

List of Electives

Elective – I

1. TMM011 Marine Steam Engineering, Marine Heat Engines & Boilers.
2. TMM012 Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC)
3. TMM013 Renewable Energy Sources & Applications

Elective – II

1. TMM021 Marine Electro Technology - II
2. TMM022 Advanced Hydraulics
3. TMM023 Double Hull Tank Vessels

Elective – III

1. TMM031 STCW Convention, ISO, ISM, Fore and Marpol
2. TMM032 Hydraulics Circuits and Control
3. TMM033 Advanced Marine Heat Engines

SEMESTER V

INDUSTRIAL ECONOMICS AND PRINCIPLES OF MANAGEMENT

THU-501

L T P

Industrial Economics

3 1 0

UNIT 1

Introduction

4

Nature and significance of Economics. Meaning of Science, Engineering and Technology and their relationship with economic development.

UNIT 2

Basic Concept

6

The concept of demand and supply. Elasticity of demand and supply. Indifference Curve Analysis, Price Effect, Income Effect and Substitution Effect.

UNIT 3

Money and Banking

8

Functions of Money, Value of Money, Inflation and measures to control it. Brief idea of functions of banking system, viz., Commercial and central banking, Business fluctuations.

Management

UNIT 4

Introduction

10

Definition, Nature and Significance of Management, Evaluation of Management thought, Contributions of Max Weber, Taylor and Fayol.

UNIT 5

Human Behavior 10

Factors of Individual Behaviour, Perception, Learning and Personality Development, Interpersonal Relationship and Group Behaviour.

MACHINE DESIGN - I

TME-502

L T P
3 1 0

UNIT 1

Introduction 3

Definition, methods, standards in design & selection of preferred size.

Selection of materials 4

For Static & fatigue loads, Materials for components subjected to creep, BIS system of designation of steels, plastics & rubbers. AISI (American Iron & Steel Institution), ASTM rubber testing methods.

UNIT 2

Design against static load. 4

Modes of failure, Factor of safety, stress-strain relationship, principal stresses, theories of failure.

Design against fluctuating load 4

Stress concentration, stress concentration factors, Fluctuating/ alternating stresses, fatigue failure, endurance limit, and design for finite and infinite life, Soderberg & Goodman criteria.

UNIT 3

Joints 3

Welded Joint, screwed joints, eccentric loading of above joints, design for fatigue loading.

Shaft, keys and coupling 4

Design against static and fatigue loads, strength & rigidity design, Selection of square & flat keys and splines, rigid & flexible couplings.

UNIT 4

Mechanical springs 4

Design of helical and leaf springs, against static and fatigue loading.

Design analysis of power screws 4

Form of threads, square threads, trapezoidal threads, stress in screws, design of screw jack.

UNIT 5

Introduction to Product Development & Design Process 8

Definition of Design, Design Process, Need Analysis, Need based developments, Design by Evolution, Technology based developments, Examples. Case Studies, Brain-storming.

DYNAMICS OF MACHINES

TME-503

L T P
3 1 0

UNIT 1

Force Analysis, Turning Moment & Fly wheel

4

Static force analysis of linkages, Equivalent offset inertia force, Dynamic analysis of slider crank & Bar mechanism. Piston and Crank effort, Inertia, Torque, Turning moment diagrams, Fluctuation of energy, Flywheel.

UNIT 2

Balancing of machines

5

Static and dynamic balancing, Balancing of rotating and reciprocating masses, Primary and secondary forces and couples.

UNIT 3

Friction

7

Pivot and collar friction, Friction circle, Single plate, Multiplate and Cone clutches, Michelle & Kingsbury thrust bearing and rolling contact bearing, belts and pulleys, Flat and V-belts, Design and selection.

Brakes and Dynamometers (Mechanical Type)

7

External and internal shoe brakes, Band and Block brakes, Hydraulic brakes, Absorption and Transmission dynamometers.

UNIT 4

Governors

6

Dead weight and spring loaded governors, Sensitivity, Stability, Hunting, Isochronisms, Effort and Power, Friction and Insensitivity, Introduction to inertia governors.

UNIT 5

Gyroscopic Motion

4

Principles, Gyroscopic acceleration, gyroscopic couple and Reaction. Effect of gyroscopic couple upon the stability of aero planes, ship, two & four wheelers.

Mechanical Vibration

Single degree free and forced, Undamped and damped vibrations, critical speeds.

MARINE AUXILIARY – II

TMM-501

L T P
3 1 0

UNIT I:

Oil Purification:

8

Theory of oil purification, Principle of operation and construction of different centrifuges for heavy fuel and lubricating oil.

UNIT II:

Blowers and Compressors: 5
Operation and constructional details of blower and compressor used on board ships. Use of compressed air.

Other Ship Board Equipment: 5
Incinerators, Sewage, Treatment plant, Engine room crane, Chain block, Tackles. Anchor chain, its testing and survey requirements, Different types of ship stabilizer, Bow thrusters, Hull protection arrangement.

UNIT III:

Steering Gears: 10
Operation & constructional detail of various type of steering machinery, Telemotor systems, Transmitters and receivers variable delivery pumps used in steering gear. Emergency steering arrangement. Care & maintenance of steering gear plant.

UNIT IV:

Shafting: 10
Method of shaft alignment, Constructional details and working of Thrust blocks, Intermediate Shaft Bearing and stem tubes bearing. Oil water lubricated Stem Tubes, Sealing Glands, Stresses in Tail End, Intermediate and thrust shaft.

UNIT V:

Dry Docking: 8
Method of dry docking of ship, Inspection and routine overhauling of underwater fitting and hull measurement of clearance and drops, Removal and fitting of propellers.

NAVAL ARCHITECTURE – I

TMM-502

**L T P
3 1 0**

UNIT I:

Geometry of Ship & Hydraulic Calculations: 8
Ship Lines, Displacement calculation, First and Second moment of area.

UNIT II:

Simpson's Rules: 10
Simpson's Rule, Application to area & volume, Trapezoidal rule, Mean & mid – ordinate rule, Tchebycheffs rule and their applications, Tonnes per cm. Immersion, Co-efficient. of form, Wetted Surface area, Similar figures.

UNIT III:

Center Of Gravity: 8

- 1 Center of gravity.
- 2 Effect of addition & removal of masses.
- 3 Effect of suspended mass.

UNIT IV:

Transverse Stability of Ship: 10

Statically stability at small angles of heel, Calculation of B.M. Metacentric height, Inclining experiment, free surface effect, Stability at large angles of heel, Curves of statically stability, Angle of loll, Stability of a wall sided ship.

UNIT V:

Resistance & Powering: 10

- 1 Frictional, Residuary & Total Resistance.
- 2 Froude's Law of comparison.
- 3 Effective Power calculations.
- 4 Ship co-relation Factor (SCF).
- 5 Admiralty and application of ITTC formula.

**MACHINE DESIGN – I - LAB
(Say min 8 out of these)**

TME- 552

**L T P
0 0 2**

- 01 Design & drawing of Riveted joints for given operating conditions.
- 02 Design of an eccentrically loaded welded, riveted or bolted joint.
- 03 Design of bolted joint for fluctuating loads.
- 04 Design & drawing of a cotter joint
- 05 Design & drawing of a knuckle joints.
- 06 Design & drawing of a simple screw jack.
- 07 Design of shaft for different loading conditions.
- 08 Design & drawing of rigid coupling (flanged type).
- 09 Design & drawing of a flexible coupling (pin-bush type)
- 10 Design & drawing of a leaf spring for an automobile.

