

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

Marine Engineering

3 rd Semester				4 th Semester			
Sub. Code	Theory	Contact hours	Credit	Sub. Code	Theory	Contact hours	Credit
BSCM 1205	Mathematics-III	3-1-0	4	BSCM1210	Mathematics-IV	3-1-0	4
BEME2209	Fluid Mechanics & Machines	3-0-0	3	BEEE2215	Energy Conversion Techniques	3-0-0	3
HSSM3204	Engineering Economics & Costing	3-0-0	3	HSSM3205	Organization Behavior	3-0-0	3
HSSM3205	OR Organization Behavior			HSSM3204	OR Engineering Economics & Costing		
BSMS1213	Material Science & Engineering	3-0-0	3	PCME4206	Mechanics of Materials-I	3-1-0	3
PCMR4201	Workshop Technology	3-0-0	3	PCMR4204	Marine Auxiliary Machinery-I	3-0-0	3
PCMR4202	Basic Ship Structure	3-0-0	3	PCME4207	Machine Dynamics-I	3-0-0	3
PCMR4203	Naval Architecture I	3-0-0	3	PCMR4205	Ship Construction	3-1-0	4
Theory Credits			22	Theory Credits			23

Code	Sessional/ Practical	Contact hours	Credit	Code	Sessional/ Practical	Contact hours	Credit
PCME7202	Mechanical Engineering lab	0-0-3	2	PCMR7206	Marine Engineering. Drawing	0-0-3	2
PCME7201	Machine drawing	0-0-3	2	PCME7204	Material Testing & Heat Power Laboratory plant operation (Summer Break)	0-0-3	2
HSSM7203	Communication & Interpersonal Skills for Corporate Readiness	0-0-3	2				
Sessional Credits			6	Sessional Credits			4
Total			28	Total			27

BSCM1205 **Mathematics - III**

Module-I (18 hours)

Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge's method, Second order partial differential equation

The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates, potential.

Module-II (12 hours)

Complex Analysis:

Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping,

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

Module –III (10 hours)

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

Text books:

1. E. Kreyszig, "Advanced Engineering Mathematics", Eighth Edition, Wiley India
Reading Chapters: 11,12(except 12.10),13,14,15
2. B.V. Ramana, "Higher Engineering Mathematics", McGraw Hill Education, 2008
Reading chapter: 18

Reference books:

1. E.B. Saff, A.D. Snider, "Fundamental of Complex Analysis", Third Edition, Pearson Education, New Delhi
2. P. V. O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi

BEME2209 **Fluid Mechanics & Machines**

Module I (12 Lectures)

Introduction : Scope of fluid mechanics and its development as a science

Physical property of Fluid: Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.

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

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

Buoyancy and flotation, Archimedes' principle, stability of immersed and floating 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,

Module II (10 Lectures)

Fluid dynamics : Introduction, Euler's equation along a streamline, energy equation, Bernoulli's equation,

Hydraulic Measurements: Water level measurements, velocity measurements, discharge measurements, venturimeter, orifice meter, current meter, pitot tube, orifice, notch and weir.

Module III (14 Lectures)

Hydraulic turbines and pumps: Impulse and reaction turbines, construction and working principle of tangential, radial and axial type turbines. Power of turbines, efficiency of turbines. Construction and working principles of centrifugal type pumps. Power and efficiency of the pump. Positive displacement pump.

Hydraulic systems: hydraulic accumulator, hydraulic intensifier, hydraulic ram, hydraulic lift, hydraulic crane, hydraulic press, hydraulic torque converter.

Text Books

1. Fluid Mechanics and hydraulic machines, Modi & Seth
2. Hydraulics fluid machines and fluid machines by S. Ramamrutham

Reference Books:

1. Fluid Mechanics by A.K. Mohanty, PHI
2. Introduction to Fluid Mechanics by Fox and McDonald, Willey Publications
3. Fluid Mechanics by Kundu, Elsevier
4. An Introduction to Fluid Dynamics by G.K.Batchelor, Cambridge University Press
5. Engineering Fluid Mechanics by Garde et. al., Scitech
6. Fluid Mechanics by J.F.Douglas, J.M.Gasiorek, J.A.Swaffield and L.B.Jack, Pearson Education.

