

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.Snyder, "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, Kinematics 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 chain, 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 Pron 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

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

Marine Engineering

<u>5th SEMESTER</u>				<u>6th SEMESTER</u>			
<i>THEORY</i>		<i>Contact Hours</i>		<i>THEORY</i>		<i>Contact Hours</i>	
<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>	<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>
HSSM3302	Optimization Engineering	3-0-0	3	PCMR4305	Marine Boiler & Steam Engg.	3-0-0	3
PCMR4301	Applied Thermodynamics-II	2-0-0	2	PCMR4306	Marine IC Engine-I	3-0-0	3
PCMR4302	Machine Dynamics-II	3-0-0	3	PCMR4307	Marine electrical Technology	3-0-0	3
PCMR4303	Advanced Fluid Mechanics & Machines	3-0-0	3	PCMR4308	Advanced electronics	3-0-0	3
PEMR5301	Professional Elective (Any One) Marine Auxiliary Machinery - II	3-0-0	3	PEMR5303	Professional Elective – III (Any One) Mechanics of Machines-II	3-0-0	3
PEMR5302	Professional Elective (Any One) Elementary Design	3-0-0	3	PEMR5304	Professional Elective – III (Any One) Naval Architecture-II	3-0-0	3
			Credits (Theory)				Credits (Theory)
			17				18
<i>PRACTICALS/SESSIONALS</i>				<i>PRACTICALS/SESSIONALS</i>			
PCMR7301	Ship lines plan & Marine Drawing	0-0-3	2	PCMR7305	Boiler Chemistry	0-0-3	1
PCMR7302	Hydrostatics & Stability Lab	0-0-3	2	PCMR7306	Microprocessor & instrumentation Lab	0-0-3	2
PCMR7303	Design Project-I	0-0-3	2	PCMR7307	Design Project-II	0-0-3	2
PCMR7304	Practical Seamanship & Elementary Navigation	0-0-3	2				
			Credits (Practicals / Sessionals)				Credits (Practicals/Sessionals)
			8				5
TOTAL SEMESTER CREDITS			25	TOTAL SEMESTER CREDITS			23
TOTAL CUMULATIVE CREDITS				TOTAL CUMULATIVE CREDITS			

5th Semester

HSSM3302 **OPTIMIZATION IN ENGINEERING** (3-0-0)

Module-I (10 Hours)

Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling.

Linear programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear programming

Module -II (10 Hours)

Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method

Assignment problems: Hungarian method for solution of Assignment problems

Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems

Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

Module -III (10 Hours)

Non-linear programming: Introduction to non-linear programming.

Unconstrained optimization: Fibonacci and Golden Section Search method.

Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method

Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming

Introduction to Genetic Algorithm.

Recommended text books

1. A. Ravindran, D. T. Philips, J. Solberg, " *Operations Research- Principle and Practice*", Second edition, Wiley India Pvt Ltd
2. Kalyanmoy Deb, " *Optimization for Engineering Design*", PHI Learning Pvt Ltd

Recommended Reference books:

1. Stephen G. Nash, A. Sofer, " *Linear and Non-linear Programming*", McGraw Hill
2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis," *Engineering Optimization*", Second edition, Wiley India Pvt. Ltd
3. H.A.Taha,A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, " *Operations Research*", Eighth Edition, Pearson Education
4. F.S.Hiller, G.J.Lieberman, " *Operations Research*", Eighth Edition, Tata McDraw Hill
5. P.K.Gupta, D.S.Hira, " *Operations Research*", S.Chand and Company Ltd.

PCMR4301 **APPLIED THERMODYNAMICS-II** (2-0-0)

Module-I (7hours)

Fuel combustion and dissociation:

Definition of Fuel, Combustion equation, Analysis of the products of combustion, stoichiometric combustion, excess air, mixture strength, dissociation. Effect of dissociation on I.C. Engines.

Module-II (10 hours)

Vapour Power Cycles:

Carnot's cycle, Rankine cycle, modified Rankine cycle, superheat cycle, reheat cycle, Regenerative cycle, Binary vapour cycle and its effect of thermal efficiency, steam Machinery plants, Combined steam & gas plant calculations.

Module-III (13hours)

Transmission of heat:

Fourier's law of heat conduction, Thermal conductivity of insulating materials. Conduction through flat and cylindrical surfaces, spherical surfaces in series. Radiation: Basic, Stephan Boltzman law, grey/black bodies etc. heat Transfer from fluids to fluids through walls. Application of heat transfer in marine heat exchangers, like coolers, heaters, condensers

PCMR4302 **MACHINE DYNAMICS-II** (3-0-0)

Module –I

1. Mechanism: motor vehicle steering gears: the Davis steering gear, the Ackermann steering gear, hook's joint.
2. Gyroscope: gyroscope couple- plane disc, two bladed air screws, analysis of the force on bearings due to the force processing of rotating disc mounted on shafts, gyroscopic stabilization.
3. Toothed gears: theory of shapes 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.

Module-II

4. Cams: simple harmonic, constant – velocity and constant acceleration, types displacement, velocity and acceleration of flower, cams with specified contours.
5. Governors: Centrifugal Governors-watt and Porter Governors, spring Loaded Governor- Hartnell Governor, sensitiveness, stability, Isochronisms, 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-III

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 damping, vibration isolation and transmissibility, transverse vibration of shafts carrying a point load, Uniformity distribution load and several loads, Dunkerly's method and energy method. Whirling of shafts, Two rotor systems, three rotor system, Geared system

Text Books:

1. Theory of Mechanics, S.S. rattan, Tata Mc Graw Hill
2. mechanism and Machine Theory, rao & ukkipati, Wiley Eastern Ltd.
3. theory of machines, Thomas Bevan

PCMR4303 **ADVANCED FLUID MECHANICS & MACHINES** (3-0-0)

Module-I

Advanced Dimension Analysis:

Non Dimensional Performance characteristic of roto-dynamic machinery

Reciprocating Pumps: Various types, Single and double acting, single and multi cylinder, co-efficient of discharge Theoretical indicator diagrams, effect acceleration and friction, use of air-vessel.

Module-II

Centrifugal Pump: Calculations of various heads, Losses and Efficiency, Work done per unit weight, Dimension of impellers, velocity diagrams at inlet and exit, calculations for power input, Torque of shafts, cavitations in centrifugal pumps, NPSH, special head

Module-III

Impulse and Reaction Turbines: Pelton Wheel: Inward Flow reaction turbine, efficiency and vane angles, van aped and head lost in runner, specific speed, Applied problems

PEMR5301 **MARINE AUXILIARY MACHINERY- II** (3-0-0)

Module –I

Propulsion Shafting System: Intermediate & Tail shaft, Propeller fitting arrangement, thrust block, shaft bearings, stern tube, water & oil lubricated stern gland, shaft alignment.