- 11 Design & drawing of a helical spring for a given application.
- 12 Product Development Design problems/exercise.

Note:

1. Studetns may be advised to use design data book for design.
2. Drawing shall be made wherever necessary on small drawing sheets.

DYNAMICS OF MACHINES - LAB

TME- 553

L T P
0 0 2

Min. 8 out of following (or such) experiments to be done:

- 01 Study of simple linkers/ models/ mechanisms.
- 02 Exp. on Velocity acceleration.
- 03 Exp. on cam.
- 04 Exp. on Governor
- 05 Exp. on critical speed of shaft (whirling of shaft)
- 06 Exp. on Gyroscope
- 07 Exp. on Balancing (static & dynamic)
- 08 Exp. on 4-bar mechanism
- 09 Exp. on Gears (tooth profile, interference etc.)
- 10 Exp. on Gear trains.
- 11 Exp. on Brakes
- 12 Exp. on clutch
- 13 Exp. on synthesis of planner linkages
- 14 Exp. on Mechanism
- 15 Exp. on Vibration (spring)
- 16 Exp. on Vibration (beam)
- 17 Exp. on Vibration (Torsional)
- 18 Exp. on Engine

MARINE AUXILIARY MACHINERY – II

TMM-551

L T P
0 0 3

1. Study Maintenance and Operation of Purifier.
2. Study Maintenance and Operation of Air Compressors.
3. Study Maintenance and Operation of Reciprocating Compressor
4. Study of Construction, Operation & Maintenance of Incinerator.
5. Operation and Maintenance of Steering Gear.

6. Study of Thrust Block.
7. Cone and Fitting of Propeller.

ELEMENTRY DESIGNING AND DRAWING

TMM-552

L T P
0 0 3

1. Design of various Shipboard Components & Systems (any two of following)
 - a) Cooling water system.
 - b) Sea water system.
 - c) Fresh water system.
 - d) Power transmission system (from Engine to Propeller)

2. Engine components drawings and free hand sketches (any six of following)
 - a) Piston
 - b) Cylinder head
 - c) Bedplate
 - d) Engine sectional sketch
 - e) Flywheel coupling bolts
 - f) Main bearing and its bolts
 - g) Air Starting valve
 - h) Fuel injection
 - i) Air distribution Valve
 - j) Fuel Pump.

SEMESTER VI

MARINE ELECTRICAL TECHNOLOGY – I

TMM-601

L T P
3 1 0

UNIT I:

(A) Power Generation and Distribution:

9

Selection of D.C. & A.C. generators for use on ships with reference to it's prime mover, Merit & Demerits of A.C. & D.C. on ships. Rules and Regulations governing electrical Machinery on ships. Location and Installation of Generator sets. Rating and Characteristics of main Switch boards. Arrangements of preferential trips and protective devices with wiring diagrams.

UNIT II:

Constructional Details:

9

Construction & characteristics of brush less high speed A.C. generators with Automatic voltage Regulator of Magnetic Amplifier type, Rapid voltage response of A.C. Generators.A.C. Distribution on ships, regulation regarding layout of distribution system on

general cargo ships and oil tankers. Navigation Lights and running Light Indicator panel. Special requirements For Lighting of deck & pump house of oil tankers. Wiring appliances. Determination of wire size of A.C. power circuits.

UNIT III:

System Earthing: **9**
 Insulated Neutral systems, Resistance earthed systems.

Rules And Regulation Of Classification Societies:

Requirements and arrangement of emergency Lighting & power by Emergency generator & storage Batteries. Emergency generator switch board, Circuit diagram for automatic starting in case of Failure of main generating plant, Connecting shore supply during dry docking, precautions while taking A.C. shore supply, Arrangement to ensure proper phase connection, Arrangement of remote switches for ventilating fans pumps, Fuel Pumps, Lubricating pumps & purifiers.

UNIT IV:

Motor And Control Equipments: **9**

Characteristics of continuous maximum rated machines. Centralized control of motors in machinery spaces. Classes of Insulation – ‘A’, ‘B’, & ‘E’ & temperature rise, Rotary generators. Starter for Miscellaneous electrical equipment for Machinery space auxiliaries & centralized control of Motors in Machinery spaces eg sequential starting & cut outs for an automatic fired boiler incorporating safety devices & combustion control equipments.

UNIT V: **8**

Sequential starting for Refrigerating plants, Incorporating, Safety devices, like high pressure cut out, cooling water failure cut-out automatic defrosting with the help of timer. Special requirements of motors & starters for Anchor Windlass & capstan, wiring diagram, lowering & hoisting arrangements, overload protection, magnetic disk, Brakes.

I.C. ENGINES

TME- 602 **L T P**
3 1 0

UNIT 1

Introduction to I.C. Engines **5**

Engine classification, Air standard cycles, Otto, Diesel, Stirling, Ericsson cycles, Actual cycle analysis, Two and four stroke engines, SI and CI engines, Valve timing diagram, Rotary engines, stratified charge engine.

Fuels **3**

Fuels for SI and CI engine, important qualities of SI engine fuels, Rating of SI engine fuels, Important qualities of CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines.

UNIT 2

SI Engines

Carburetion, Mixture requirements, Carburetor types Theory of carburetor, MPFI **3**

Combustion in SI engine, Flame speed, Ignition delay, abnormal combustion and its control, combustion chamber design for SI engines. **2**

Ignition system requirements; Magneto and battery ignition systems, ignition timing and spark plug, Electronic ignition. **2**

UNIT 3

CI Engine

Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timing. **4**

Combustion in CI engines, Ignition delay, Knock and its control, Combustion chamber design of CI engines. **2**

Scavenging in 2 Stroke engines, pollution and its control. **2**

UNIT 4

Engine Cooling **2**

Different cooling systems, Radiators and cooling fans.

Lubrication **2**

Engine friction, Lubrication principal, Type of lubrication, Lubrication oils, Crankcase ventilation.

Supercharging

Effect of altitude on power output, types of supercharging.

Testing and Performance **4**

Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines.

UNIT 5

Compressors **3**

Classification, Reciprocating compressors, Single and multi stage, Intercooling, volumetric efficiency.

Rotary compressors, Classification, Centrifugal compressor, Elementary theory, Vector diagram efficiencies, Elementary analysis of axial compressors, Surging and stalling, Roots blower, Waned Compressor, performance analysis. **4**

NAVAL ARCHITECHTURE – II

TMM-602

L T P

3 1 0

UNIT I

Longitudinal Stability and Trim: **9**

Longitudinal B.M., Moment to Change trim one cm., Change of trim, Change of L.C.B. with change of trim, Change of trim due to adding or deducting weights, Alteration of draft due to change in density.

UNIT II **9**

Flooding calculation, Floodable Length curves, M.O.T. method of determination of Floodable Lengths, Factors of subdivision, Loss of Stability due to grounding, Docking stability, Pressure on chocks.

UNIT III

Strength of Ships **9**

Curves of buoyancy & 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.

UNIT IV

Propulsion and Propeller **8**

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, Voithschneider Propeller theory, Blade element theory, law of similitude and model tests with Propellers, propulsion tests, Geometry and geometrical properties of Screw propellers, ship Model calculation ship trails.

