreneurship Project		2
				CPME 9407	Comp. Viva Voce		2
	Total		**27**		**Total**		**25**

L-Lecture **T-Tutorial** **P-Practical**

7th Semester

HSSM 4430 ENVIRONMENTAL ENGINEERING (3-0-0)

Objective : This course introduces the students to the environmental consequences of Industries, development actions etc. and the methods of minimizing their impact through technology and legal systems.

Module – I (8 Hours)

Ecological Concepts and Natural Resources : Ecological perspective and value of environment. Environmental auditing, Biotic components, Ecosystem Process : Energy, Food Chain, Water cycle, Air cycle etc., Environmental gradients, Tolerance levels of environment factor, EU, US and Indian Environmental Law, Global Perspective.

Chemistry and Microbiology in Environmental Engineering : Physical and chemical properties of water, Atmospheric chemistry, Soil chemistry, Microbiology, Chemical and biochemical reactions, Material balances and Reactor configurations.

Concept in Hydrology : Hydrological cycle, Water balance, Energy budget, Precipitation, Infiltration, evaporation and evapotranspiration, Rainfall-runoff relationships, Urban hydrology, Ground water, Ground water chemistry, Water contamination and pollution prevention.

Module – II (9 Hours)

Water Pollution : water quality standards and parameters, Assessment of water quality, Aquatic pollution, Freshwater pollution, Estuarine water quality, Marine pollution, Organic content parameters, DO and BOD demand in streams, Transformation process in water bodies, Oxygen transfer by water bodies, Turbulent mixing, Water quality in lakes and preservers , Ground water quality.

Air Pollution : Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change –green house gases, non-criteria pollutants, emission standard form industrial sources, air pollution metereology, Atmospheric dispersion.

Noise Pollution : Physical Properties of sound, Noise criteria, Noise Standards, Noise measurement, Noise control.

Module – III (12 Hours)

Water Treatment : Water quality standards, Water sources and their quality, Water treatment processes, Pre-treatment of water, Conventional process, Advanced water treatment process.

Waste Water Treatment : Water flow rate and characteristics, Design of waste water network, Waste water treatment process, pretreatment, primary and secondary treatment of waste water, Activated sludge treatment : Anaerobic digestion and its microbiology, Reactor configurations and methane production. Application of anaerobic digestion. Bio-solids regulations, Characteristics and processing of bio-solids, first and second stage processing of sludge. Sludge disposal,. Integrated sewage and sludge management.

Solid Waste Management :

Source classification and composition of MSW : properties and separation, storage and transportation, MSW Management, Waste minimization of MSW, Reuse and recycling, Biological treatment, Thermal treatment, Landfill, Integrated waste management.

Hazardous Waste Management, Hazardous waste and their generation, Medical hazardous waste, Household waste, Transportation and treatment of hazardous waste : Incinerators, Inorganic waste treatment, Treatment systems for hazardous waste, handling of treatment plant residue.

Industrial Air Emission Control :

Characterization of air stream, Equipment selection, Equipment design, Special Methods : Flue gas desulphurization, NOx removal, Fugitive emissions.

Module – IV (8 Hours)

Waste Minimization : Concept, Life Cycle Assessment, Elements of waste minimization strategy, Benefits of waste minimization, Elements of waste minimization programme, Waste reduction techniques.

Environment impact Assessment, Origin and procedure of EIA, Project Screening for EIA, Scope studies, Preparation and review of EIS.

REFERENCE :

1. G. Kiely – Environmental Engineering Irwin/ McGraw Hill International Edition, 1997
2. M. L. Davis and S. J. Masen, Principles of Environmental Engineering and Science, McGraw Hill International Edition, 2004

CPME 6401 METROLOGY, QUALITY CONTROL AND RELIABILITY (3-1-0)

Module – I (12 hours)

A. METROLOGY

a. Line and End Standards, Principles of Measurements, Calibration, accuracy and Precision, Random error and systemic error

b. Measurement of Surface Roughness, Screw, Thread and Gears.

c. Limits, Fits and Gauges, Assembly by full, partial and group interchangeability, geometric tolerances.

d. Measurement of straightness, Flatness and circularity.

Module- II (12 Hours)

B. QUALITY CONTROL

a. Some useful Probability Distribution, Testing of hypothesis, type I and type II errors, control limit theorem.

b. Cause of Variation, standard error of mean, process capability, PCR, RPI, Natural tolerance Limits, /Specification Limits, Trial and Revised control Limits, Rational subgroups, Control charts for variable (X,R,S, CUSUM, EWMA), Control charts for fraction, non-conforming control charts for non-conformation.

c. Design of single sampling plan. Double, multiple and sequential sampling plans, O.C. curve, AOQ, AOQL,

Module- III (8 hours)

C. RELIABILITY

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.