HSSM3204 **Engineering Economics & Costing**

Module-I: (12 hours)

Engineering Economics – Nature and scope, General concepts on micro & macro economics. The Theory of demand, Demand function, Law of demand and its exceptions, Elasticity of demand, Law of supply and elasticity of supply. Determination of equilibrium price under perfect competition (**Simple numerical problems to be solved**). Theory of production, Law of variable proportion, Law of returns to scale.

Module-II: (12 hours)

Time value of money – Simple and compound interest, Cash flow diagram, Principle of economic equivalence. Evaluation of engineering projects – Present worth method, Future worth method, Annual worth method, internal rate of return method, Cost-benefit analysis in public projects. Depreciation policy, Depreciation of capital assets, Causes of depreciation, Straight line method and declining balance method.

Module-III: (12 hours)

Cost concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into fixed and variable costs. Break-even analysis-Linear approach. (Simple numerical problems to be solved)

Banking: Meaning and functions of commercial banks; functions of Reserve Bank of India. Overview of Indian Financial system.

Text Books:

1. Riggs, Bedworth and Randhwa, “Engineering Economics”, McGraw Hill Education India.
2. M.D. Mithani, Principles of Economics.

Reference Books :

1. Sasmita Mishra, “Engineering Economics & Costing “, PHI
2. Sullivan and Wicks, “ Engineering Economy”, Pearson
3. R.Paneer Seelvan, “ Engineering Economics”, PHI
4. Gupta, “ Managerial Economics”, TMH
5. Lal and Srivastav, “ Cost Accounting”, TMH

HSSM 3205 **Organizational Behaviour**

Module I :

The study of Organizational Behaviour : Definition and Meaning, Why Study OB
Learning – Nature of Learning, How Learning occurs, Learning and OB.
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, Herzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations.

Module II :

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 Followership, How to be an effective Leader, Conflict-Nature of Conflict and Conflict Resolution. An Introduction to Transactional Analysis (TA).

Module-III :

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 Organisational Behaviour – Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global Perspective.

Text Books :

1. Keith Davis, Organisational Behaviour, McGraw-Hill.
2. K.Aswhappa, Organisational Behaviour, Himalaya Publishing House.

Reference Books :

1. Stephen P. Robbins, Organisational Behaviour, Prentice Hall of India
2. Pradip N. Khandelwal, Organizational Behaviour, McGraw-Hill, New Delhi.
3. Uma Sekaran, "Organizational Behaviour", TATA McGraw-Hill, New Delhi.
4. Steven L McShane, Mary Ann Von Glinow, Radha R Sharma "Organizational Behaviour" , TATA McGraw- Hill.
5. D.K. Bhattachayya, "Organizational Behaviour", Oxford University Press
6. K.B.L.Srivastava & A.K.Samantaray, "Organizational Behaviour" India Tech
7. Kavita Singh, "Organizational Behaviour", Pearson

BSMS1213 **Material Science and Engineering**

MODULE-I

(11 Hours)

Introduction, Classification of Engineering Materials, Engineering properties of materials, Selection of Materials

Mechanical Properties of Materials: Tensile strength, Stress–strain behaviour, Ductile and brittle material, Impact test, Toughness, Hardness test, Fatigue and fatigue test, Creep and Creep test, Fracture

MODULE-II

(13 Hours)

Electrical and Electronic materials: Electrical conductivity, Thermal conductivity, Free electron theory, Energy band concept of conductor, insulator & semiconductor.