Pumps: 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.

Module –II

Fuels: Types of fuels: coal, petroleum and natural gas, their physical and chemical properties and classification, Testing methods, merits and demerits of use of different fuels in ship board operation.

Oil Purification: Theory of oil purification, various methods of oil purification, principles of operation and construction of different centrifuges for heavy fuel and lubricating oil, like FOPX system, self cleaning system, use of Homogenizers etc.

Cargo handling System in tankers: Cargo Pumps, loading & discharge arrangement, tank cleaning system, crude oil washing water rinsing, stripping system, and Inert Gas system.

Module –III

Evaporates: Construction and operation of different types of evaporators, Fresh water Generators, and distillers, Reverse osmosis Process, Conditioning arrangement of distilled water for drinking purpose.

Lubrication System:Theories of lubrication, Types of lubricants, their properties and ship board use. Terminologies, Different additives, L/O. Analysis and engine condition monitoring. Loading pattern of various types of bearing in Marine use. Ship board testing of L.O./F.O/ Oily mist detector & its use.

Ship Protection & Maintenance:Corrosion- Causes and prevention, Painting & Cathodic protections, Sacrificial Anodes, vs Impressed Current method etc.

PEMR5302 **ELEMENTARY DESIGN** (3-0-0)

Module –I (10 Hours)

Procedures in Machine Design, Concepts of design procedure and processes, Design synthesis, Ergonomic consideration in design. Feasibility, Preliminary Design Alternative, Preliminary & Final Plans & Drawing, Use of standards in design, selection of preferred sizes, common useful materials and manufacturing considerations in design.

Review of failure criteria in mechanical design, properties of materials, heat treatment processes, BIS system of designation of steels, Basis of good design. Deformation, wear corrosion.

Common useful material design, Basis of good design. Failure of machine parts deformation web corrosion.

Strength consideration For Machine Design:

Strength of materials, Reliability, influence of size, stress concentration, strength under combined stresses, static loads, Impact loads, Repeated loads, completely reversed loads, static plus Alternating loads, cyclic & combined loads, fatigue strength, Dynamic stresses, selection of materials.

Module-II (10 hours)

Specifications: Fit, Tolerance, finish-BIS, Design and Drawing to specifications for parts subjected to direct loads.

Fasteners: Bolts & screws, cotter and knuckle joints, keys and couplings, pipe joints.

Module-III (25 hours)

Riveted joints and welded joints, design of welded machine parts.

Power transmission: Shafts and axles, Bearing clutches and brakes, Belt Drives, Chain Drives.

Design and Drawing of tooth gearing like Spur and Bevel gear, Rack and Pinion Worm and Worm wheels, Helical gears etc.

PRACTICALS

PCMR7301 **SHIP LINESPLAN DRAWING & MARINE DRAWING** (0-0-3)

- a. Shell Expansion Plan
- b. Lines plan
- c. General Arrangement plan
- d. Docking plan
- e. Midship section

Marine Drawing : Advanced Marine Machinery assembly drawings.

PCMR7302 **HYDROSTATICS & STABILITY LAB.** (0-0-3)

- a. Determination of Metacentric height of a floating body
- b. To determine the Metacentric height of Venturimeter
- c. To determine the efficiency of a Pelton wheel
- d. To determine the co-efficient of velocity & co-efficient of discharge of water through various orifices.
- e. To determined the friction co-efficient for flow of water through pipe
- f. To determine the co-efferent through various notches.
- g. To study & verify Bernoulli's Theorem.
- h. To verify different characteristics of a centrifugal pump

PCMR7303 **DESIGN PROJECT-I** (0-0-3)

project on designing of

- a. Nuts and Bolts
- b. Cotter Joints
- c. Knuckle joints
- d. Welded Connections
- e. Muff- Coupling
- f. Flange Coupling
- g. Flexible Coupling

PCMR7304 **PRACTICAL SEAMANSHIP, ELEMENTARY NAVIGATION AND SURVIVAL AT SEA (0-0-3)**

Navigational Lights and Signals: Port and starboard, towards and aft mast lights, colours and location. Look out precautions and Bad weather, flags used on ships, flag etiquette, Morse and semaphore signaling, sound signals.

Anchors: Their use, Dropping and weight anchor, cable stopper.
Rope Knots and Moorings: Types of Knots, Practice of knot formation, materials of ropes, strength, care and maintenance, use of mooring line, heaving line, Rat guards, Canvas and its use.

Survival at sea:

Survival difficulties and factors, equipment available, duties of Crew members, initial action on boarding, maintaining the craft.

Practical: Knots, bends and hitches, Ropes splice, Donning of life jackets, Life boat drills, Lowering and hoisting of life boats.(models)

Life boats and Life rafts: Construction, Equipments carried carrying capacity. Davits and their operation, launching of life rafts (inflatable type). Embarkation into lifeboat and life raft. Survival pack, stowage and securing arrangement.

Abandon Ship: Manning of lifeboat and life raft. Muster list, Radio and Alarm signals, Distress Signal (S.O.S.) Distress calls time and Radio frequency. Pyro-techniques.

PCMR 4305 MARINE BOILER & STEAM ENGINEERING (3-0-0)

Module-I

General considerations governing the design of Boilers: (2 hours)

Types of marine boilers, comparison of smoke tube and water tube boilers: destructive and Non Destructive tests on plates, rivets, welded seams, classification societies requirements for boiler construction.

Smoke tube Boilers: (2 hours)

Various types in Marine use, principle dimensions and staying of flat surface of multitubular cylindrical Boilers. Vertical Auxiliary Boilers.

Water Tube boilers: (6 hours)

general description with sketches of principal types of Boilers in marine use, super heater, Economizer, Air pre-heater and steam pre-heater. Circulation and use of unheated Down comers in highly rated boilers. Superheat temperature control, Attemperatores and De-superheaters

Waste heat Boilers: (3 hours)

Waste heat recovery calculation, Lamont exhaust gas boiler. Scotch composite Boiler, Cochran exhaust gas and composite boiler. Exhaust gas (Spanner, composite boiler), Forced water circulation boiler, Double evaporation boilers.

Module -II

Boiler Mountings: (5 hours)

Safety valves- Improved High. Lift, Full Lift and Full Bore type: Gauge glass- Ordinary plate type and remote indicator; Automatic feed regulator, three element High & Low water level alarms, Main steam stop valves, retractable type soot blower etc.

Operation Care & Maintenance: Precommissioning procedures, Hydraulic test, steam raising and operating procedures.

(3 hours)

Refractory: Purpose Refractory types of Refractory and reasons for failure.