Module- IV

Taguchi's Loss function, Orthogonal Arrays, Linear Graphs, parametric design, signal-to noise Ratio, ANOVA.

TQM, Taguchi, ISO 9000, ZIT, Quality circle

Test Books :

1. R.K. Jain, "Engineering Metrology", Khanna Publisher, Delhi
2. B.L. Hansen and P.M. Ghare, "Quality control and Application", Prentice Hall of India.
3. A.K. Gupta, " Reliability Engg. And Terotechnology", Macmillan India.
4. T.P. Bagchi, " Taguch methods Explained Practical steps to Robust design", PHI
5. A. Mitra, "Statistical Process Control and Improvement", Pearson.

Reference :

1. I.C. Gupta," A test book of Engineering Metrology" Dhanpat Rai & sons, Delhi.
2. M.r. Taher," Metrology, Measurement and Measuring Instruments", RNLBP. Allhabad.
3. M. Mahajan, "a test ook of Metrology", Dhanpat Rai & sons, Delhi.
4. E.L. Grant and R.S. Leveaworth, Statistical quality Control", 7e, mc-Graw Hill.

5. D.C. Montgonery, “Introduction to Statistical Quality control”, John Wiley & sons.
6. E. Ebeling, “an Introduction to /reliability and Maitainability Engg.”, MC-Graw Hill.
7. M. Mahajan, “Statistical Quality Control”, Dhanpat Rai & Sons.

CPME 6402 REFRIGERATION AND AIR CONDITIONING (R & AC) (3-1-0)

Refrigeration and Air Conditioning (R&AC) is an important subject in Mechanical Engineering. Preservation of food, fruit, perishable goods etc under low temperature is a modern day necessity. Likewise, for comfortable living and work environment, Air Conditioning is essential and these aspects prompt the need to learn the working principles of R&AC.

Module I (10 hours)

1. Air Refrigeration System : Introduction, Unit of refrigeration, Coefficient of performance, Reversed Carnot Cycle, Temperature limitations, maximum COP, Bell Coleman air refrigerator, Air Cycle System for Air-craft.
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 cycle and super-heated cycle, Effect of suction and discharge pressure on performance, Actual vapour compression cycle. Problem illustration and solution.

Module II (10 hours)

3. Multi-stage compression and Multi-evaporator systems : Different arrangements of compressors and inter-cooling, Multistage compression with inter-cooling, Multi-evaporator system, Dual compression system.
4. Vapour Absorption System : Simple Ammonia - absorption system, Improved absorption system, Analysis of vapour absorp

Module III (10 hours)

Refrigerants ; Classification of refrigerants - Halocarbon (compounds, Hydrocarbons, Inorganic compounds, Azeotropes, Properties of refrigerants, comparison of common refrigerants, uses of important refrigerants, Brines.

Psychrometrics : Properties of air-vapour mixture, Law of water vapour-air mixture, Enthalpy of moisture, Psychrometric chart, simple heating and cooling, Humidification, De-humidification, Mixture of air streams. Review question and discussions

Module IV. (10 hours)

Requirements of comfort air conditioning : Oxygen supply, Heat removal, moisture removal, air motion, purity of air, Thermodynamics of human body, confort and confort chart, effective temperature, factors governing optimum effective temperature, factors governing optimum effective temperature.

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

Text Books :

1. A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpat Rai & Sons.
   Chapters ; 3,4,5,6,7,11,16,17,19,20

REFERENCE BOOKS :

1. Refrigeration and Air conditioning by P.L. Balloney, Khanna Publishers.
2. Refrigeration and Air conditioning by Manohar Prasad,
   New Age international publishers.
3. Refrigeration and Air conditioning by C.P. Arora, Tata McGraw Hill.

CPME 6403 MECHANICAL MEASUREMENT AND CONTROL (3-0-0)

Module I (10 Hours)

The significance of mechanical measurements, basic detector transducer elements : Electrical transducer, Sliding Contract devices, Variable-inductance transducer elements, the differential transformer, Variable-reluctance transducers, Capacitive transducers. The piezoelctric effect, photo-electric transducer, electronic transducer element.

Intermediate modifying system : Electrical intermediate modifying devices, Input circuitry. The simple current sensitive circuit, the ballast circuit, The voltage-dividing potentiometer circuit, The voltage balancing potentiometer circuit, Resistance bridges.