Superconductor materials: Principles of superconductivity, zero resistivity, Critical magnetic field and critical current density, Type I & II superconductors, Applications of superconductors

Dielectric Materials: Microscopic displacement of atoms and molecules in an external DC electric field, Polarization and dielectric constant, Dielectric susceptibility, polarization mechanisms, Temperature and frequency dependence of dielectric constant, Dielectric breakdown, Ferroelectric materials, Piezoelectrics, pyroelectrics and ferroelectrics, Dielectric materials as electrical insulators

Magnetic Materials: Concept of magnetism – Diamagnetic, Paramagnetic, Ferromagnetic materials, Hysteresis, Soft & hard magnetic materials, Ferrite

MODULE-III

(11 Hours)

Optical materials: optical properties – scattering, refraction, reflection, transmission & absorption, Laser – principles and applications, Optical fibres – principles and applications

Polymeric materials: Types of polymers, Mechanism of polymerization, Mechanical behaviour of polymers, Fracture in polymers, Rubber types and applications, Thermosetting and thermoplastics, Conducting polymers

Composite Materials: Microcomposites & Macrocomposites, fibre reinforced composites, Continuous fibre composites, Short fibre composites, Polymer matrix composites, Metal-matrix composites, Ceramic-matrix composites, Carbon-carbon Composites, Hybrid composites.

Ceramics: Types, structure, properties and application of ceramic materials

Other materials: Brief description of other materials such as Corrosion resistant materials, Nano phase materials, Shape memory alloy, SMART materials

Text Books:

1. Material Science for Engineers, James F. Shackelford & Madanapalli K Muralidhara, Pearson Education
2. Materials Science and Engineering, W.D.Callister, Wiley and Sons Inc.

Reference Books

1. Materials Science by M.S. Vijaya , G.Rangarajan, Tata MacGraw Hill
2. Materials Science by V. Rajendra, A. Marikani, Tata MacGraw Hill
3. Materias Science for Electrical and Electronic Engineers, I.P.Jones, Oxford University Press
4. Elements of Material Science and Engineering, L.H.Van Vlack, Addison Wesley
5. The Science and Engineering of Materials, Donald R. Askeland and Pradeep P Phule, Thomson Learning (India Edition)
6. Materials Science and Engineering, V.Raghavan, Prentice Hall of India Pvt.Ltd.
7. Materials Science and Engineering in SI units, W.F.Smith, J.Hashemi and R.Prakash, Tata MacGraw Hill
8. Engineering Materials, Properties and Selection, Kenneth G. Budinski and Michael K. Budinski, Prentice Hall of India
9. Material Science & Engineering, Vijaya M. S., Rangarajan G, Tata McGraw Hill.
10. Material Science & Enginnering, S.K.Tripathy, A.K.Padhy & A. Panda, Scitech publication.

PCMR 4201 **Work shop Technology**

Module –I

Bench Work & Fitting

Vices, Hammers, Chisels,, chipping, files, filing, Scraper, Grinding & Polishing, Hackshaw, Sawing, Marking tools, Surface plate, Scriber, Punch, V-block, Angle plate, Try square, Marking Out, Drill, Drilling, Reamer, Reaming, Taps, Tap drill size, Tapping, Dies & Stock dieing.

3hr

Plumbing, Threading & Joints:

Plumbing, Specification of pipes, Materials used for pipes, pipe fitting & Joints, Taps & valves, Plumbers tools, Threaded fastener, Screw threads and their uses, Cap screws & Machine Screw, Set screws, Methods of producing screw threads, flaring & flaring tools, Bolts, studs, Forms of nuts, Rivetting joints.

2hr

Pattern making and Foundry

Pattern materials & types of Patterns, patterns making tools, allowances, Construction of patterns, Core prints, Core boxes, colour coding, foundry details i.e. moulding sand, tools etc. Casting process details including different types of Casting

3hr

Sheet metal work:

Metals used in sheet metal work, Sheet metal hand tools, Sheet metal operation, Sheet metal joints, Hems and seams, sheet metals allowance, sheet metal working machine, laying out a pattern.

2hr

Wood & wood working: structure, grain & seasoning of wood, Carpentry tools, carpentry process, wood working machines.

Module-II

1hr

Welding and Related process:

Gas welding, Arc welding, Resistance welding, solid state welding, Newer method, brazing, soldering, bronze welding, welded joints and edge preparation, welding of pipes, inspection and testing of welds.

3 hr

Mechanical working of metals:

Hot working, Hot Rolling, seamless tubing, Drawing Deep Drawing, Cold drawing, Cold rolling ,Peening, sizing, Coining and hobbing.