(3 hours)

Oil Burning:

1. Procedures of liquid fuel burning in open furnace
2. various types of atomizer
3. furnace arrangement for oil burning
4. boiler control system i.e. master control, fuel control, air control and viscosity control.

(2 hours)

Reciprocating/ Steam engines: History of multiple expansion marine reciprocating engines and steam turbines. Description of different types of steam turbines.

(2 hours)

Constructional details: Types of blades, method of fixing, solid built-up & drum rotor for impulse and reaction turbines, castings for HP and LP impulse and reaction turbines, diaphragms, nozzles, glands, carbon glands, labyrinth packing glands, main bearings and thrust bearings.

(4 hours)

Module-III

Lubrication of Turbines: suitable oils and their properties, lubrication of main bearing, thrust bearings, thrust bearings and gears. Gravity and pressure lubrication-oil system and emergency lubrication arrangement.

(2 hours)

Condensers: Shapes and types of condensers, constructional details, location and method of securing, working principles, contraction and expansion allowances, leak test. Effect-change of temperature, circulating water quality, change of main engine power, condenser surface.

(2 hours)

Operation and Maintenance:

Turbine drain system, turbine gland steam, warning through a turbine plant, control of speed and power of population, throttle valve control and nozzle control, emergency controls, emergency operation of turbines, vibration in marine steam turbine, steam turbine losses. Breakdown and fault finding.

Alignment checking:

By bridge gauge and poker gauge, allowances for expansion, sliding foot, thrust bearing static. And dynamic balancing.

(6 hours)

PCMR 4306 MARINE INTERNAL COMBUSTION ENGINE-I (3-0-0)

Module –I

Performance and Characteristics of I.C. Engine: 4- stroke and 2-stroke cycles: Deviation from ideal condition in actual engines; Limitation in Parameters, Timing Diagrams of 2-stroke and 4-stroke engines. Comparative study of slow speed, medium speed and high-speed diesel engines- suitability and requirements for various Purposes Mean Piston speed, M.C.R. and C.S. R. ratings. Practical heat balance diagrams and thermal efficiency.

(4 hours)

General description of I.C. Engines: Constructional Details of different Marine diesel Engines (M.A.N., Sulzar, B&W make etc.).

(6 hours)

Principal Components: Jackets & Liners, Cylinder heads. Pistons, Cross heads, Connecting rods, Bed plates, A-frames, welded construction for bed plates and frames. Tie rods. (9 hours)

Module-II

Scavenging and Supercharging Systems: Scavenging arrangements in 2-stroke engines; Air charging and exhausting in 4-stroke engines; various types of scavenging in 2-stroke engines; Uni-flow, cross loop and reverse loop scavenging, their merits and demerits, scavenge pumps for normally aspirated engines; under piston scavenging, scavenge manifold. (4 hours)

Supercharging Arrangements: Pulse and constant Pressure types; their relative merits and demerits in highly rated marine propulsion engines. Air movements inside the cylinders. Turbocharger and its details. Two stage, un-cooled, radial turbochargers. (3 hours)

Combustion of Fuels in I.C. Engines: Grade of suitable fuels. Preparation of fuels for efficient combustion. Fuel Injectors, and its details. Ignition delay, after burning Compression Pressure ratio and its effect on engines. Reasons for variation in compression pressure and peak pressure, design aspects of combustion chamber. Control of NOX, SOX in Exhaust emission. (5 hours)

Module-III

Cooling of I.C. Engines: various cooling media used; their merits and demerits, Cooling of Pistons, Cylinder jackets & Cylinder heads, Bore Cooling, Coolant conveying mechanism and systems, maintenance of coolant and cooling system. (3 hours)

Safety and Prevention of mishaps in I.C. Engines

Causes and Prevention of crank-case explosions, and scavenge fires, detection of same and safety fittings provided to prevent damage, Uptake fire, starting airline explosion., thermal stresses.

(4 hours)

Gas Turbine Plants: Constant volume or Explosion cycle Gas Turbine plant, constant pressure cycle or joule-Brayton cycle Gas Turbine plant, simple C-B-T-H cycle, condition for maximum work output and thermal efficiency and work ratio of Gas Turbine plants

(5 hours)

PCMR4307 MARINE ELECTRICAL TECHNOLOGY (3-0-0)

MARINE ELECTRICAL TECHNOLOGY-I

Module-I

Power Generation : Merits and Demerits of A.C. & D.C. on board; Rules and Regulations governing electrical machineries on ships; Different alternator Excitations-systems on board – (indirect, Direct, static excitations).

Brushless generator construction & operational diagram, Automatic voltage regulator. Alternative Source of Power: emergency Generator & Different starting method including auto-start, emergency batteries construction and its different Emergency Loads.

Rules and Regulation, Emergency power, Maintenance, Emergency Power source on board, Shore supply- Specifications as per voltage/ frequency, precaution while taking shore supply.

Module-II

Distribution: Different electrical diagrams and their uses, electrical signals types of distribution network onboard; main & Emergency switch board, construction, different switch gear & protective devices.

Grounded and insulated neutral systems, precautions adopted in High voltage distribution system, Cables and temperature classification.

Motor & Control Equipments: Types of Marine Motor, types fo enclouser, protective devices on motors, motor characteristics curves, sequential starting (e.g. Refrigerating plants, automatic fired boiler).

Miscellaneous marine electrical equipment Alarms system: Engine Room telegraph, Rudder Angles Indicator, R.P.M & revolution counter, centralized salinity indicator, watertight door operation, alarm system(types, supply) on board's oxygen analyzer, high and low level alarms, Navigational lights, emergency Radio operation, Electrical Deck Auxiliaries.

Module-III

Maintenance of Electrical systems, fault finding & repair: type of faults and indications in generator, motor and distribution system, different testing equipments and meters (Multimeter/ mugger, clamp meter etc.). Salvaging & care while fault finding and repair, preventive maintenance, periodic surveys, spares requirement.

Special Electrical Practice:

Rules and regulations & operation of electro hydraulic & Electric steering gear, Diesel electric and Turbo electric propulsion system, pod / azipod drive unit, superconductivity applied in propulsion, turbo alternator, special electrical practice for oil, gas and chemical tanker (tanker classification, dangerous, hazardous zones, temperature classes). Flame proof Ex. 'd' and intrinsic safety Ex 'I' and EX 'n' equipments and their application in Zones, Maintenance of Ex- Protected apparatus.