Terminating Devices and Methods ; Introduction, Meter Indicators. The vacuum tube voltmeter, CRO, Electronic Switch, CRO recording techniques, Oscillographs.

Module II (10 Hours)

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, Gravitation transducers, Elastic transducers, Elastic diaphragms, Secondary transducer used with diaphragms, strain gauge pressure cells, measurement of high pressure, Measurement of low pressures, dynamic characteristics of pressure measuring systems, Calibration methods.

Module III (10 Hours)

Measurement of Fluid Flow

Flow characteristics obstruction meters, Obstruction meter for compressible fluids. The variable-area meter, calibration of flow measurement devices.

Temperature Measurement

Use of bimetals pressure thermometers, Thermocouples, Pyrometry, Calibration of temperature measuring devices.

Vibration and Shock :

Measurement and test methods - Vibrometers and accelerometers, elementary vibrometers and vibration detectors, Elementary accelerometers, The seismic instrument.

Module IV (12 Hours)

Description of open and closed loop control systems and their block diagrams. Use of block diagram and signal flow graph to find overall transfer function.

1st and 2nd order systems and their response to step and slnusoidal input, error analysis, static and dynamic error coefficients.

Routh's stability criterion. The Root-Locus method, Bode Plot and Nyquist plot, Gain margin and phase margin.

Textbooks

1. Mechanical Measurements, T.G. Beckwith and N. Lewis Buck, Oxford and IBH Publishing Co.
2. Modern Control Engineering, K.K. Ogata, prentice Hall India

Elective –I (any one)

PEME 6401 AUTOMOBILE ENGINEERING (3-0-0)

Module I (8 Hours)

Introduction :

Main units of automobile chesis and body, different systems of the automobile, description of the main parts of the engine, motor vemicleast.

Power for Propulsion

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

Module II (12 Hours)

Transmission Systems

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

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

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

Module III (12 hours)

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 of brake shoes, servo and power brakes.

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

Electrical system of an automobile : Starting system, starting drive, generation system, ignition system, other electrical system.

Module IV (12 hours)

Advance system in automobiles :

Electronics, computers, robots and emission control in automobiles, CNG engine, recent research and development.

Textbooks :

1. Automobile engineering , G.B.S. Narang
2. Automobile Mechanics, J. Heitner
3. Automobile Engineering, K.M. Gupta, Vol I & II (Umesh Publication)

REFERENCE BOOKS :

1. The motor vehicle, Newton and Steeds

PEME 6402 POWER PLANT ENGINEERING (3-0-0)

Module- I (10 Hrs)

INTRODUCTION

Different sources of energy, Types of power plant and site selection, overall view of a steam power plant.

STEAM GENERATOR

Fossil fuel steam generators, classification, circulation in water tube boilers, Modern high pressure water tube boilers, Boiler mounting and accessories, Combustion equipment including air supply systems (Natural and

Mechanical Draught Systems). Feed water treatment (Necessity & general consideration only). Boiler performance calculations.

Module - II

STEAM TURBINES

Flow of steam through nozzle & turbine blades (I) Types of nozzles and their area of application & related calculation, critical pressure & chocked flow, super saturated flow. Effect of friction and nozzle efficiency (ii) Turbine types, Variation of Pressure and Velocity in different types of turbines, Simple impulse Turbines, Pressure - compounded impulse turbines and Velocity compounded impulse turbines. Turbine power and related calculations.

Module - III (12 Hours)

REACTION TURBINES

Reaction turbines with power and related calculations with different degrees of reaction, Blade height calculations. Variation of blade velocity along blade height, Losses in steam turbines, Reheat factor & condition line, Governing of turbines.

STEAM CONDENSER & CIRCULATING WATER SYSTEMS

Types, Surface condenser, Performance calculation, Air removal methods, Vacuum & vacuum efficiency. Cooling towers.

Module - IV (8 Hours)

NUCLEAR POWER PLANT

Introduction, Nuclear fuels, Nuclear fission, Reactor components, & materials and classification, Pressurized water Reactor (PWR), Boiling Water Reactor (BWR). CANDU Reactor, Gas cooled Reactors, Liquid metal fast breeder Reactor. Heavy water Reactors.

BOOKS RECOMMENDED :

1. Power plant engineering ; - By P.K. Nag (2nd edition) TMH
2. Power plant technology : By E.I. Wakil TMH

PEME 6403 COMPUTER AIDED DESIGN AND MANUFACTURING (3-0-0)

Module I (8 Hours)

Fundamentals of CAD

The design process, applications of computer for design, creating the Manufacturing Database, The design workstation, Graphical Terminal, Operator input Devices, Plotters and other devices, the CPU, secondary storage.