UNIT V

Rudder Theory

9

Action of rudder in turning a ship, Force on rudder, Torque on stock, calculation of force, Torque on non rectangular rudder, Angle of heel due to force, Torque on rudder, Angle of heel when turning . Types of rudder, Models experiments and turning trials, Area of shape of rudder, Position of rudder, Stern rudder, Bow rudder. Motion of ship on waves, Theory of waves, Trochoidal waves, Relation between line of orbit centers and the undistributed surface sinusoidal waves, Irregular wave pattern, Waves spectra, Wave amplitudes, Rolling in unresisting media, Rolling in resisting media, Practical aspects of rolling, Antirolling devices, Forces caused by rolling and pitching, Heaving and Yawing.

FLUID MACHINERY

TME- 604

L T P

3 1 0

UNIT 1

Introduction

5

Classification of Fluid Mechanics, Application of momentum and momentum equation to flow through hydraulic machinery, Euler's fundamental equation.

Impact of jet

3

Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve), effect of inclination of jet with the surface.

Hydraulic Turbines

9

Classification of turbines, Impulse turbines, constructional details, velocity triangles, power and efficiency calculations, governing of Pelton wheel.

UNIT II

Reaction Turbines

9

Francis and Kaplan turbines, constructional details, velocity triangles, power and efficiency calculations, degree of reaction, draft tube, cavitation in turbines, principles of similarity, unit and specific speed, performance characteristics, selection of water turbines.

UNIT III

Centrifugal Pumps

7

Classifications of centrifugal pumps, vector diagram, work done by impeller, efficiencies of centrifugal pumps, specific speed, model testing, cavitation and separation, performance characteristics.

UNIT IV

Positive Displacement Pumps

7

Reciprocating pump theory, slip and coefficient of discharges, indicator diagram, effect and acceleration, work saved by fitting air vessels, comparison of centrifugal and reciprocating pumps, positive rotary pumps, Gear and Vane pumps, performance characteristics.

UNIT V

Other Machines

5

Hydraulic accumulator, Intensifier, Hydraulic press, Lift and Cranes, theory of hydraulic coupling and torque converters, performance characteristics.

Water Lifting Devices

3

Hydraulic ram, Jet pumps, Airlift pumps.

REFRIGERATION & AIR CONDITIONING

TME- 606

L T P

3 1 0

UNIT 1

Refrigeration

8

Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P.

Air Refrigeration cycle

Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART).

UNIT II

Vapour Compression System

8

Single Stage system, Analysis of vapour compression cycle, use of T-S and P-H charts, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multistage vapour compression system requirement, Removal of flash gas, Intercooling, Different configuration of multistage system, Cascade system.

UNIT III

Vapour Absorption System

5

Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Elementary idea of refrigerant absorbent mixtures, Temperature- concentration diagram & Enthalpy-concentration diagram, Adiabatic mixing of two streams, Ammonia- water vapour absorption system, Lithium-Bromide water vapour absorption system, Comparison.

Refrigerants

3

Classification, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants.

UNIT IV

Air Conditioning

9

Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart , Different Psychometric processes, Thermal analysis of human body Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat Transfer through walls & roofs, Infiltration & ventilation, Internal hear gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP).

UNIT V

Refrigeration Equipment & Application

7

Elementary knowledge of refrigeration & air conditioning equipments e.g compressors, condensers, evaporators & expansion devices, Air washers, Cooling, towers & humidifying efficiency, Food preservation, cold storage, Refrigerates Freezers, Icc Plant, Water coolers, Elementary knowledge of transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning.

I.C. ENGINE LAB

TMM-651

L T P

0 0 3

1. Fuel Injector Study and Overhauling.
2. Fuel Injector Repair and Testing.
3. Fuel Injectors Nozzles, fault finding.
4. Study of Combustion Chambers shape and design.
5. Study & Overhaul of Fuel Injection Pumps
6. Study of Cooling System & Fault finding.
7. Study of Lubrication and fault finding.
8. Dismantling & Study of Supercharges.

FLUID MACHINERY LAB

TME- 654

L T P
0 0 3

Say min 8 experiments from following or such experiment

1. Impact of Jet experiment.
2. Turbine exp. on Pelton wheel.
3. Turbine exp. on Francis turbine
4. Turbine exp. on Kaplan turbine
5. Exp. on Reciprocating pump
6. Exp. on centrifugal pump.
7. Exp. on Hydraulic Jack/Press
8. Exp. on Hydraulic Brake
9. Exp. on Hydraulic Ram
10. Study through first visit of any pumping station/plant
11. Study through second visit of any pumping station/plant
12. Any other suitable experiment/test rig such as comparison & performance of different types of pumps and turbines.

REFRIGERATION & AIR CONDITIONING LAB

TME- 656

L T P
0 0 2

Say min 8 out of the following

1. Experiment on refrigeration test rig and calculation of various performance parameters.
2. To study different types of expansion devices used in refrigeration system.
3. To study different types of evaporators used in refrigeration system.
4. To study basic components of air-conditioning system
5. Experiment on air-conditioning test rig & calculation of various performance parameters.

6. To study air washers.
7. Study of window air conditioner.
8. Study & determination of volumetric efficiency of compressor.
9. Visit of a central air conditioning plant.
10. Visit of cold storage.

SEMESTER VII

COMPUTER AIDED DESIGN (CAD)

TME- 701

L T P
3 1 0

UNIT I

Introduction and review of computer programming

5

Introduction to CAD/CAE, Element of CAD, Concepts of integrated CAD/CAM, CAD Engineering applications, its importance & necessity. Review of C, C++, statements such as if else for while & switch, functions, pointer-notations, structure & class, concept of OOP.

Computer Graphics-I

3

Computer systems, Graphics input devices-cursor control devices, Digitizers, Scanners, speech oriented devices and touch panels, Graphics display devices- CRT, color CRT monitors, DVST, Flat-panel display, Graphics output Devices.

UNIT II

Computer Graphics-II

3

Graphics software, Graphics functions, output primitives-Bresenham's line drawing and Mid-point circle algorithms.

Geometric Transformations.

5

Word/device co-ordinate representations, 2D and 3D geometric transformations, matrix representation-translation, scaling, shearing, rotation and reflection, composite transformations, concatenation, rotation about arbitrary axis. Exercise and programs.

UNIT III

Plane Curves

4

Curve representation, Interpolations Vs approximation, Parametric Continuity conditions, Spline Curves-Hermite Spline, Bezier spline and B-Spline Curves and its Properties.

3-D Graphics

4

Polygon surfaces- Polygon mesh representations, Quadric and Superquadric surfaces and Blobby objects, Fractals. Solid modeling-wire mesh and sweep representation, constructive solid geometry, Boolean operations, Boundary representations. Colour models.

UNIT IV

Computer Aided Design of Machine Elements and other Systems

7

CAD of machine elements such as shaft, springs, bearings and problems from other systems such as heat exchanger, inventory control etc. Writing computer program in C, Drafting/Design of software such as Auto-CAD and Pro-E.

UNIT V

Numerical Methods

6

Introduction, Errors in numbers, Binary, octal and Hexadecimal number representation. Root-finding & Optimisation. Interactive methods- Bisection method, Regula-Falsi method, Newton Raphson method, Interpolation- Lagrange and Newton's interpolation, Curve fitting-Least square method, Numerical differentiation-interpolation methods, Numerical integration- Trapezoidal and Simpson method.

Finite Element Methods

3

Introduction and Application of FEM, Stiffness Matrix/Displacement Matrix, One-Two Dimensional bar and beam element (as spring system) analysis.