2hr

Smithing & Forging:

Forging materials, Hand tools and applications, Heating devices, Forging temp. Smith forging(Hand & Power), Impression die forging,. Drop Hammer, Press forging, Roll die forging, HERF, Fibrous structure of forging, grain flow, defects in forging.

2hr

Metal Cutting & Cutting tools:

Types of cutting tool, Orthogonal and oblique cutting, mechanics of cutting & Chip formation, Cutting tool nomenclature, Cutting speed and feeds, Cutting tool material and cutting fluids.

2hr

The Lathe :

Function of lathe, Types, Size, Descriptions and functions of lathe parts, thread cutting mechanism, Centering, Turning, Taper Turning,, Knurling, Filing, Polishing, Grooving, Drilling, Reaming on Lathe, Cutting tools, Tools bits & tool holders, types of tool, cutting speed, depth of cut.

3hrs

Capstan & Turret Lathes:

Difference between a Capstan, and turret and engine lathe, Principal parts of Capstan & Turret lathe, Tools & Tool holding devices, Production of a hexagonal bolt etc.

Module –III

2hrs

Boring Machine

Types and parts of boring machine, Size, Boring tools, Horizontal & Vertical boring, operations, Jig boring machine details.

2 hrs

Drilling machine

Types portable drilling machine, Sensitive, Upright, Radial, Gang, Multiple spindle, and Autodate drilling machine quantities, deep hole, machines, parts, Tool holding devices, Drill size, cutting speed, feed etc.

2hrs

Shaper: Types, Principal parts, Size of shaper, shaper mechanism, operation, tools, cutting speed,feed,depth of cut etc.

2hrs

Planning machine & slotting machine:

Types, sizes, parts, Mechanism of operation, Tools, Cutting speed, Feed and depth of cut.

3hrs

Grinding machine:

Kinds of grinding, different parts grinding operation wet and dry grinding, Grinding wheel (shapes & sizes) selection of grinding wheel, cutting speed & work speed. Feed & depth of cut.

4hrs

Milling Machine:

Types, Parts, mechanisms , size, cutters, fundamentals of milling processes, Gear cutting, fundamentals of gear milling, spur and helical gear, gear hobbing and Bevel gear generating process.

2hr s

Powder metallurgy:

Introduction, Process, manufacture of metal powder, Blending, Compacting, Presintering, sintering. Isostatic pressing, Products of powder metallurgy, Advantages & disadvantages.

3hrs

Text Book:

1. Hajra Chondhury S.K. – Elements of workshop Technology – Indian Book Distribution Company.
2. P.E. Elli : An introduction to Workshop Practice. Blackie & Sons Ltd. London.
3. chapman W.A>J. Workshop Technology Vol-I,II,III

PCMR 4202 **Basic Ship Structure**

Module –I

Ships Terms:

Various terms used in ship construction with reference to ship's parameter e.g. L.B.P., Moulded draught etc., General Classification of Ships.

Stresses in ship's Structure:

Bending, Shear, Hogging, Sagging, Racking, Pounding, Panting etc., and Strength members to counteract the same.

Module- II

Sections and materials use:

Type of section like Angles, Bulb Plates, Flanged beams used in ship construction, Rivetting & Welding. Testing of welds, fabricated components.

Bottom & Side Framing:

Double bottoms, Water tight floors, solid and bracket floors, Longitudinal framing, keels, side framing like Tankside brackets, Beam Knee, Web frame etc.

Module- III

Shell & Decks:

Plating systems for shells, Deck plating & Deck girders, discontinuities like hatches and other openings, supporting and closing arrangements, mid-ship Section of ships.

PCMR4203 Naval Architecture – I

Module – I

Ship Geometry and hydrostatic calculations – ship geometry, body plan, half-breadth plan, profile and buttocks; offset table; Numerical integration methods – Trapezoidal rule, Simpson's rules, three-eight-minus-one rule, Tchebycheff's rule and other methods; Sectional area and vertical moment calculation; hydrostatic calculations and curves.