Module II (10 Hours)

Computer graphics Software and Database

Configuration, Graphics Packages, Constructing the Geometry, transformations, Database structure and content, wire frame versus solid modeling.

Module III (10 Hours)

CAM

Numerical Control and NC Part Programming

NC Cordinate system, NC motion control system, Economics of NC, Manual and Computer Aid programming, the APT language, NC programming with interactive graphics.

Module IV (10 Hours)

Problems with conventional NC, NC technology : CNC, DNC combined DNC/ CNC system, Adopter control manufacturing systems.

Computer Integrated manufacturing system, Machine Tools and related Equipment, Materials Handling system, Computer system

TEXTBOOKS :

1. Computer Aided design and Manufacture, Grover M.P Zimmers, E.W, Prentice Hall
2. CAD/CAM/CIM P. radhakrishnan & Subramanyam, Willey Eastern Limited
3. Automation, Production System, and CIM, Goover, Prentice Hall
4. Mastering CAD/ CAM, Ibrahim Zeid, TMH
5. N.C Machine, Kundra, Rao, Tewari, TMH

PEME 6404 FLUID POWER & CONTROL(3-0-0)

Module – I (10 hours)

Chap - 1 : Pumps & Compressors :

Operation, Hydraulic Pumps, variable flow hydraulic pumps, Air compressors, water vapour problem.

Chap - 2 : Valres ; Introduction, Check value, throttle value, pressure value, Directional control value. Actuators for operating directional control value.

Chap - 3 : Loan actuators : type, Air cylinders, Hydraulic cylinders, Air & Hydraulic motors, Hydrostatic transmission, Rotary actuators.

Module – II (10 hours)

Chap - 4 : Basics of microcomputers :

The microprocessor, microcomputer, mode of operation, The bus, memory, Input / Output, DC Power supplies, Buffers, Programmable controllers.

Chap - 5 : Feed back elements :

Introduction, control of position, push button and limit switches, Digital and analog devices.

Chap - 6 : Interfacing ; components for switching, interfacing mechanical switches, converting digital values to analog voltages, Analog to digital & digital to analog converters.

Module – III (10 hours)

Chap - 7 : Interference & Notice Suppression :

The problem, standard precautions & extra precautions, software solution.

Chap - 8 : Programming ; Types of programming, comparison between machine code & BASIC, Registers, Hexadecimal numbering system, choice of microprocessor, machine code programming porgramming example.

Chap - 9 : Proportional solenoid value :

Short stroke & long stroke solenoid value spool design, pressure compensation, frequency response Amplifiers for proportional solenoids.

Module – IV (8 hours)

Chap - 10 : Hydraulic servo value : Throttle action, need for the whole system to have stiffness, High frequency response, cleanliness of oil.

Chap - 11 : Design examples

Chap - 12 : Case study

Text book :

1. Fluid Power with microprocessor control : An Introduction by E.W. Reed and I.S. Larman.
2. Prentice Hall International, N.D.

REFERENCE BOOK :

1. Fluid Power Control by J.F. Blackburn, G. Reethof & J.L. Shearer,

John Wiley & Son Inc. & The Technology Press of M.I.T.

Elective – II (Any one)

PEME 6405 MANAGEMENT INFORMATION SYSTEM (3-0-0)

Management Information System is a powerful Tool for Organizational Managers in Decision-Making. The rapid change in information technology and proliferation of information have together made MIS a necessity to tackle the complex fabric of business organization.

Module I : (10 hours)

Management Information System : An Overview : Introduction to MIS - Definition of MIS - Framework for MIS organization and Management Triangle - Information needs and its economics - System Approach - Meaning and objectives of MIS - Disadvantages of Information System - Approach of MIS development - Constraints in developing an MIS - MIS and use of computer - Limitations of MIS - Review questions and discussions.

Information system for Decision Making - Introduction - Transaction Processing System - Management Information System - Intelligent Support Systems - Office Automation System - Review questions and discussions.

Module II (10 hours)

Computer Hardware for Information Systems - Introduction - Basics of Data Representation - types of computers - Basic components of computer systems - Factors to buy a PC - Review questions and discussions.

Computer software for information systems - Introduction - Programming Languages - classification of software - role of software in problem solving - criteria for investment in hardware and software - Review questions and discussions.