ADVANCED I.C. ENGINES

TMM-701

L T P
3 1 0

UNIT 1:

General Description of I.C. Engines: Marine Diesel Engine of M.A.N., Sulzer, Doxford, B & W Make etc. comparative study of slow speed, Medium speed and High Speed Diesel Engines- suitability and Requirements for various purposes. Special features of various types of engines. 3

Constructional Details of I.C. Engines: Principle components: Jackets & Liners, Cylinder heads, Piston, Cross heads, Connection Rods, Bed plates, A- frames, Welded Construction For bed plates and Frames, Tic rods. 3

Scavenging and Supercharging system: Scavenge manifolds, Turbocharger and its details. Supercharging arrangements: Pulse and constant pressure type, their relative merits and demerits in highly rated marine propulsion engines, Air movements inside the cylinder. 3

Fuel Pump and Metering Devices: Jerk and common rail system, Fuel injection system, helical groove and spill valve type fuel pumps. System for burning heavy oil in slow and medium speed Marine engines. 3

UNIT 2:

Maneuvering Systems: Starting and reversing system of different marine diesel engine with safety provisions, Indicator diagram and Power calculation. Construction details of indicator instruments, Significance of diagram. Power calculation, Fault detection, Simple draw cards and out of phase diagrams, Power balancing, Performance characteristic curves, Test bed and sea trial of diesel engine. 8

UNIT 3:

Lubricating Systems: Lubricating arrangement in diesel engines including coolers & filters, Cylinder lubricating, Linear – wear mechanism and preventive measures. 4

Medium Speed Engines: Different type of medium speed marine diesel engines, Coupling and reduction gear used in conjunction with medium speed engine, Development in exhaust valve design, V-Type engine details . 4

UNIT 4:

Gas Turbine: General construction and diesel feature for marine plant, Material of construction, Heat exchangers and reheat arrangements, Comparison of free piston engine gasifiers and conventional air stream combustion Chamber. 4

Automation in Modern diesel Engine Plant: Remote operation, Alarm and Fire safe system, Governor and their basic function constant speed and overspeed governors, Constructional detail & hurting of governors. 4

UNIT 5:

Maintenance of Diesel Engines: Inspection and replacement of various components member such as piston. Piston ring, Cylinder head, Liner, Bearing, Driving chain & gears etc. Crankshaft deflection and alignment, Engine holding down, Arrangement, Trouble shooting in diesel engine. 5

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 **4**

MARINE MACHINERY SYSTEM DESIGN

TMM-702

L T P

3 1 0

UNIT I:

9

DESIGN CONSIDERATION CONTINUED: Manufacturing methods, Castings, forgings, Fabrication & plastic moulding: Machining Tolerances, Surface Finishes, Application to basic design principles in respect of function, Available materials.

UNIT II:

9

Production methods, Economics, Aesthetic appeal. Initial and servicing costs, Analysis of force, Flow through on assembly and its effect on the design. Design with reference to repairs and reconditioning especially “at sea” work with its normal restrictions and limitation.

UNIT III:

9

Marine Machinery Component Design:

Design & drawing of marine machinery components subjects to combined bending, twisting & direct Loading Like crankshafts, Propeller shaft etc., Design and Drawing of Flywheel, Safety valves, Reducing valves, compression & Torsion springs, Journal Bearings, Thrust bearing etc. Design of lifting equipment e.g. Engine room overhead crane, Mechanical pilot etc.

UNIT IV:

9

Advanced Design of Marine System:

Design & drawing of water cooling systems including Pumps, Filters, Heat exchanger for Diesel & Steam engine plants. Lubricating oil systems including Pumps, Purifiers Pressure bypass valves. Electro-hydraulic steering gear system including Rudder, Rudder stock, Tiller arm & rams etc.

UNIT IV:

10

Marine diesel Engine Air starting system including Air receivers, compressors and Air starting valves.

Marine Diesel Engine scavenge & Exhaust system.

Marine Diesel Engine Fuel Injection system Including Fuel pumps and fuel- injectors.

Power transmission system Including Thrust Blocks.

Intermediate Shaft and Tail-End Shaft.

Design of steam Turbine Plants.

Design of Gas Turbine Plants.

MARINE STEAM ENGINEERING, HEAT ENGINES AND BOILERS

TMM-011

L T P

3 1 0

UNIT 1:

10

Steam Turbines: Compounding of steam turbines, pressure compounding & velocity compounding, pressure velocity compounding of impulse turbines. Condition for maximum energy transfer in above cases. Impulse-reaction or parsons turbine. Degree of reaction, condition for max energy transfer in reaction turbines, stage efficiency, overall efficiency and reheat factor condition curve.

Marine Steam Turbine: Development in steam engines, Reciprocating engine to low Pressure. Steam turbine & to modern high superheat, Reheat & regenerative plants. General Principles of construction and design. Simple Impulse, Pressure Compound Impulse, Pressure Velocity Compounded Impulse. Parson's axial flow reaction turbine, Double flow turbine, Radial flow reaction Turbine, Double casing turbine.

Layout of Plants: General layout and description of a modern geared steam turbine installation including auxiliaries in marine use. Combined Gas turbine & Steam turbine circuits. Location of Gears, Flexible couplings and Thrust blocks. Steam exhaust and drain line system, Gland Steam system.

UNIT 2:

10

Vapour Power Cycles: Carnot's cycle with vapour, Rankine cycle, modified Rankine cycle, Superheat Cycle, reheat cycle, regenerative cycle, binary Vapour cycle & its effect on thermal efficiency, steam machinery plants, nuclear power plants.

Gas Turbine Plants: Constant volumes or explosion cycle Gas turbine plant, Const Pressure Cycle or Joule-Brayton Cycle Gas Turbine Plant, Simple C.B.T Cycle, Condition for Max Work output & thermal efficiency in simple cycle. Methods of improvement of thermal efficiency and work ration of Gas turbine Plant. C.B. T.H. Cycle, Complex Cycles, Closed Cycle operation of Gas turbine plants, Its merits & demerits. Total head or stagnation condition.

Selection of Materials: Material used for various components like blades, Rotor, Gears, Casing & Sealing gland etc and their justification.

Constructional Detail: Types of blades & method of fixing, Solid built up & drum rotor for impulse and reaction turbine, Casing for H.P & L.P., Impulse & reaction turbine diaphragms, Nozzles & glands, Carbon glands, and labyrinth packing glands, Bearing and gears, All addendum gearing, Epicycle gearing, Articulated type double reaction Gearing for marine use.

Lubrication of Turbines: Suitable oil & their properties. Film lubrication, Forced lubrication, Lubrication of main bearing & Gears. Types of all oil jets. Emergency lubrication arrangement.

UNIT 3:

9

Operation of Maintenance: Warming up procedure of main propulsion turbines, Ahead & astern running. Control of power & speed of propulsion. Throttle valve control & Nozzle control Governing, Self closing emergency stop valve, Emergency governors, Condenser vacuum control, Servo motor governor for Generators. Quick engaging turning gear for turbine.

Turbine Trails: Energy losses & head balance method of improving turbine efficiency emergency operation of turbines. Alignment checking, Bridge & Poker gauge, Allowance for expansion, Sliding foot, Adjustment of thrust bearing energy losses and heat balance, method of Improving.