PCMR 4308 **ADVANCED ELECTRONICS** (3-0-0)

Module – I

1. **Review of combinational circuit** : Adder, Multiplier, Multiplexer; General idea about Flip Flop - shift register and co (12 hours)

Module – II

2. **Transducers** : Strain gauge, Thermo couple, LVDT, Piezo electric Transducers, Optical Transducers, Inductive-Torque (3 hours)

3. **Electronic Instruments** : Basic Principle of operation of transistor voltmeter, Digital Frequency meter, Digital multimeter (4 hours)

4. Silicon controlled Rectifier, Thyristor, Power control and inverters. (4 hours)

5. **Microprocessor architecture** : Introduction to 8085 up, pins and signal register organization, timing and control mod (5 hours)

6. **Instruction set and Assembly Language Programming of 8085** – Instruction set, memory and I/O addressing, Ass (5 hours)

7. Memory interfacing and interrupts. (2 hours)

Module – III

8. **Introduction to 8051, 8255** – only architecture & pin diagram (2 hours)

9. **Intel 8086 (16 bit processor)** - Architecture, Addressing mode, pins and signal, Instruction format (5 hours)

10. **Digital Data Acquisition system** : Interfacing transducers to Electronics control and measuring system, instrumentation (3 hours)

Reference books :

1. Digital Electronics by A.Anand Kumar, PHI publication (module I)
2. Electronics Instrumentation and measurement Technique by w.o.cooper (module II)
3. Introduction to microprocessor for scientist & Engineers by Ghosh & Sridhar(PHI)(moduleIII)
4. Advanced microprocessor & peripherals by A.K.Ray & K.M.Bhurchandi(TMh)(module IV).
5. Elements of Electronic Instrumentation and Measurement by Joseph J. Carr (Pearson)
6. Power Electronics by P. S. Bhimbra (Module II)

PEMR 5303 MECHANICS OF MACHINES -II (3-0-0)

Module- I

Turning Moment & Flywheel : Functions of Flywheel, Crank Effort Diagrams, Fluctuation of speed and energy. Effect of centrifugal tension on flywheel, inertia torque and its effects on crank effort diagrams. (3 hours)

Kinematics and Link-Mechanisms : Relative motion between bodies moving in different planes. Instantaneous center method, Rubbing velocities at pin joints. Graphical Construction for relative velocity and acceleration in different link and sliding mechanisms. Analytical determination of velocity and acceleration. Forces in crank and connecting rods. Inertia force on link connecting rods etc. Effect of friction. (3 hours)

Cams : Types of cams and followers. Specified motion of followers. Uniform acceleration and deceleration, S.H.M and uniform velocity, Graphical construction of cam-profile. (4 hours)

Analytical design procedure for cams with Straight Flank, Curved Flank, Circular flank with various types of followers, spring force and reaction torque. In-line cams and off center cams. (4 hours)

Balancing : Balancing of masses rotating in different planes, dynamic forces at bearings, Primary and secondary balance of multi-cylinder in-line engines and configurations. (3 hours)

Module – II

Spur Gearing : Various definition e.g. p.c.d module, path of contact, velocity of sliding, Interference, Gear Ratio and center distance of simple and compound gear trains. (5 hours)

Toothed Gearing : Types of gear, conditions for transmission of constant velocity ratio, methods of avoiding interference, Transmission of power by gear trains on parallel shafts, Rack and pinion, Bevel gears, worm and worm wheel, Spur gear, Helical gears, Spiral gears, Epicyclic gear trains, Torque on gear trains, acceleration in gear trains. (3 hours)

Gyroscope : Gyroscopic couple, Vector representation of torque and angular momentum, steady rectangular precession, Vector treatment, Steady conical precession, Motion involving steady precession, Application to ship stabilization. (3 hours)

Vibration : Free harmonic vibration, Linear motion of an elastic system, Angular motion of an elastic system, Differential equation of motion, Free vibration of springs in series and parallel, Simple and Compound pendulums, Single and two degrees of freedom. (3 hours)

Module – III

Torsional Vibrations : Single rotor system, rotor at end and rotor in the middle, Effect of Inertia of shaft, Two rotor system, rotors at both ends and rotors at one end, Three rotor and multirotor system. Torsionally equivalent shaft, Geared shaft system. (3 hours)

Forced Vibrations : Forced Linear and Angular vibrations, Periodic force transmitted to support, Periodic moment of the support. (3 hours)

Transverse Vibrations of beams : Single concentrated load, effect of the mass of the beam, Energy method – several concentrated Loads, Uniformly distributed load, Dunkerley's empirical method for several Concentrated loads. (3 hours)

Whirling of Shafts : Whirling of shafts, Critical speed, Effect of slope of the disc, Effect of end thrust. (3 hours)

Damped Vibrations : Idea of viscous and coloumb damping, Linear and Angular vibrations with viscous damping, Forced damped linear and angular vibrations, Periodic movement of the support. (2 hours)

PEMR 5304 NAVAL ARCHITECTURE-II (3-0-0)

Module-I

Calm water resistance of ships:- Components of resistance- viscous and wave making, frictional and residuary components; other components- appendages, wind, roughness and fouling, waves etc. shallow water resistance; resistance of high speed craft; model experiments- Froude number, Reynold's number, Froude's law of similarity, ITTC friction line, towing experiments, extrapolation of model experiments results, correlation allowance, EHP- naked, trial and service.

Propulsion & Propellers: Definitions, apparent and real ship wake, Thrust relation between powers, relation between mean pressure and speed, measurement of pitch, Cavitations.

Propeller types, Fixed pitch, Variable Pitch, Ring propeller, Kort nozzles, Voith Schneider Propeller, Propeller theory. Blade element theory, Law of similitude and model tests with propellers, propulsion tests, Geometry and geometrical properties of screw propellers, ship model correlation, ship trails.

Module-II

Motion of Ship on waves: Theory of waves, Trochoidal waves, relationship between line of orbit centers and the undistributed surface, Sinusoidal waves, Irregular wave pattern, Wave spectra, Wave amplitudes, Rolling in unresisting media, rolling in resisting media, practical aspects of rolling. Anti rolling devices, Forces caused by rolling and pitching, Heaving and Yawing.

Structural Performance: Simple beam theory, Buoyancy and load curves, shear force and bending moment calculation, deflection of hull girder, midship section modulus and stresses at deck and keel, wave bending moment, classification requirement for section modulus, in-plane stresses, bucking, bulkhead analysis.

Module-III

Rudder Theory: Action of the Rudder in turning a ship, Force on rudder, Torque on stock, calculation of force torque on nonrectangular rudder, angle of heel due to force torque on rudder, angle of heel when turning.

Types of Rudder, model experiments and turning trials, Area and shape of rudder, position of rudder, position, stern rudders Bow rudders.

Maneuverability – rudder- aerofoil theory, lift, drag and Centre of pressure; turning moment on a ship due to ship and rudder; turning and control characteristics, control loop; different maneuvering devices.