Module III (10 hours)

Decision Support System (DSS) - Introduction - Definition - Evolution of DSS - objectives of DSS - classifications of DSS - characteristics of a DSS - components of a DSS - Functions of a DSS - Development of DSSs - Group Decision Support Systems - Executive Information System (EIS) - success criteria for DSS / EIS, Relationship between MIS and DSS - Review questions and discussions.

Information system in Business - Introduction - functional acreas in business - Manufacturing Information systems - quality Information Systems - Financial and Accounting Information systems - Research and Development Information Systems - Human Resource Information systems - Geographical Information systems - cross functional systems - Review questions and discussions.

Module IV (10 hours)

Strategic Management Information System (SMIS) - Introduction - characteristics of SMIS - strategic planning for MIS - Development of SMIS - MIS strategy implementation - Barriers to development of SMIS - Review questions and discussions.

Information Resource Management (SMIS) - Introduction - Principles of IRM - IRM objectives - functional components of IRM - Organization of Information Resources Function - Application of scarce information system resources - Management of Information systems personnel - Management of end-user computing - A pro-active CIO strategy - Review questions and discussions.

Text Book

Management Information Systems by A.K. Gupta, Second Edition - 2003Publisher,S.Chand & Co. Ltd., Ram Nagar, New Delhi – 110055, Chapters - 1,2,3,4,8,9,13,14

PEME 6406 PRODUCT DESIGN AND PRODUCTION TOOLING (3-0-0)

Module I (8 hours)

Product design considerations, product planning, product development, value analysis, product development.

Product design for sand casting, design of gating system and risering.

Module II (8 hours)

Forging design, allowances, die design for drop forging, design of flash and gutter, Upset forging die design.

Sheet metal working shearing, blanking plercing, deep drawing operation, Die design for sheet metal operations, progressive and compound die, strippers , stops, strip layout.

Module III (10 hours)

Design of jigs and fixtures principle of location and clamping, clamping methods, locating methods, Drill Jig bushing, Indexing type drilling Jig.

Process Planning – selection of processes, machines and tools and design of sequence of operations, Time & cost estimation, Tooling design for turret lathe and automats.

Module III (10 hours)

Design of single point cutting tool, broach and form tool, design of limit gauges.

Textbooks :

1. Fundamentals of Tool Engineering design, S.K. Basu, S.N. Mukherjee, R. Mishra, Oxford & IBH Publishing co.
2. Manufacturing Technology, P.N. Rao , Tata McGraw Hill
3. A Textbook of Production Engineering, P.C. Sharma, S. Chand & Co,

PRACTICALS

CPME 9403 REFRIGERATION & AIRCONDITIONING AND MECHANICAL MEASUREMENT LAB.

(A) Refrigeration and Air conditioning Lab

1. Determination C.O. P of vapour compression cycle
2. Performance test on Air conditioning test rig
3. Generation of psychometric chart
4. Determination of C.O.P of ice plat

(B) Mechanical Measurement Lab (Any four)

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. Experiment on Pneumatic trainer
6. Experiment on Hydraulic trainer
7. Determination of damping coefficient of vibration absorbing materials using vibration measuring equipment.

8th Semester

HSSM 4404 MARKETING MANAGEMENT (3-0-0)

Objective of the Course :The course aims at introducing the basic concepts of marketing to the undergraduate students in engineering. The learning shall help the students in better designing, manufacturing and selling product/ service packages keeping competitive market, customers and cost in view.

Module – I (9 hours)

Marketing Management : Concept, Process, Functions and relevance in the current context.

Marketing Environment : Socio-economic forces. Competition : national and global, Technology, Government Policy, Suppliers, Buyers, Consumer Resistance considerations. Environment scanning tools and techniques

Competition Analysis : Factors contributing to competition, Competition analysis tools, Competitive arena mapping, Segmentation matrix.

Market Planning : Exploring Opportunity, Product –market selection, Approaches to Market Planning, Market Planning Process.

Module II (10 hours)

Market Research and Information Systems : Research Process, The Internet and World Wide Web based Information collection and processing, Database, Data Warehouses and Data Mining, Global Market Research, Competitive Intelligence.

Consumer Behaviour : Importance of buyer and his/ her role in purchasing. Influence of buyer behaviour, Buyer behaviour study tools. Organizational buying behaviour.

Market Segmentation, Targeting and Positioning : Definition, Bases and Methods of segmenting consumer and Industrial markets. Target Market strategies: Domestic and global perspective. Market Positioning.