UNIT 4:**9**

Marine Boilers: General consideration governing the design of boilers: Types of marine boilers, comparison of smoke tube and water tube boilers, Destructive & non destructive tests on plates, Rivets, Welded seams, Classification societies requirement for boilers construction.

Smoke Tube Boilers: Various types in marine use, Principal dimensions & staying of flat surface of multitubular cylindrical boilers, Vertical auxiliary boilers.

Water Tube Boilers: General description with sketches of principal type of boilers in marine use, Superheater, Economizer, Air preheater & steam preheater, Circulation and use of unheated down corners in highly rated boilers superheat temperature control, Attemperators and superheaters.

UNIT 5:**9**

Waste Heat Boilers: Waste heat recovery calculation, lamont exhaust gas boilers, Scotch composite boiler, Cochran exhaust gas and composite boiler, Spanner marine exhaust gas and composite boiler, Forced water circulation boiler, Double evaporation boiler.

Boiler Mounting: Safety valves. Improved high left, full left & full bore types, Gauge glass, Ordinary plate type and remote indicator, Automatic feed regulator three element high & low water level alarm. Main steam stop valves. Retractable Type shoot blower etc.

Operation, Care & Maintenance: Pre commissioning, Procedures, Hydraulic tests, steam raising & Operation procedures, action in the event of shortage of water. Blowing down of boiler, laying up of boiler, general maintenance, External and internal tube cleaning. Tube renewals etc. maintenance inspection & survey of boilers.

ELECTROMAGNETIC INTERFERENCE (EMI) AND ELECTROMAGNETIC COMPATIBILITY (EMC)

TMM-012**L T P****3 1 0****Unit I****8**

Introduction to causes of EMI- Sources of conducted interference and its characteristics, (a) Non- Functional Sources (b) Functional sources of EMI. Characteristics of Interference – (a) Bandwidth (b) Amplitude behavior (c) Waveform (d) Occurrence

Unit II**8**

Design practice for minimizing conducted Interference sources of Radiated Interference and its characteristics (a) Non-functional Sources (b) Functional Sources (c) Electromagnetic Pulse (d) Design Practice

Unit III**9**

Interference coupling by conduction and radiation. (a) Coupling via conducted path (b) Radiation coupling (c) Design Practice. Grounding and Bonding Shielding (a) Cable and connector Shielding Filtering (b) Filter Design (c) Transient Suppression (d) Power Line filters (e) Materials and special devices

Unit IV**7**

Mathematical Model – (a) Source Model (b) Coupling Model (c) Susceptor Model

Unit V**8**

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.

RENEWABLE ENERGY SOURCES & APPLICATIONS

TMM-013

L T P

3 1 0

Unit I

9

Principles of Renewable Energy- Fundamentals, Scientific Principles of Renewable Energy, Technical Implications, Social Implications, Solar Radiation- Extra Terrestrial Solar Radiation, Components of Radiation, Geometry of Earth & Sun. Geometry of the Collector. Solar Beam, Effects of Eastern Atmosphere, Measurement, Estimation of Solar Radiation, Solar Water Heating- Heat Balance, Unsheltered & sheltered Heaters, Systems with Separate storage, Selective Surfaces, Evacuated collectors, Uses of Solar Heat, Air Heater, Space Heating & Cooling, Water Desalination, Solar Ponds, Solar Concentrators, Electrical Power systems .

Unit II

8

Photo Voltaic Generation – Silicon P-N Junction. Photo absorption, Solar Radiation Input Photo Voltaic Circuit Properties & Loads, Limit to Cell Construction. Types & adaptation of Photo voltaic. Other types of Photo voltaic and thermoelectric Generation.

Unit III

9

Wind Powder- Turbine types & terms, Linear Momentum & Basic Theory, Dynamic Matching, Stream Tube Theory, Characteristics of the Wind, Power Extraction by a Turbine, Electricity Generation, Mechanical Power, Total Systems. Wave Energy- Wave Motion, Wave Energy & Power, Wave Patterns, Devices. Tidal Power- The cause of tides, enhancement of Tides, Tidal Flow Power, Worked Range Power sites, Ocean Thermal Energy Conversion- Principles, Heat Exchangers, Pumping Requirements, Other Practical considerations.

Unit IV

9

Hydro Power & Geothermal Energy- Energy storage & Distribution- Importance of Energy Storage & Distribution. Biological Storage, Chemical Storage, Heat Storage, Electrical Storage, Fuel Cells, mechanical storage, Distribution of Energy, Problems, Bio Mass, Principles of using Biomass, Availability Economics, Biofuels, Biofuel classification, thermo chemical biochemical, Agrochemical, Biomass Production for energy farming, Energy farming advantages & disadvantages. Geographical Distribution. Crop yield, Energy analysis, Direct combustion for heat, domestic cooling & heating, Crop drying, process heat & electricity.

Unit V

8

Pyrolysis, Solids, Liquid, Gases, Hydrogen Reduction. Acid & enzyme hydrolysis, Conversion of Oil (c0c0) to Ester. Methanol liquid fuel Alcoholic fermentation. Directly from sugar cane sugar Beet. Starch crops. Cellulose, Ethanol fuel use. Ethanol Production. Anaerobic digestion for Biogas Basic process & energetic Digester sizing. Working Digesters, Agrochemical fuel Extraction advantages & disadvantages.

CAD/CAM LAB

TME- 751

L T P

0 0 2

CAD Experiments

01. Line drawing or Circle drawing algorithm experiment: writing the program and running it on computer.
02. Transformations algorithm experiment for translation/rotation/scaling: writing program and running it on computer.
03. Design problem experiment: writing the program for design of machine element or other system and running it on computer.
04. Optimization problem experiment: writing a program for optimizing a function and running it on computer.
05. Auto CAD experiment: understanding and use of Auto CAD commands.
06. Writing a small program for FEM for 2 spring system and running it. Or using a FEM package.
07. Use of Graphic software standards packages e.g GKs/PHICS/GLetc.
08. Use of pro Engineer/ Ideas etc.

CAM experiment

1. Writing a part-programming (in word address format or in APT) for a job for drilling operation (point-to-point) and running on NC machine.
2. Writing a part programming (in word address format or in APT) for a job for milling operation (contouring) and running on NC machine
3. Experiment on Robots and it programs
4. Experiment on Transfer line/ Material handling
5. Experiment on difference between ordinary machine and NC machine, study or retrofitting.
6. Experiment on study of system devices such as motors and feed back devices.
7. Experiment on Mechatronics & Controls.

BOILER CHEMISTRY LAB

TMM-752

L T P
0 0 3

1. To determine hardness of sample of water in ppm in terms of CaCO_3
2. To determine chloride content of a sample of water in ppm in terms of CaCO_3 .
3. To determine alkalinity due to phenolphthalein, total alkalinity and caustic alkalinity of sample of water in ppm.
4. To determine phosphate content of a sample of water.
5. To determine dissolved oxygen content of a sample of water.
6. To determine sulphate content of a sample of water.
7. To determine pH value of a sample of water.

ADVANCED I.C. ENGINE LAB

TMM-751

L T P

1. Dismantles one unit of a Marine Propulsion Engine.
2. Dismantles one unit of Marine Auxiliary Engines.
3. Calibration of Piston
4. Calibration of Liner
5. Calibration of Journal
6. Calibration of Crankpin
7. Measuring Crankshaft deflections & study
8. Identifies the preventive maintenance schedule of Engines
9. Study of safety devices on engine i.e.
 - a) Lub oil pressure drop alarm
 - b) Low Lub oil pressure cut off and alarm
 - c) Turning gear interlocks arrangement
 - d) High cooling water temperature alarm
 - e) Study of over speed cut Off and Governors.