Powering Performance Characteristic- Powering Performance characteristics, matching engine and propeller, sea trial procedure for speed measurement, change of performance in a sea way and with ageing.

Maneuvering performance Characteristics- Maneuvering trails during sea trials, heel during turn, IMO criteria for collision prevention.

PRACTICALS

PCMR 9305 **BOILER CHEMISTRY LAB** (0-0-3)

- (a) To determine hardness content of the sample of boiler water in P.P. M. –in terms of CaCO_3
- (b) To determine chloride content of the sample of water in P.P.M- in terms of CaCO_3Ca
- (c) To determine alkalinity due to phenolphthalein, total Alk, and caustic alk of the sample of water in P.P.M.
- (d) To determine phosphate content of the sample of water.
- (e) To determine dissolved oxygen content of the sample of water.
- (f) To determine Sulphate content of the given sample of water.
- (g) To determine Ph-value of the given sample of water.

CPMR 9306 **MICROPROCESSOR & INSTRUMENTATION LAB.** (0-0-3)

1. Addition of 2 8 bit nos. result 16 bit.
2. Addition of 2 16 bit nos.
3. subtraction of 2 16 bit
4. Multiplication of 2 nos.
5. Division of 2 8 bit nos.
6. Find out the smallest/ largest no. from an array of nos.
7. Arrange the given sequence of no. in ascending order.
8. Measurement of Amplitude, frequency, phase of signal using CRO, for sine wave, square wave and triangular wave.
9. Measurement using LVDT.
10. Measurement using strain gauge.
11. Measurement using thermo couple.
12. Verification of piezo electric effect.
13. verification of shifting using universal shift register IC 74153
14. counter operation- using IC 7490

CPMR 9307 **DESIGN PROJECT** (0-0-3)

1. Shaft Axle Design
2. Brake Design
3. Design of flywheel
4. Design of cams
5. Design of gears
6. Design of springs
7. Design of bearings.

COURSE STRUCTURE

4th YEAR B.TECH PROGRAMME IN MARINE ENGINEERING

7 th SEMESTER				8 th SEMESTER				
Sub. Code	Theory	Contact hours	Credit	Sub. Code	Theory	Contact hours	Credit	
PCMR4401	Ship operation & management	3-0-0	3					
PCMR4402	Marine Refrigeration & Air conditioning	2-0-0	2					
PCMR4403	Marine Machine system Design	3-0-0	3					
PCMR4404	Marine I.C. Engine-II	3-0-0	3					
PCMR4405	Marine control Engg. & Automation	3-0-0	3					
	Elective-II (any one)	2-0-0	2					
PEMR5401	Renewable Energy source & application							
PEMR5402	Electromagnetic interference (EMI) & Electro magnetic compatibility (EMC)							
PEMR5403	Maritime Regulation	2-0-0	2					
	Theory Credits		18					

7 th SEMESTER				8 th SEMESTER				
Sub. Code	Sessional/ Practical	Contact hours	Credit	Sub. Code	Sessional/ Practical	Contact hours	Credit	
PEMR7401	<i>Mechanical Lab</i>	0-0-3	2	PCMR7403	Training in Ship-in-Campus	1248Hrs.	14	
PEMR7402	<i>Vibration Lab</i>							
PEMR7403	<i>Heat Lab</i>							
PCMR7401	Fire Prevention & Control Lab	0-0-2	2					
PCMR7402	Seminar	0-0-2	1	PCMR7404	STCW & Class IV Preparatory	0-0-3	2	
				PCMR7405	Plant Operation , Simulation & Control	0-0-3	2	
				PCMR7406	Project	0-0-5	5	
				PCMR7407	Comprehensive Viva-voce	0-0-3	2	
	Sessional Credits		5					
	Total Credit		23		Total Credit		25	

7TH SEMESTER

CPMR 8405 SHIP OPERATION AND MANGEMENT (3-0-0)

Module - I

Brief History of shipping : Modern shipping Practice. Marine vehicles and cargo, care of cargo against damage. Development in Shipping and cargo handling Multimodal transportation, Factors affecting universal adoption. Liner and tramp shipping services.

(3 hours)

Conference systems – Organisation & concerns Shippers Council. Chartering, Charter parties. Theory of freight rates and fares. Rate fixation machinery and government control. Responsibilities of ship owners & charterers. Tanker chartering. Freight rates & fares – various terms, influencing factors, market pricing.

(5 hours)

Bill of lading – Function & Uniqueness & related problems. Carriage of goods by sea act . Cargo Surveys and protests.

(3 hours)

Module – II

Marine Insurance : Underwriting and loss adjusting principles applied to Marine cargo insurance. Hull / machinery policy, particular average. General average , P & I

Clubs – making claims.

(6 hours)

Shipping Companies – Organisational structure, Restructuring on the basis of functional coherence, ship management companies. Turn around strategy for sink shipping companies. Ownerships of vessels, Shipping Company and its administration.

(5 hours)

Capitalization and finance : Characteristics, cost ratios & allied definition. Sources, Financing package, Lender security, Relation between Insurance premium, & non-conformity / condition of class. Economics of new and second hand tonnage. Subsidies, procedure & implication of buying & selling new / old vessels.

(5 hours)

Module – III

Ship Operations : Planning sailing schedules. Influencing factors, Unbalance in sea trade, counter – action, Voyage estimation, Manning of ships, engagement & discharge of crew. Economic factors. Commercial Shipping

(5 hours)

Merchant Shipping act : Registration of ship, Ship's papers. Port Procedures. Pilotage, Flags of convenience, flags of discrimination and their effects on shipping. Duties regarding pollution. Collision, Explosion, fire etc. Vessels in distress. Shipping causalities penalties under Merchant Shipping Act.

(8 hours)

Marine Fraud : Genesis and Prevention.

Indian Shipping : Current scenario and few case studies.

(5 hours)

CPMR 8402 MARINE REFRIGERATION AND AIR CONDITIONING

(2-0-0)

Module - I

Reversed Carnot Cycle, Vapour compression cycles, Refrigerating effect, Co-efficient of performance, Cooling capacity, rating of a refrigerating plant, Methods of improving C.O.P. Use of vapour tables, Applied problems.

(5 hours)

Typical Marine Refrigerating Plants with multiple compression and Evaporator system. Refrigeration in liquefied gas carriers.

(5 hours)

Module - II

Different Refrigerants , chemical formula, desired properties (general, physical, chemical, thermodynamic) comparison, effect on environment, Montreal protocol, new refrigerants.

(5 hours)

Design and Construction of various components of refrigeration plants, i.e. Compressor, condenser, evaporator, expansion valves, control and safety equipments.