Market Demand Forecasting : Key Terms, Forecasting Tools : Short term tools : Moving average and Exponential smoothing methods, Long-term forecasting Tools : Time series analysis, Econometrics methods, Qualitative tools : Buying Intention Survey, Sales Force Opinion and Delphi Techniques.

Module – III (11 hours)

Product Planning : Product Life Cycle, Locating products in PLC, New Product Development Process, Branding Strategy, Positioning a Brand, Brand Equity, Packaging and Labeling, Product-mix and Product Line, Product-Mix strategies, Planned Obsolescence.

Pricing Decision : Objectives and Factors influencing pricing, Cost-Plus Pricing, Breakeven Analysis, Price Based on Marginal Analysis, Price Elasticity of Demand, Operating statement, Markups Analysis Ratios, Pricing Strategies : Market-Entry, Discounts and allowances, Geographic Pricing, Special Pricing.

Promotion Decisions : Marketing Communication and Promotion Process, Promotion Mix, Advertising : Media and Media selection process. Organising for advertising, sales promotion.

Module -IV (10 hours)

Channels of Distributions : Designing Distribution Channels, Wholesaling and Physical Distribution, Retailing. Supply Chain Management (Basic only). Personal selling, Direct Marketing, Managing Sales Force.

Trends in Marketing : Global Marketing, Customer Services, Customer Relationship Management, Rural Marketing and Service Marketing.

REFERENCES :

1. M. J. Etazel , B. J. Walker and W. J. Stanton, Marketing, Tata McGraw Hill, 13th Edition, 2004.
2. R. Saxena, "Marketing Management" Tata McGraw Hill, second Edition, 2003.

CPME 9404 SIMULATION, MODELING AND CONTROL (3-1-0)

Module 1 12 hours

Overview of feedback control systems, Dynamics of mechanical systems, Differential equations and state variable form, Models of electromechanical, Heat-and fluid flow models, Linearization and scaling, Models from experimental data, Dynamic response using pole-zero locations, Time domain specifications, Classical 3-term controllers and its digital implementation, Stability analysis by Routh Criterion.

Module 2 10 hours

Basic simulation modeling, Discrete event simulation, Simulation of queuing and inventory systems, Continuous, Discrete-continuous and Monte

Carlo simulations.

Module 3 10 hours

Statistical models in simulation, Discrete and continuous distributions, Poisson process, Empirical distribution, Generation of pseudo random numbers, Analysis of simulation data, Parameter estimation, Goodness-of-fit tests, Multivariable time series models.

Modules 4 10 hours

Simulation of manufacturing and material handling systems, Goals and performance measures, Modeling downtime and failures, Trace driven models, Case studies.

Books :

1. Discrete-Event system simulation by Jerry Banks, J.S. Carson, B.L. Nelson and D.M. Nicol (Pearson
2. Feedback control of dynamic systems by G.F. Franklin, J.D. Powell, A-Naeini, Pearson Publications.
3. Simulation modeling and analysis by A.M. Law, W.D. Kelton, Tata McGrawHill Publications.

Elective –III (Any one)

PEME 6407 MECHANICAL VIBRATIONS (3-0-0)

Module-I 10 hours

1. **Review on un-damped free Vibration :**
   Systems with single degree of freedom, Equilibrium method, Energy method, Raylegh's method, Stiffness of spring elements.
2. **Damped Variations :**
   Viscous damping-Law of damping, Logarithmic decrement.
3. **Forced Vibration with Harmonic Excitation :**
   Steady state solution with viscous damping, method of complex algebra Reciprocating and rotating unbalance. Base excitation vibration isolation. Air springs, energy dissipated by

damping. Equivalent vaicous damping, structural damping sharpness of resonance, vibration measuring instruments, whirling of rotating shafts, Rigid shafts supported by flexible bearings.

Module-II 10 hours

4. Two degree of freedom systems :

   Generalized Derivation of Equation of motion, coordinate coupling, Langrange's equations.

5. Multi-degree of freedom system :

   Derivation of Equations, Calculation of Natural Frequencies by Rayleigh, stodala, Matrix iteration and Holzer-Methods.

Module-III 12 hours

6. Torsional Vibration : Single and multi-rotor systems, geared system and branched system.
7. Vibration of continuous system. Transverse vibration of beams and rods with different end conditions Euler equation for beams

Module-IV 6 hours

8. Signature analysis and preventive maintenance, Vibration testing equipments, vibration signatures, standards, Field balancing of rotors

Text Books :

1. Mechanical vibration - Tse, Morse & Hinkle (Prentice Hall of India)
2. Mechanical Vibration with Application - W.T. Thomas - CPC Publication

PEME 6408 COMPOSITE MATERIALS (3-0-0)

Module - I

1. **Introduction :**

   Classification and characteristics of composite materials, mechanical behaviour of composites, constituents, Reinforcements, Matrices, Fillers, Additives, Applications an advantages of composites.