MARINE CONTROL ENGG. & AUTOMATION

TMM-801

L T P
3 1 0

UNIT 1:

Control System:

5

Introduction to control terms, Block diagram for control systems, Open loop and closed loop feed back control, Comparison of closed loop and open loop, Feed forward control, Feed forward modification. Regulators and Servomechanism. Proportional plus integral plus derivative control. Use of various control modes.

Graphical representation of Signals:

4

Input & step Ramp sinusoid. Pulse and impulse, Exponential function etc Error detector. Controller output elements.

UNIT II:

The Dynamics of Simple Servo-mechanism For Angular Position Control:

9

The torque proportional to error, Servo mechanism, Different response of servo mechanism. Technique for improving the general performance of servo mechanism. The frequency response test. Series compensation using Nyquist Diagram. Parallel compensation using the Inverse Nyquist Diagram.

UNIT III:

Process Control System:

5

Automatic closed loop process, Control System Dynamic characteristic of controllers. Practical pneumatic controllers. Electronic Instrumentation for measurement and control Analog Computing and Simulation. The use of Digital computer in the simulation control system. Hybrid computers.

Transmission:

4

Pneumatic & electrical transmission suitability for marine use, Pneumatic type of controllers. Hydraulic electric and electronic controllers for generation of control action. Time function controller.

UNIT IV

Correcting Units:

4

Diaphragm actuators, Valve – positioners, Piston actuators, Electro pneumatic transducers, Electro hydraulic actuators and electric actuators control valves.

Application of Controls on Ships: 4

Marine boilers Automatic combustion control, Air /fuel ratio control, Feed water control signal, Two and three element type, Steam pressure Control.

UNIT V: 5

Combustion chamber pressure Control, Fuel oil Temperature. Control, Control in main machinery unit for temperature of Lubricating oil, Jacket cooling water, Fuel valve cooling water, Piston cooling water, and scavenger, Fuel oil viscosity control, Bride control of main machinery, Instruments for UMS classification.

SHIP OPERATION AND MANAGEMENT

**TMM-802 L T P
3 1 0**

UNIT I: 8
Brief History Of Shipping:

Modern shipping practice, Marine vehicles and cargoes. Development in Shipping and cargo handling. Principal shipping organizations, Liner and tramp shipping services, Conference systems, Charter parties. Theory of Freight rates and fares. Rate fixation machinery and government control. Bill of landing. Carriage of goods by sea act. Cargo surveys and protests.

UNIT 2: 8
Marine Insurance:

Underwriting and loss adjusting principles applied to marine Cargo Insurance. Hull policy, Particular average, General average. P & I Clubs.

UNIT 3: 8

Ownership of vessels, Shipping company and its administration, Capitalization and finances. Economics of new and Second hand tonnage subsidies.

UNIT 4: 8
Ship Operations:

Planning sailing schedules, Voyage estimate, Economic factors, Commercial shipping practice, Manning of ships, Engagement & discharge of crew, D.L.B. seaman’s welfare.

UNIT 5: 8
Merchant Shipping Act:

Registration of ship, Ship’s papers. Port procedures, Pilot age, Duties regarding Pollution, Collusion, and explosion fire etc. vessel in distress shipping Casualties penalties under Merchant shipping act.

MARINE AUXILIARY - III

TMM-803

L T P
3 1 0

UNIT I:

Marine Refrigeration and A.C. Plant:

8

Design & Constructional detail of various equipment for refrigeration and A.C, Refrigerator used in marine practice and their justification, Control of temp in various room in cargo or domestic plant, Control & safety equipment.

UNIT II:

Marine and Cargo Ventilation:

8

Design & constructional detail, International requirement, Operation & maintenance of equipment.

UNIT III:

Noise and Vibration:

9

Element of aerodynamic and hydrodynamic sound, Noise source on ship, noise suppression technique, Level measurement various, Mode of vibration on ship (i.e. free, forced, transverse, their source & effects), Resonance and critical speed, structural borne & air borne vibration. Anti vibration mounting of machineries, Detuners, Dampers with reference to torsional vibration dampers, use of torsigraphs.

UNIT IV:

Fuels:

8

Source of supply, Study of primary fuel, Coal, Petroleum, Natural Gas classification of fuel, treatment of fuel for combustion in marine I.C.E and steam plant.

UNIT V:

Lubrication:

9

Theories of lubrication, Type of lubricants, and their properties, Suitability of lubricants for various uses, solid and fluid lubricants, Additives oil and their specific use. Terminology used in lubrication system, loading pattern of various bearing in marine use and lubrication system adopted. Different type of bearing used for marine machineries.

MARINE ELECTRICAL TECHNOLOGY – II

TMM-021

L T P
3 1 0

UNIT I

Essential equipment and special circuit

9

Classification society's requirements for electrical equipment for steering gears, Electrical control from wheel house for electro hydraulic steering gear, all electrical steering gear circuit and control equipment, navigation lights.

UNIT II

Miscellaneous marine equipment and alarm system **8**
Electrical engine room telegraph, Remote indicating revolution counter, Remote helm indicator, Salinity indicators, Mist Detectors, Carbon di-oxide recorder.

UNIT III **9**
Electrical Equipment for water tight door operation, Centralized alarm system in machinery space for the above, fire alarm system for engine room, Hold and accommodation, High temperature alarms, Low and high level alarms.

UNIT IV **9**
Electrical Propulsion-System, Differences and relative merits, Alternating current, Diesel electric and Turbo electric and turbo electric propulsion system- engines, Generators, motors, Excitation system and control.

UNIT V **9**
Maintenance of Electrical Equipment-Detection of faults and repairs, Preventive maintenance and periodic survey of equipment, classification societies requirements for spares on board.

ADVANCED HYDRAULICS

TMM-022 **L T P**
3 1 0

UNIT I Hydraulic Transmission of Power **8**
Hydraulic Motors, Valves, Types of Hydrostatic drives. Types of Hydraulic Transmission Systems.

UNIT II Multimotor Open- Circuit Systems and closed- circuit systems **8**
Applications of Hydraulic Transmission. Advantages of Hydrostatic transmission. Rotodynamic Transmission.

UNIT III Hydraulic Coupling **8**
Torque converted and characteristics of hydraulic coupling and Torque Converter. Liner Transmission of Hydraulic Power. Circuit for devices like Hydraulic Press, Jack, Accumulator, Intensifier and Hydraulic lift. Fluid Power.

UNIT IV **9**
Introduction. Applications of Control Systems. Control Signals Hydraulic Servo mechanisms. Servo Valves, valve operated servo mechanisms ad Pump controlled servo mechanisms, Fluidics.

UNIT V **8**
Introduction and definition. Terms used in fluidis, efficiency of a fluidic device. Digital devices and analog devices.

DOUBLE HULL TANK VESSELS

TMM-023

L T P
3 1 0

Unit I

9

Origin of Double hull ships, their usefulness and superiority over conventional single skin ships, use of double hull tank ships for transport of different types of commodities, prevention of oil-spill and pollution of sea, IMO requirements, schedule for phasing out single hull tank vessels of different sizes.