(5 hours)

Module - III

Operation and maintenance of refrigeration plants, control of temperature in different chambers, charging of refrigerant/oil, purging of air, defrosting methods, trouble shooting.

(6 hours)

Refrigeration of cargo holds, brine system and its operation & maintenance, methods of air circulation in holds, insulating materials, micro-organism, dead and live cargo, factors affecting refrigerated cargo, container ship refrigeration, preparation for loading cargo, survey of refrigeration equipments.

(3 hours)

Heat load calculation on refrigeration and air conditioning plant.

Air Conditioning : necessity on board ships, different systems, control of room air temperature, humidity, noise, dust and purity. Construction of duct and diffuser, fans, ventilation of accommodation.

(3 hours)

CPMR 8403 MARINE MACHINE SYSTEM & DESIGN (3-0-0)

Module - I

Manufacturing Methods , Castings, Forgings, Fabrication & Plastic Moulding: Machining Tolerances, Surface Finishes: Application to basic design principles in respect of Function, Available materials, Production Methods, Economics, Aesthetic appeal. Initial and Servicing costs, Analysis of Force, Flow through an Assembly and its effect on the design. Design with reference to Repairs and reconditioning specifically "at sea" work with its normal restrictions and limitations. (5 hours)

Marine Machinery Component Designs & Drawing :

Design and drawing of marine machinery components subject to combined bending, twisting and direct loading like Crankshafts, Propeller Shafts etc., Design and Drawing of Flywheel, Piston, connecting rod, safety valves, Reducing valves, Compression & Torsion springs, Journal bearings, Thrust bearings etc. Design of lifting equipment e.g. Engine room overhead crane, Globe& other valves.

(15 hours)

Module - II

Advanced Design of Marine Systems Design & Drawing :

(a) Power transmission system including Thrust blocks, Intermediate shaft and tail-end Shaft.

(b) Water cooling systems including pumps, filters, Heat exchangers for Diesel and Steam Engine Plants.

(c) Lubricating oil systems including pumps, Purifiers pressure by-pass valves.

(d) Marine Diesel Engine Air starting systems including air-receivers, Compressors and Air starting Valves

(13 hours)

Module - III

Advanced Design of Marine system Design & Drawing :

(a) Design of Steam Turbine Plants.

(b) Design of Gas Turbine Plants.

(c) Electro-hydraulic Steering gear systems including Rudder, Rudder Stock, Tiller arm, ram and cylinder.

(d) Life Boat and its launching device.

(12 hours)

CPMR 8404 MARINE INTERNAL COMBUSTION ENGINE – II (3-0-0)

Module - I

Forces and Stresses : Balancing, Overloading, Different type of vibrations & its effects, A/F Vibration.

(2 hours)

Fuel pumps and metering devices : Jerk and common rail systems; Fuel injection systems Helical groove and spill valve type fuel pumps. System for burning heavy oil in slow and medium speed marine engine, V.I.T & Electronic injection system.

(2 hours)

Effects of viscosity on liquid fuel combustion.

Measuring equipment and its working principle.

Necessity of variable fuel injection system.

Procedures of application on a modern slow speed long stroke engine.

Necessity for adoption of fuel quality setting system.

Incorporation of FQSL along with the V.I.T system on the engine.

(2 hours)

Manoeuvring Systems : Starting and reversing systems of different marine Diesel Engines with safety provisions.

(5 hours)

Module - II

Indicator Diagrams and Power Calculations : Construction Details of indicator instrument. Significance of diagram power calculations, fault detection, simple draw cards and out of phase diagrams. Power balancing, Performance characteristic curves, Test bed and Sea trials of Diesel engines.

(4 hours)

Lubrication Systems : Lubrication arrangement in Diesel Engines including Coolers & Filters, Cylinder-lubrication, Linear wear and preventive measures, Combinations of lubricating oil its effect and preventive measures.

a. Improvements in Lubricating oils through use of additives. Type of additives.

b. Monitoring engines through lubricating oil analysis reports.

(3 hours)

Medium Speed Engines : Different types of medium speed marine diesel engines, Couplings and reduction gear used in conjunction with medium speed Engine, Development in Exhaust valve design, V-type engine details.

(a) Use of poor quality residual fuels and their consequences.

(b) Improvements in designs for higher power output.

(c) Fuels, combustion process – fundamentals.

(4 hours)

Module - III

Automation in modern diesel engine plants : Remote operation, Alarm and fail safe system, Governors and their basic functions Constant speed and overspeed governors. Constructional details and hunting of governor.

(a) Computerised monitoring and diagnostic application in Propulsion engines. The intelligent engine concept.

(b) Nox-control of marine Diesel Engines.

(c) Improvement in designs for increased T.B.O. (Time between Overhauls)

(8 hours)

Maintenance of Diesel Engines : Electronic Governor, Inspection and replacement of various component members such as Piston, Piston ring.

Cylinder Head , Liner, Bearings Driving Chain and gears etc. Crankshaft deflection and alignment, Engine holding down arrangements, Tightening of Tie bolts.

Trouble shooting in Diesel engines : Hot & Cold corrosion, Crankshaft web slip, X-head bearing problems, microbial degradation in fuel & lub oil.

(7 hours)

Modern trends in development : Current Engines (Sulzer RTA, B&W, CMC & SMC, SEMT Pillingich) Intelligent Engine (Camless concept), Improvement in design for increased TBO.

(3 hours)

U.M.S Operations in ships. (2 hours)

CPMR 8406 MARINE CONTROL ENGG. & AUTOMATION (3-0-0)

Module – I

Measuring Devices

Pressure, Temperature, Level and Flow measuring devices. Miscellaneous Instruments;

(a) Shaft Power meters, Unbonded Strain Gauges, Bonded Strain Gauges, Troductor

(b) Tachometers (Electric and Mechanical)

(c) Water Purity Meters: Salinity indicator, PH meters

Signal Transmitting Devices: Flapper Nozzle, Electro Pneumatic signal converter, Electrical signal transmission. Pneumatic, Types of Controllers: hydraulic electric and electronic controllers for generation for control action, Variable Inductance and capacitance transducer, Force Balance Transducer, Synchros.

(12 hours)

Module – II

Automatic Control Theory: Process Control, Feedback, Closed Loop and Open Loop Control, Two Step (On-Off) Control, Modulating Control, Off Set or Droop, Desired Value, Set Value, Proportional, Integral and Derivative Control, Split Range, Ratio and Cascade Control, System Response: Distance Velocity, Measurement and Transfer and Transfer Lags.

(6 hours)

Automatic Controllers: Functions of a proportional, Integral and Derivative Action Controllers, Stacked Type, Electronic, and Pulse type Controllers, Controller Adjustments Relays On-Off Cut Off Switches.