Module - II

2. **Processing and Testing**

   Initial form of constituent materials, Manufacturing procedures for fibre-reinforced plastics, quality control, testing of composites.

Module - III

3. **Macromechanical Behaviour :**

   Stress strain relations of anisotropic materials - Engineering constants for orthotropic and isotropic materials, plane stress condition, stress strain relations for a lamina of arbitrary orientation, strength of orthotropic lamina.

Module - IV

4. Behaviour of Laminated composites, classical lamination theory

   Evaluation of laminates, General design consideration.

Text Book

1. Mechanics of Composite Materials, R.M. Jones, Mc. Graw Hill Book Co.

Reference Book :

1. Fibre - Reinforced composites :- Materials, manufacturing and Design by P.K. Mallick, Marcel Dekker Inc., New York and Basel.
2. Composite materials Brontman & Croch

PEME 6409 ROBOTICS AND ROBOT APPLICATIONS (3-0-0)

Module – I (10 hours)

1. **Robotics :** Definition, Law of Robotics, theoretical background, Robotic system and Robot anatomy-common robot configurations, Manipulator, Coordinate system, work envelope, Controller, Teach Pendants, Human system and Robotics specifications of robots, machine intelligence, Safety measures.
2. **Robot kinematics :** Representing the position, Two –DOF, 2D manipulator, 3 DOF, 2D Manipulator, 4 DOF, 3D Manipulator, Homogenous transformations

Module – II (12 hours)

3. **Robot Drive System :** Mechanics of Hydraulic systems, Positive displacement pump, other types of pumps
4. Actuators – Linear and Rotary hydraulic actuators, Directional control valves, Servo control valves, Flow control valve, Pressure control valve.
5. Pneumatic system : Positive displacement compressor, Rotary compressor, Pneumatic conditioner-Air filter, Pressure regulator, electrical motors, Control loops, Principle of servo control in a robot, Steeper motor- Principle and drive circuit.

Module – III (10 hours)

6. End effectors : Drive system for grappers, mechanical magnetic, Vacuum and Adhesive grppers
7. Sensors : Need to sensing systems, sensing devices, Types of sensors, Centract, Force and Torque, Proximity and Range, Electro-optical sensors, Robot vision system.

Module –IV (8 hours)

8. Robot language and programming : Types of programming, Lead through programming, Motion programming, Robot language-VAL system, Welding instructions.
9. Robot Applications : Material handling, Machine loading and on loading, machining, Assembly, Inspection and Welding, Inspection

Text Book :

1. Robotic Technology and Flexible Automation, S.R. Deb, TMH
2. Robotics, Fu. Lee. Gonzalez

Elective –IV (Any one)

PEME 6410 TRIBOLOGY

Module - I 8 Hours

Introduction : Lubricant and lubrication, Types of bearings ., properties and testing of lubricants, equations of flow , Hag poiseulle flow., flow between two parallel plates

Module - II 8 Hours

Hydro dynamic lubrication :

Petroffs equation for a lightly loaded bearing mechanism, pressure development in an oil film, Reynold's equation in two dimensions, load carrying capacity of journal bearing, Heat balance of lubricants

Module - III 10 Hours

Hydrostatic Bearing :

Principles, Component of hydrostatic lubrication , Hydrostatic circular thrust bearing , calculation of required in pressure , load carrying capacity, flow rate , power loss in bearing due to friction, concept of gas lubricated bearing

Design and selection of antifiction bearing

Module - IV 8 Hours

Friction and wear of metals :

Theories of friction, surface contaminants, Effect of sliding speed on friction, classification and mechanism of water resistant materials.

Text books :

1. Introduction to Tribology of Bearing , B.C .Majumdar (AHW)
2. Basic Lubrication theory, A. Cameron (John Wiley & sons)
3. Mechanism and machine Theory, J.S.Rao & R.V. Dukki Patti, New Age International publication

PEME 6411 FINITE AND BOUNDARY ELEMENT (3-0-0)

Module – I (12 hours)

Introduction and basic concept, Elastic stress analysis using linear elements, Some mathematical fundamentals and computer algorithm.

Module – II (12 hours)

Variation approach and heat flood analysis, weighted residual technique and unsteady state heat flow analysis, Beams, plates and shells.