Unit II

9

Design considerations, main dimension, hull-weight estimate, double hull requirements, minimum depth of double bottom tank, wing tank width, clearance for inspection, etc. maximum cargo tank size, capacity, effect of free surface, damage stability, hydrostatically, balanced loading, sloshing loads, its elimination or minimization.

Unit III

9

Structural design, non-uniform and uniform stress distribution, unidirectional (longitudinal) structural members, elimination of transverse structural members (except transverse bulkheads) minimization of structural discontinuities and stress concentration zones, use of steel of higher strength, resistance to grounding and collision, classification society requirements, access to inside and bottom spaces.

Unit IV

9

Cargo handling system, use of submerged pumps, ordinary cargo transfer system, assurance of quality of cargo oil, complete elimination of risk of admixture of different grades oil, concealed pipe-lines, easy maintenance, inspection and cleaning, elimination of explosion risks.

Unit V

8

Economic aspects, fast loading discharging of oil cargo, quicker cleaning, ballasting and deballasting, number of trips per year.

STCW CONVENTION, ISO, ISM, FIRE & MARPOL

TMM-031

L T P
3 1 0

UNIT 1:

1. Fire Prevention

4

Fire triangle basic principle of fire prevention and fire fighting, Fire fighting equipments on board ship, Construction and operation, charging and upkeep of fire extinguishers. Fire alarm system. CO₂ sprinklers and mechanical foam system. Duty roster and fire fighting of oil fires. Fire fighting – wood, metal etc. , Fire fighting – electrical

2. Safety

3

Safe working practices, Entry into confined spaces. Hot work inside confined places. Safety precaution while handling portable electrical equipments. Safety while working with pressure vessel and pipes

3. Method of fire control in engine room, in a hold, in a tank, on deck and in accommodation, fire fighting on board ship in a port / at sea. **2**

UNIT 2:

1. Marpol

9

U.N.O and IMO and its relationship and working with classification societies, member countries and its committees. Various Conventions and description of articles and technical annexure of MARPOL convention. Technical annexure – VI i.e. air pollution. Oily water separators, Oil record book. Precautions to be taken during bunkering operation.. Method of preventing oil discharge from oil cargo tank cleaning. Shore reception facilities incinerators

UNIT 3:

1. ISO

5

Development of ISO System. Various well known standards being used globally. Various controlling and certificate issuing organization and their Inter-relationship. Various clauses of ISO : 9000. Practical exercise on locating non-conformances in a system

2. ISM Code

5

ISM . SOLAS. Load line convention. COLREG. Classification societies. Role of Government Department i.e. Mercantile Marine Department, Port Authorities etc. Assessment of cadets through written examination for above.

UNIT 4:

8

STCW Convention: Standards of training, Certification and watch-keeping for sea-farers- International Conference of 1978. Basic principles to be observed in keeping an 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 system, 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.

UNIT 5:

8

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 personnels; Pollutions.

Shipboard Applications – Regulations & Codes of Practice; Ship design & equipment of Oil, Chemical & Gas Tankers; Ship operation, repair & maintenance; Emergency operation; Training of other personnels. Requirement of continued up-dating of proficiency. Modifications of STCW vide June’95 Conference.

HYDRAULIC CIRCUITS & CONTROL

TMM-032

**L T P
3 1 0**

UNIT I

8

Basic Fluid Power Components, their functions, symbol along with various hydraulic terms.

UNIT II

8

Different types of Pumps, Relief valve, Pressure Control valve Non-return valve, pilot-operated relief valve. Flow.

UNIT III

9

Control valves with pilot operation. Compressibility and Inertia Loading, Hydraulic Stiffness, system Natural Frequency. Allied problems, Design of hydraulic circuits and different control mechanisms, e.g., mech, electr., pneumatic/ hudraulic.

UNIT IV

8

Hydraulic Power Transmission Systems: circuits, different loads eg. Const power, pure inertia, inertia with viscous damping on output haft etc., related problems.

UNIT V

9

Hydraulic circuit accessories e.g Tank, piping, flexible hose, various fittings eg. Compression type. Clamp type etc., Weld nipple with O-ring seal/ face to face seal. Pipe couplings, Assembly of different hydraulic components without using piping eg. Vertical/ horizontal stacking, manifold block etc. Different types of Filters, Instruments & control elements e.g. float switch, thermostat, pressure switch etc.

ADVANCED MARINE HEAT ENGINES

TMM-033

**L T P
3 1 0**

Unit I

8

Combined Steam Turbine and Diesel Engine Cycles, Combined steam turbine and Gas Turbine cycles, combined Gas Turbine and Diesel Engine cycles/ Plants.

Unit II **9**

Different Methods of Improving the Overall Thermal Efficiency of the entire plant, Design of the most optimum condition and combination of complex plants, Cascade Refrigeration plants, Free piston Gas Generators.

Unit III **10**

Turbo Blowers and Turbo Compressors- Compressor Characteristics for Axial Flow compressors and Centrifugal compressors, stalling of compressors. Turbine characteristics, Matching of components like compressor and Turbine. Performance of different units in combination in single shaft arrangement.

Unit IV **9**

Combustion and Flame stabilization- Combustion of liquid Fuels, Atomization, mixing, combustion curve and different methods of Flame stabilization, Design & combustion chamber, Spray of Fuel, Pre-mixing of Gaseous.

Unit V **8**

Fuels for combustion, Stability of the flame, Design of different types of compact Heat Exchangers for different Applications. e.g Air preheater, Gas and Oil Heaters etc.

ENGINE SIMULATORS & CONTROLS LAB

TMM-851

Simulator Lab Experiments:

1. Description of basic engine functions and their simulation introduced in Auto-Chief-II system of Nor-Control.
2. Manual method of engine operation from engine room station. Engine operation from remote stations i.e. engine control room and Navigation Bridge.
3. Safety and interlocks in UMS-ships and effect of malfunction of main engine auxiliaries.
4. Electronic logic circuits in remote control stations.
5. Simulation of engine functions in logic circuits.
6. Study and adjustments of logic circuits for remote control operation of main engine and trouble shooting.
7. Interfacing Input / Output interfacing and pneumatic interfacing in the system.
8. Role of classification societies with reference to UMS-Ships.

Control Lab. Experiments:

9. Operation of Automatic Viscosity Controller and maintaining a specific viscosity of a given fuel.
10. Operation of an Automatic Viscosity Controller and measuring the flow from in a given pipe.
11. Operation and utility of 3 Term (P + I + D) Pneumatic controller. ;
12. To study the functioning of a Mist Detector and checking the alarm when the Pre-set value is exceeded.
13. Study the operation of fire detection unit using Ionization chamber type detector.

MARINE POWER PLANT OPERATION PRACTICALS

TMM-852

- 1. Running of 2-Stroke Diesel Engine (Coupled to alternator):**
Methods of starting, running under different load conditions (load on the alternators), Watch keeping & recording of the temperatures, pressures on different meters on the diesel engine instrument panel and Switch Board. Looking after the auxiliary machinery viz. Air compressor, Cooling water pump and Lab. Oil pump.
- 2. Boiler Operation:**
Smoke Tube Boiler (Marine Scotch Boiler), Raising steam from cold condition upto its working pressure and maintaining the same while operating the Reciprocating engine and the auxiliary machinery, maintenance schedule for the Scotch Boiler, Blowing of gouge glasses with precautions involved- Necessity and procedure of cross Blowing. Overhauling of mountings. Dismantling, overhauling and adjustment of High lift Safety Valve, Studing the working of Boiler plant auxiliary machinery.
- 3. To study the operation of the water tube boilers (Foster wheeler type)**
Firing from cold condition, raising steam upto its working pressure and to maintain the same while operating the Steam Turbines and the auxiliary machinery, precautions involved during firing of boiler. Operation of steam super heater, water level indicators, high and low level alarms and other boiler mountings, Overhauling and adjusting of safety valves, Recording and controlling of various pressures & temp. on the Instrument panel. Care of Boiler auxiliaries, feed water system and fuel system.
- 4. Running of Steam Recprocation Engine:**
Warming up of the engine. Lubrication of moving parts and precautions involved Starting of the engine, Reversing procedure. Running the engine at full power and taking Indicator Cards. Linking out' of the three Cylinders. Adjusting the 'cut off' period of the engine and studying the effect.