Weights – total weight of ship as a sum of light weight and deadweight; light weight – steel, machinery and outfit; deadweight – cargo, ballast and consumables; inclining experiment; LCG and VCG estimation.

Capacities – volumetric capacity of cargo spaces, tanks and other spaces; capacity table and diagram; GRT and NRT computation.

(15 hours)

Module – II

Transverse stability at small angles – Definition of stable, unstable and neutral equilibrium; stability at small angles – metacentric radius and metacentric height; effect of free surface, lifting of weight, grounding etc., stability of submerged bodies, stability of catamarans.

Transverse stability at large angles – cross curves of stability; stability lever/stability moment curve; inclining moment, dynamical stability; angle of loll, angle of vanishing stability; IMO regulations on stability.

(10hours)

Longitudinal stability and trim – Longitudinal BM, MCT1, change of L.C.B with change of trim, change of trim due to adding or deducting weights, change in draft and trim because of filling / flooding several tanks with different densities, alteration of draft due to change in density, Flooding calculations, Floodable length curves, M.O.T method for determination of floodable lengths, factors of subdivision, Loss of stability due to grounding, Docking stability, Pressure on chocks.

Module – III

Strength of Ships : Curves of buoyancy and weight, Curves of Load, Shearing force and bending moments, Alternate methods, Standard conditions, Balancing ship on wave, Approximation for max. Shearing force and bending moment, method of estimating B.M & Deflection. Longitudinal strength, Moment of Inertia of Section, Section Modulus.

(10 hours)

Freeboard – freeboard and reserve buoyancy; damage stability – introduction; ILLC guidelines for freeboard – Class A and class B freeboards; Water-tight Closing appliances on deck; Plimsol mark and assignment of freeboard; draught marks forward and aft.

Vibration – Calculation of hull natural frequency at different modes, propeller RPM and hull resonance diagram

PCME 7202 **Mechanical Engg. Lab**

Group A

1. Determination of equilibrium of coplanar forces.
2. Determination of Moment of Inertia 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 Cv and Cd of Orifices.

Group C

7. Calibration of Bourdon Tube Pressure gauge and measurement of 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.

PCME 7201 **Machine Drawing**

Machine drawing related to ship components / parts

HSSM7203 **Communication & Interpersonal skills for Corporate Readiness Lab.**

Lab

30 hours

This course will focus on communication in professional (work-related) situations of the kind that BPUT graduates may expect to encounter on entering the professional domain.

Some typical forms of work-related communication, oral or written, are listed below. Practice activities for all four skills can be designed around these or similar situations.

1. Gaining entry into an organization
 - i. Preparing job-applications and CVs
 - ii. Facing an interview
 - iii. Participating in group discussion (as part of the recruitment process)

- 2 In-house communication
 - a. Superior/ Senior → subordinate / junior (individual → individual / group)
 - i. Welcoming new entrants to the organization, introducing the workplace culture
etc.
 - ii. Briefing subordinates / juniors : explaining duties and responsibilities etc.
 - ii. Motivating subordinates / juniors ('pep talk')
 - iii. Instructing/ directing subordinates/ juniors
 - iv. Expressing / recording appreciation, praising / rewarding a subordinate or junior
 - v Reprimanding / correcting / disciplining a subordinate/junior (for a lapse) ; asking
for an explanation etc.

 - b. Subordinate / Junior → Superior / Senior
 - i. Responding to the above
 - ii. Reporting problems / difficulties / deficiencies
 - iii. Offering suggestions

4th Semester

BSCM1210 Mathematics – IV

Module-I (20 hours)

Numerical methods:

Approximation and round of errors, Truncation error and Taylor's series
Roots of equation: The bisection method, the false-position method, fixed point iteration, the Newton-Raphson method, Muller's method
Linear algebraic equation: LU decomposition, the matrix inverse, Gauss-Seidel method
Interpolation: Newton divided difference interpolation, Lagrange Interpolation, Newton's forward and backward interpolation.
Numerical integration: The trapezoidal rule, The Simpson's rules, Gauss quadrature
Ordinary differential equation: Euler's method, Improvement of Euler's method, Runge-Kutta methods

Module-II (10 Hours)

Probability:

Probability, Random variables, Probability distributions, Mean and variance of distribution, Binomial, Poisson and Hypergeometric distributions, Normal distribution, Distribution of several random variables.