(4 hours)

Correcting Units : Diaphragm actuators, Valve-positioners, piston actuators, Electro-pneumatic transducers. Electro-hydraulic actuators and Electric actuator control valves.

(2 hours)

Module- III

System Analysis

Laplace Transforms, Transfer Functions and Block Diagrams. Concept of stability, Routh & Hurwitz stability criteria. Analysis of System Performance under dynamic or transient operating condition using Laplace Transforms. Performance characteristics. Nyquist stability criterion.

(5 hours)

Application of Controls on ships: Marine Boiler-Automatic Combustion control, Air/fuel ratio control, feed water control two and three element type, steam pressure control, combustion chamber pressure control, fuel oil temperature control, piston cooling water and scavenge air, fuel oil viscosity control, working of control system during Manoeuvring of Direct Reversing Diesel Engine Bridge control of main machinery. Instrument for UMS classification.

(16 hours)

(PEMR 8402)MARITIME REGULATION. (2-0-0)

Module-I

M.S. Act

Provisions of the Act:

Preliminary & Definition

Formation of National Shipping Board & its power

General Administration- D.G. MMD, Surveyor, Shipping Office, Seaman's welfare and employment.

Procedure for register Indian ship

Application, marking, Ownership, Documents to be retained, Change of Ownership, name of the ship

National columns for India ships.

Certificates of Officers: Grades of certificates, Examination to grant to certificates, Loss of Certificates, Certificated officers required for foreign ships.

Duties of shipping master

Safeties and other certificates for construction of ships. (safety certificate, safety equipment certificate, safety radio certificates, Exemption certificates etc.)

Marine Board formation & power

Provisions relating to cancellation & suppression of certificates.

Break & Salvage- Salient Features.

STCW -95- Brief history & synopsis of STCW – 95 – Brief history & synopsis of STCW 95 & minimum manning requirement.

Module-II

SOLAS:

Brief description of Articles of the International Convention for safeties of life at sea, 1974.

Chapter-I –Part 'a' & 'b' surveys & certificates.

Chapter-II- 1 (Part A,B,C,D,E)

Chapter-II -2 (Part A, B, C,D,.E,F,G)

Chapter-III – Part A & B

Chapter-IV – Part A,B, & C

Chapter-V- Safety of Navigation
Chapter-VI- Carriage of Cargo (Part A,B,C)
Chapter –VII- Part A,B,C,D, &E
IMDG, IGC, IBC, INF codes
Chapter-VIII, chapter IX &X
Chapter –XI- 1 & Chapter XI-2 & XII

Module-III

Marpol:

- a. International Convention for Prevention of pollution from ships, 1973 & its articles.
 - b. 1978 Protocol & its articles.
 - c. 1997 Protocol & articles.
 - (ii) Annex-I & regulation & appendices.
 - (iii) Annex-II & its regulation & appendices.
 - (iv) Annex III, IV & V & Vi
 - (v) New Annexes like water ballast, exhaust, emission etc.
-
1. Statutory certificates and their validity periods
 2. Amendments at different chapters, annexes & latest status procedure for amendments, tacit acceptance etc.
 3. ISPS, FSS codes, Ism
 4. Collision Regulations (Col-Reg)
 5. surveys, Enhanced survey, HSSC
IACS, classification society

ELECTIVE – II

PEMR 8407 RENEWABLE ENERGY SOURCES & APPLICATIONS (2-0-0)

Module – I

Principles of Renewable Energy :

Introduction. Fundamentals, Scientific principles of renewable energy. Technical implications, social implications.

Solar Radiation :

Introduction, Extra terrestrial Solar Radiation. Components of Radiation. Geometry of Earth & Sun. Geometry of the Collector. Solar Beam.

Effects of Earth's Atmosphere. Measurement.

Estimation of Solar Radiation. Problems.

Solar Thermal Systems:

Introduction: Solar Water Heater, Air Heater, Space Heating & Cooling. Water desalination. Solar Thermal Electrical Power System,

Photo Voltaic Generation:

Silicon P-N Junction. Photo absorption. Solar Radiation Input. Photo Voltaic Circuit properties & Loads, Limit to Cell efficiency. Solar Cell Construction. Solar PV applications. Problems.
(14 hours)

Module – II

Wind Power:

Introduction. Turbine Types & Terms. Linear Momentum & Basic Theory. Dynamic Matching. Stream Tube Theory, Characteristics of the Wind. Power Extraction by a Turbine, Electricity Generation. Problems

Ocean Energy:

Wave Energy: Introduction, Energy extracted from waves, Problems.

Tidal Power :

Introduction. The cause of Tides. Enhancement of Tides. Tidal Range Power. World Range Power sites. Problems.

Ocean Thermal Energy Conversion: Principles.

Hydro Power & Geothermal Energy: Brief Review & Description. (10 hours)

Module- III

Energy storage & Distribution :

Importance of Energy Storage & Distribution. Biological Storage. Chemical Storage. Thermal Storage. Electrical Storage, Mechanical Storage

Fuel Cells: Introduction, Classification, Brief Review, Description & application.

Hydrogen energy

Bio mass Energy : Introduction

Bio fuels: Introduction. Bio fuel Classification, Biomass Conversion Technology, Biogas production from waste Biomass, Classification of Biogas Plants, Operational parameters of Biogas plants, Problems. (10 hours)

PEMR 8405 ELECTROMAGNETIC INTERFERENCE (EMI) AND ELECTROMAGNETIC COMPATIBILITY (EMC) (2- 0 - 0)

Module – I

Introduction to causes of EMI

Sources of conducted interference and its characteristics.

(a) Non-Functional Sources

(b) Functional Sources of EMI Characteristics of Interference
Bandwidth, Amplitude behaviour, Waveform, Occurrence

(8 hours)

Design practice for minimizing conducted interference.

Sources of Radiated Interference and its characteristics Nature of Sources of Radiated Interference,

(a) Non-functional sources (b) Functional Sources

(c) Electromagnetic Pulse (d) Design Practice.

(9 hours)

Interference coupling by conduction and radiation.

(a) Coupling via conducted path (b) Radiation coupling

(c) Design Practice

Module – II

Grounding and Bonding

Shielding

Cable and connector Shielding

Filtering :

- (a) Filter Design (b) Transient Suppression
 - (c) Power Line Filters (d) Materials and special devices
- (14 hours)

Module – III**Mathematical Model**

- (a) Source Model (b) Coupling Model (c) Susceptor Model

EMC Specification

- (a) Military standards and specification.
- (b) Industrial and Government specification.