Module – III (12 hours)

Nonlinear, curved, Isoparametic elements, Material, Nonlinearity including plasticity, Creeping, Viscons Flood and metal forming.

Module – IV (12 hours)

Boundary element method : potential problems, Adaptive mesh refinement and large problem solvers

Tex Books

1. Finite and Bounadary Element Mthod in Engineering, O.P. Gupta, Oxford and IBH Publishing
2. The Finite Element Method in Engineering Science, Zienkiwicz, TMH

PEME 6412 MECHATRONICS (3-0-0)

Module – I

1. Evaluation of Mechatronics, Single theory, signal analysis and processing, Laplace transformation, Z-transformation modulation and de-modulation.
2. Electrical components and Electronic device –Resister, inductor and capacitor, reactance and impedance. Basic electronics devices junction diodes, Bipolar transistors

Module – II

3. Basic Digital Technology : Digital number system, Binary number system, Hexadecimal number system, Binary addition, Boolean Algebra, Logic function, Universal GATES, FLIP-FLOPA, Registers counters.
4. System modeling : Frequency response, Mechanical system, electrical system, Thermal system, Fluid system.

Module – III

5. Transducer and Sensors : Principles, difference between transducer and sensors, transducer types – photo emissive, photo conductive, photovoltaic, thermistors, Thermocouple, Inductive, capacitive, Peizoelectric, Hall effect transducers, Ionization transducer, Encoders- Incremental encoder, Optical encoder, Bimetallic strip, Strain gauge, load cell diaphragm.

Module – IV

6. Actuators- Electromagnetic principles, Solenoids and relays, Electric motors, D.C. Motors, Stepper motor Hydraulic valves, Hydraulic actuators, Pneumatics
7. Microprocessor ad Microcontroller : Microprocessor based Digital control, registers, Program counter, Intel -8085 microprocessor.

Text Book :

(i) Mechatronics, N.G. P.C Mahalik, Tata McGraw Hill

(ii) Mechatronics, D.G. Alciator, M.B. Histand, Tata McGraw Hill

PEME 6413 RAPID PROTOTYPING (3-0-0)

Module – I (8 hours)

Classification of manufacturing processes, Different manufacturing systems, Introduction to rapid Prototyping (RP), Need of RP in context to batch production, FMS and CIM and its application.

Module - II (10 hours)

Basic principles of RP steps in RP, Process chain in RP in integrated CAD-CAM environment, Advantages of RP, Classification of different RP techniques based on raw materials, layering technique (2D or 3D) and energy sources.

Module – III (12 hours)

Process technology and comparative study of stereo lithography (SL) with photopolymerisation =, SL with liquid thermal polymerization, solid foil polymerization, selective laser sintering, selective powder binding, Ballastic particle manufacturing –both 2D and 3D, Fused deposition modeling, Shape melting, Laminated object manufacturing solid ground curing, Repetitive masking and deposition.

Module – IV (10 hours)

Beam interference solidification, Holographic interference solidification special topic on RP using metallic alloys, Programming in RP modeling, Slicing, Internal Hatching, Surface skin films, support structure.

Text Book :

1. Introduction to Rapid Prototyping, Amitav Ghosh, North West Publication, New Delhi

CPME 9406 ENTREPRENEURSHIP PROJECT

1. The project will be for 2 credits and 3 periods per week is to be devoted for the project.

2. The teacher has to give elementary idea about entrepreneurship through classroom teaching before a project report is prepared by the student.

3. The teacher will first cover the following topics through lecturer and exercises on motivation and games.

   - Entrepreneurship concept, EDP in India, Indian middle class value.
   - Entrepreneurial qualities, motivation perception, risk taking etc.
   - Market survey, Business opportunity guidance
   - Role of DIC, SFC, Bank etc.
   - Working capital assessment, Balance Sheet, Costing, Book keeping.
   - Decision making, Leadership, Communication skill
   - Preliminary Project Report, preparation for a specific product and submission of the report.

4. Evaluation

   (a) The teacher has to conduct tests/ motivational exercises to assess entrepreneurial capability of the student (20%)

   (b) The teacher has to test the knowledge of the student on the above topic through a written test. (20%)

(c) The teacher has to evaluate the report submitted by the student (i.e. Project report within 50 pages) (60%).

REFERENCE BOOKS :

1. Entrepreneurship of Small Industries, M. V. Deshpande, Deep and Deep Publication

2. Management of Small Scale Industry, Vasant Desai, Himalaya Pub. House