Module-III (10 Hours)

Mathematical Statistics:

Random sampling, Estimation of Parameters, Confidence Intervals, Testing of hypothesis, Acceptance sampling, Chi square test for goodness of fit , Regression Analysis, Fitting Straight Lines, Correlation analysis.

Text books:

1. S. C. Chapra and R. P. Canale, "Numerical methods for Engineers", Fifth Edition, McGraw Hill Education
Reading Chapters : 2, 3(3.1, 3.2), 4(4.2, 4.3), 5(5.1, 5.2, 5.3), 6(6.4), 9(9.1, 9.2), 10(10.2), 13(13.1,13.2,13.5), 16(16.1, 16.2), 17(17.3), 20(20.1, 20.2, 20.3)
2. E. Kreyszig," Advanced Engineering Mathematics:, Eighth Edition, Wiley India
Reading Chapters: 22, 23(except 23.5 and 23.8)

Reference books:

1. Jay L. Devore, "Probability and Statistics for Engineering and Sciences", Seventh Edition, Thomson/CENGAGE Learning India Pvt. Ltd
2. P. V.O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi

BEEE2215 Energy Conversion Techniques

MODULE- I

(10 Hrs)

1. DC GENERATORS: Constructional features and operating principles, EMF equation, No Load Characteristics for Separately Excited DC Generator and DC Shunt Generator, Conditions for Self Excitation, Critical Resistance and Critical Speed, Losses and Efficiency.
2. DC MOTORS: Speed~Armature Current, Torque~Armature Current and Speed~Torque Characteristic for (i) Separately Excited DC Motor, (ii) DC Shunt Motor, (iii) DC Series Motor, Starting, Speed control and application of DC motor.

MODULE- II

(10 Hrs)

3. SINGLE PHASE TRANSFORMERS: Constructional Features, EMF Equation, Turns Ratio, Open Circuit Test and Short Circuit Test, Losses and Efficiency, Introduction to Three Phase Transformers: Three Single Phase Transformers Connected as a Bank of Three Phase Transformer.
4. INDUCTION MOTORS: (a) Three Phase Induction Motors: Constructional Features of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Principle of Operation, Concept of Slip, Slip~Torque Characteristics, Starting of Squirrel Cage Rotor type and Slip Ring/Wound Rotor type of Induction Motors, Speed Control of Induction Motors.
(b) Introduction to Single Phase Induction Motors: Construction, Principle of Operation and Application.

MODULE- III

(10 Hrs)

5. THREE PHASE SYNCHRONOUS GENERATORS: Constructional Features, Principle of operation as Alternator, Synchronous reactance, Equivalent circuit of alternator, Power-Angle curve, Synchronization of alternators.
6. THREE PHASE SYNCHRONOUS MOTORS: Constructional Features, Principle of Operation, Torque Expression and Phasor Diagram for Synchronous Motor, Electrical Power and Mechanical Power, Starting and application of Synchronous Motor.

Text Book :

1. Electric Machines – D P Kothari & I J Nagrath – Tata McGraw Hill.

Reference Book(s):

2. The Performance and Design of DC Machines – A E Clayton.
3. Theory and Performance of AC Machines – M G Say
4. Electrical Machinery – P S Bimbhra – Khanna Publishers.
5. Electrical Machines – P K Mukherjee and S Chakravorti – Dhanpat Rai Publications.
6. Electric Machinery – Fitzgerald, Charles Kingsley Jr., S. D. Umans – Tata Mc Graw Hill.
7. Electric Machinery And Transformers – Guru & Hizioglu – Oxford University Press.
8. Electric Machines – Charles Hubert – Pearson Education.

PCME 4206 **Mechanics of Materials-I**

Module-I

1. Analysis of Axially Loaded Members:

Composite bars in tension and compression- temperature stresses in composite rods- statically indeterminate problem.