EMC Test Plans and procedures. (a) Measurement methods for Field strength and for conducted interference. (14 hours)

PRACTICALS**CPMR 9402 MECH. LAB. / VIBRATION LAB/ HEAT TRANSFER LAB. (3-0-0)**

1. To determine Torque on internal gear and planet gear in epicyclical gear & holding torque apparatus.
2. To determine the balancing weights required for static & dynamic balancing of an unbalanced system.
3. To calculate the velocity of spin and velocity of precession of a rotor, rotating about a horizontal axis.
4. To find the critical speed of whirling shaft.
5. To study the Torsional vibration of two rotor system
6. To study damped Torsional vibration of signal rotor system
7. To verify Dunkerley's rule for transverse vibration,
8. To study the forced damped vibration of a simple supported beam
9. To determine the radius of gyration of a compound pendulum
10. To determine the radius of gyration of disc using tri- filler suspension.
11. To determine the characteristics curves and sleeve position against speed of rotation in case of :
 - a. Hartnell Governor
 - b. Porter Governor and
 - c. Proell Governor
12. Heat Transfer experiments.
 - a. To determine the Thermal Conductivity of good conductors.
 - b. To determine the Thermal Conductivity of insulating materials
 - c. Heat Transfer through Fins or extended surface.
 - d. Heat transfer through forced Convection.

CPMR 9404 FIRE PREVENTION AND FIRE CONTROL LAB.

(0-0-2)

(a) Fire hazards & demonstration : Fire triangle, Fire Tetrahedron, Fire-chemistry, Spontaneous combustion, Limits of

(3 hours)

(b) Fire protection built in ships : SOLAS convention, requirements in respect of materials of construction and design

(3 hours)

Fire test, escape means, electrical installations, ventilation system and venting system for tankers. Statutory requirements fire fighting systems and equipments on different vessels, fire doors & fire zones.

(3 hours)

(c) Detection of safety Systems & demonstration: Fire safety precautions on cargo ships and tankers during working

(5 hours)

(d) Fire Fighting Equipment & demonstration: Fire pumps, hydrant and hoses, Couplings, nozzles and international Maintenance, testing and recharging of appliances, preparation, Fire appliance survey. Breathing apparatus types, uses, Principle.

(8 hours)

(e) Fire Control & Practice : Action required and practical techniques adopted for extinguishing fires in accommodation organization for fire and emergencies. Combustion products and their effects on life safety. Fire signals and muster. Fire drill. Leadership and duties, Fire control plan, Human behaviour, Special precautions for prevention /fighting fire in tankers, chemical carriers, Gas carriers, safe working practice.

(8 hours)

i) Study & Testing and operation of Jet and spray type nozzles and fire hoses.

ii) Operation, charging and maintenance of portable fire extinguishers

iii) Operation, use and functions of Breat Bhubaneshwar hing apparatus.

(a) Self contained type.

(b) Bellow Type.

iv) Study of working of life boat and provisions for life boat.

v) Use of life jackets.

vi) Study of construction and operational details of life raft giving importance to manual and hydrostatic release

(15 hours)

CPMR 9405 SEMINAR (0-0-2)

To be given by students in subjects as determined by teacher.

8th SEMESTER

Training in Ship- in –Campus :

(For Training on running of real ship board machines)

Engine Room Layout: Layout of Main & Auxiliary machinery in engine room in the “ship in Campus”, Actual layout in different ships & comparison there of. 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 hydrophone system. Colour code and safety fittings of bunkering of lines and other pipe lines etc. bunkering procedure and precautions there of.

MARINE MACHINERY OVERHAUL AND MAINTENANCE
PROCEDURE
MARINE WORKSHOP

Dismantling and overhauling of

- (1) Main Engine unit
- (2) Generator Engine
- (3) Various types of pumps i.e. centrifugal gear screw etc.
- (4) F.W. Generator.
- (5) Incinerator
- (6) Auxiliary Boiler
- (7) Purifier & Clarifier
- (8) Thrust Block
- (9) Stern Tube & Propeller shaft
- (10) Various types of valve i.e. screw down, gate, shi sluice etc.
- (11) Clearing of settling & service Tank
- (12) Cleaning of Bilge stern boxes.

CPMR 9403 STCW AND CLASS IV PREPARATORY

Standards of Training, Certification and Watch-keeping for sea-farers International Conference of 1978 and modifications under STCW 1995.

Basic principles to be observed in keeping engineering watch.

Criteria for composing the engine room watch. Operation & watch requirements. Fitness for duty. Protection for marine environment. Requirement for certification; minimum knowledge requirement for certification- theoretical, practical; Duties & responsibilities concerning safety & protection of environment. Requirements for watch keeping duties. Physical & training & experience in watch keeping routine; main and aux. machines, pumping systems, generating plant.

Safety and emergency procedures, first aid.

Minimum requirement for Ratings of Engine Room watch. Special requirement for engineer officers for Oil Tankers, chemical tankers and Gas Tankers. Details of operational guidance for In-charge of an engineering watch.

Engineering watch (underway)., General, Taking over watch, periodic checks of machinery, Engine Room Log, Preventive repair and maintenance; Bridge notification. Navigation in congested water and during restricted visibility, calling the attention of the Chief Engineer Officer, Watch-keeping personnel.

Engineering watch (unsheltered anchorage)- Conditions to be ensured. Watch-keeping (in port) Watch arrangements; Taking over the watch; keeping a watch Oil, chemical & Gas Tankers- Principles, Characteristics of Cargo; Toxicity hazards; Safety equipments; protection of Personnel; Pollutions.

Shipboard Applications- Regulations & Code Practice; Ship design & equipment of Oil, chemical & Gas Tankers; Ship operation, repair & maintenance; Emergency operations; Training of other personnel. requirement of continued updating of proficiency, Definition of flag state/ port state. Port state control inspection,

Implication of ship's detention.

ISM Code: Statutory certificates and documents to be provided on board for safe trading of vessel and port state control inspection. Basic safety concept on board a merchant vessel & operation knowledge of the relevant IMO instruments like SOLAS, MARPOL, LOADLINE, TONNAGE, COLREG, STCW with latest amendments, how above instruments are adopted under Explicit/ Tacit acceptance procedure, how statutory/ Class certificates and documents obtained. Surveys special/ intermediate/ annual to be conducted on ocean going ships. Related conventions for the certificates, period of validity, involvement of ISM, issue of DOC/ SMC and maintenance of SMC.

CPMR 9308 PLANT OPERATION ,SIMULATION & CONTROL (0-0-3)

1. Working in college workshop & practice running Diesel engines.
2. To work with simulators & study different parameters.
3. Study of automatic controllers.
 - 3.1. Level Control.
 - 3.2. Temp. Control.
 - 3.3. Proportional, Integral & derivative Controls & their combinations.
 - 3.4. Viscosity Controller
 - 3.5. Study of oil mist detector