2. Members in Biaxial State of stress:

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

3. Strain Deformation:

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

Module-II

4. Shear Force and Bending Moment Diagrams for simple Beams:

Support reactions for statically determinate beams, relationship between bending moment and shear force, Shear force and Bending moment diagrams.

5. Simple Bending of Beams:

Theory of simple bending of initially straight beams, distribution of normal and shear stress, beams of two materials composite beams.

Module-III

6. Deflection of beams:

Slope and deflection of beams by integration method and area- moment method.

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:

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

REFERENCE BOOKS:

2. Strength of Materials by G.H. Ryder

PCMR4204 Marine Auxiliary Machinery- I

Module-I

Engine Room Layout : Lay out of main and auxiliary machinery in engine rooms in different ships. Layout of Pipe lines, Pipe material, Piping arrangement for steam, bilge, ballast and oil and cooling system lines with various fittings. Domestic fresh water and sea water and sea water hydrosphere system. Colour code and safety fittings of bunkering procedure and in the pipe lines etc.

Bunkering Procedure:

Precautions taken i.e. safe practice, safety fittings in bunkering lines etc. Line diagram for H.F.O & D.O in bunkers.

Blowers and Compressors:

Operational and constructional details of blowers and compressors used on board ships. Uses of compressed air.

Pumps & Filters:

Types of pumps, centrifugal pumps and priming methods, Positive displacement pumps- Reciprocating, Screw, Gear and Lobe pumps, submerged and deep well pumps, characteristics and application of pumps, care and Maintenance of pumps.

Strainers and filters, types of Marine filters, Auto cleaner and Duplex filters, Static filters, Priming, maintenance of filters.

Module -II

Deck Machinery:

Various types of deck machinery used in ships (e.g. Winches and Windlass) and their requirements. Operation and Maintenance. Deck Cranes, Hydraulic deck machinery, hydraulic motors, line lifters and systems.

Anchoring & Mooring:

Anchors, Anchor windlass, hawse pipe, anchoring arrangement, mooring fitting, mooring & towing winches, mooring arrangement in forward and aft.

Dry cargo Handling

Cargo winches, light and heavy derrick System, Cranes, types of cargo hatch covers and their operation, Automatic loading and unloading of bulk cargo, RORO Ships, stem and side doors for horizontal loading of cargo and vehicles.

Lifting Gears:

Engine room crane, chain blocks, tackles, Anchor chain its testing & survey requirement.

Module-III

Heat Exchangers:

Tubular and plate type, construction and maintenance, materials used, Tube removal & plugging.

Pollution Prevention:

Use of coalescers, baffles, grids, Stoke's law, Static & Turbo Separators, Oily Bilge Separators, their construction and operation, prevention of oil pollution and various international requirements, Marpol Conventions, OLM & OCM, introduction of IMO conventions, regulation, rules and arrangements. Job requirements of a watch keeping engineer.

Regulations regarding Sewage, Garbage and liquid discharge from ships, Sewage Treatment plant, Sludge Tank & Sludge P/P, Incinerator.

Ventilation:

Ventilation of Cargo holds, pump rooms, CO₂ and Battery Room, Air Charge requirements, Total air requirement of engine room for efficient combustion, compressed air system in Engine Room, Regularity requirement for Ventilation, ventilator openings on deck, fans, their installation and maintenance.

PCME 4207 **Machine Dynamics-I**

Module –I

1. Mechanisms: Basic Kinematic concepts and definitions, Mechanism, Link, Kinematic Pair, Classification of Kinematic pairs, Degrees of freedom, Kinematic, Binary Revolute and Quaternary joints and links, degrees of freedom for plane mechanism, Grubler's Equation, Inversion of mechanism, Four bar chains and their inversion, single slider crank mechanism, Double slider crank chain and their inversion
2. Kinematic analysis: Determination of velocity using graphical and analytical techniques, Instantaneous centre method, relative velocity at a Pin-joint. Acceleration Diagram for a slider – crank mechanism, Coriolis component of acceleration and its application.
3. inertia forces in reciprocating Parts: Velocity and acceleration of piston by analytical method, Angular velocity and angular acceleration of connecting rod analytical method and by graphical method, piston effort, force acting along the connecting rod, Crank Effort, Turning moment on crank –Shaft.

MODULE-II

4. Dynamically equivalent system, compound Pendulum, correction couple. Turning moment diagram for different types of engines, Fluctuation of energy and fluctuation of speed.
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, multi plates and cone clutches.

MODULE-III

6. Brakes & Dynamometers: Classification of brakes, Analysis of simple Prony brake, Rope brake, Band brake dynamometer, Belt transmission dynamometer, Torsion dynamometer.
7. Gear Trains: Simple Train, Compound train, Reverted train, Epicyclical 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

1. A text book of Theory of Machines (in S.I. units)- R.K. Bansal, Laxmi publication

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

Reference Books:

1. The Theory of Machines – Thomas Bevan.

PCMR 4205 **Ship Construction**

Module – I

Statutory Certificates :

Statutory certificates and their validity. Ships registration formalities, intact stability, criteria under damaged conditions (constructional point of view in compliance with statutory regulations, Enhanced survey requirements, HSSC).

Constructional Features and rule guidelines for a merchant vessel as per MARPOL regulations, IBC and IGC codes.

(15 hrs)

Materials for shipbuilding – steel, physical properties, Grades of steel for shipbuilding; aluminum, shipbuilding grade, where used; Fibre Reinforced plastics, types of **fibres** and resins, moulding methods, precautions during construction; Testing of materials and welds, destructive and non-destructive testing methods, rule requirements for testing.

(12 hrs)

Module – II

Shipyard layout – design office, mould loft, stockyard, plate preparation, hull shop, prefabrication shop, building berth, assembly shops and area, outfitting jetty, building docks; material handling; painting.

(4 hrs)

Shipbuilding Practice – preparation, marking, cutting, forming and welding of plates and section; subassembly and assembly of units; unit construction method; outfitting and advanced outfitting; dock trials and sea trials, delivery.

(10 hrs)

Launching – end-on launching, side launching – launching ways, launching schedule.

(3 hrs)

Module – III

Building docks and dry docks – docking and floatation of ships in a dry dock; fitting and removal of propellers and rudders; under water hull inspection and repairs.

(9 hrs)

Quality control – Role of Classification Societies; Construction under survey and periodic surveys; Classification Society Rules; Shipyard's own quality control.

(7 hrs)

PCMR 7206 **Marine Engineering Drawing**

Module I

Drawing : Advanced Marine Machinery assembly drawings.

Part - I (Auxiliary Machine)

Marine machinery components as assorted stop and sluice valves and auxiliary equipment dismantled; to be conceptualised in assembly and laid out as working & functional parts. Sectional views in elevation and plans executed. Part sectional views depiction.

Part - II (Main Machine)

Marine engine components dismantled. Assembled drawings of pistons, thrust blocks, liners, connecting rods, crossheads, injection valves, starting valves, Fuel pumps, stern tube & Tail shaft, Rudder carrier bearing and all equipment with main machinery. Sectional / Outside and plan views of parts fitted / removed and in functional order.

1. Architectural Design-I & Measured Drawing

Objective: to develop the skill of analysis, creative idea finding & their synthesis. Design of simple space through creative ideas by visualizing external & internal dimensions.

Design of small objects with respect to function, structure and aesthetics.

Importance of physical factors in architectural design, orientation, ventilation, adequate protection from rain, insects etc.

The human dimensions in various postures. Their relation to dimensioning of everyday utilities like the table, chair, sinks etc.

Design of small structures- street furniture, kiosks, clock towers, milk booth, cycle stand, shop etc. and objects of interest with respect to form and orientation.

Study of design of part of residential buildings, with respect to Indoor and outdoor spaces of buildings. Detail layout of residential components such as bathrooms, kitchen, bed room etc.

Minimum two projects and one time problems must be conducted.

Time problem is to be of 8 hours duration.

PCME 7204 **Material Testing and Heat Power Lab**

(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