TMM 853 : CLASS IV PREPERATION

REVISION OF THE FOLLOWING FOUR SUBJECTS FOR CLASS IV PART A, EXAM HELD BY MERCANTILE MARINE DEPTT. D.G. SHIPPING

1. HEAT ENGINES

Heat, Temperature and its measurement. Absolute temperature. Specific heat capacity. Specific enthalpy of evaporation and fusion. Problems involving changes of phase and not more than three substances. Linear, superficial and volumetric expansion due to temperature changes. Coefficients and the relationship between them. Basic thermodynamic principles. Properties, energy, the First Law of Thermodynamic, flow and non-flow processes.

Heat and work transfer. Qualitative treatment of heat transfer by conduction convection and radiation. Laws of conduction and thermal conductance and applications to problems. Cases Boyle's and Charles laws for perfect gase4s. Characteristics equation. Constant R and its use in simple problems. Isothermal, adiabatic and polytropic process. Relationship between pressure, temperature and volume. Work done. Changes in internal energy.

Specific heat C_p and C_v and the relationship between them.
Ideal Gas cycles. Constant volume cycle. Dual cycle. Air standard efficiency.
I.C. Engines, Elementary Principles and cycles of operation, Actual indicator diagrams. Mean effective pressure. Work done, power developed, indicated and brake thermal efficiencies, mechanical efficiency, overall efficiency. Fuel consumption. Heat balance.
Air compressors, Elementary principles and cycles of operation.
Calculation of work done. Indicator diagrams.
Properties of steam. Saturated steam, dry, wet. Dryness fraction.
Super-heated steam. Internal, energy. Enthalpy. Specific volume.
Steam tables. Throttling. Separating and throttling calorimeters.
Steam plant. Advantages of using steam expansively. Rankine cycles. Thermal, mechanical and overall efficiencies of prime movers. Boiler efficiency, heat balance for engine and boiler trails. Change in dissolved solids in boilers and evaporators due to contaminated feed and effect of blowing down. Elementary principles of steam turbines including simple velocity diagrams for impulse and reaction turbines. Force and work done on blades.
Combustion. Solid and liquid fuels. Calorific value. Chemical equations for complete combustion. Theoretical minimum air required. Excess air. Refrigeration. Vapour-compression cycle. Refrigerating effect. Cooling load. Use of tables of properties of refrigerants. Coefficient of performance.

2. APPLIED MECHANICS

Statistics. Force as a vector. Triangle and polygon of forces. Resultant and equilibrant of a system of concurrent coplanar forces. Equilibrium of three coplanar forces, moment of a force. Couples. Moments of areas and volumes. Centroids and centers of gravity (limited to geometrical shapes). Conditions of equilibrium of solids.
Necessary force applied parallel to an inclined plane to pull up or down the plane or to hold it. Work done at uniform speed up the plane. Friction, Coefficient of friction, Friction angle. Energy and power lost due to friction in simple bearings.
Kinematics. Linear motion. Graphs and equations for displacement, speed, velocity and uniform accelerations. Velocity as a vector. Relative velocities in one plane only. Angular motion. Equations for displacement, velocity and uniform acceleration.
Dynamics, work and power. Problems with constant force or force with linear variation. Energy Potential energy. Kinetic energy of translation Newton's laws of motion. Conservation of momentum. Centrifugal force and its application to conical pendulum, unloaded governor, curved tracks and machine parts. Stress in thin rim due to centrifugal action.
Machine. Simple lifting machine. Graphics of lead-effort and load-efficiency. Linear law. Velocity ratio, mechanical advantages and efficiency of the following machines: wheel and axle, differential wheel and axle, rope pulley blocks and single and double purchase crab winches. Reduction gearing.
Stress and strain. Direct stress and strain. Modulus of elasticity. Shear stress and strain. Modulus of rigidity. Factor of safety. Stress due to restricted expansion or contraction of single members.
Beams. Shearing force and bending moment diagrams for cantilevers and simply supported beams with concentrated or uniformly distributed loads. Stress due to bending.
Torsion. Strength and stiffness of solid or hollow shafts. Stress due to torsion. Power transmitted by shafts and coupling bolts.
Thin shells. Circumferential and longitudinal stress in thin cylindrical shells subject to internal pressure.

Hydrostatics. Equilibrium of floating bodies. Variation of fluid pressure with depth. Total force due to liquid pressure on immersed plane surfaces horizontal or vertical. Centre of pressure on a rectangular vertical plane surface or triangular plane surface, both with one edge parallel to the surface of the liquid.

Hydraulics. Full bore flow of liquid through pipes under constant head. Flow through orifice, Coefficient of velocity, contraction of area and discharge.

3. MATHEMATICS

Algebra, Indices, Surds, Logarithms. Quadratic equations.

Partial fractions. Arithmetical progression. Geometric progression Binomial theorem and its applications. Simple relation between trigonometrical ratio.

Compound angles, inverse trigonometrical functions, trigonometrical equations. Relations between angles and sides of a triangle.

Solution of triangle, sum of a cosine curve and sine curve.

Plane and Co-ordinate Geometry. Co-ordinates of a point, changing of axes, the circle, the parabola.

Empirical Laws. Determination of empirical laws by plotting function of a data.

Calculus: Differentiation of algebraic, circular, exponential and logarithmic functions, of products, quotients functions of a function and simple implicit functions. Examples of maxima and minima. Simple cases of points of inflexion. Partial differentiation (1st order only). Examples of motion of a body. Simple harmonic motion, deflection of beams.

Integration of standard forms by substitution and by parts. The definite integral as the limit of a sum. Application of integration to area under curve; volume of revolution; First moment of area and the position of a centroid of an area; Work done by variable forces; mean values, Root mean square values of $\sin nx$ and $\cos nx$.

The rules of Guldens.

Theorems of parallel and perpendicular axes. Second moments of area and moments of inertia of a rectangular and circular laminae. Complex Quantities: Imaginary quantities, complex quantities in terms of an angle.

4. ENGINEERING DRAWING

Types of drawing, Line work, Pictorial Projection, development, Screw threads and fasteners, Locking and retaining devices, Riveted type fastenings, Welded connections, Dimensioning, Limits and fits, Geometrical tolerance, Cams, Bearings, Seals, Lubrication arrangement and tolerances of ball and roller bearings, Engineering drawing- Marine machinery:- Isometric views & Assembly drawings.

The drawing paper will consist of a test of the ability to apply the principles of projection and candidates will be asked to draw a plan, elevation, side view or section or a combination of these views of a piece of marine machinery from information supplied. Only one question will be set and all required information for the completion of the drawing will be given in the question paper.

U.P. TECHNICAL UNIVERSITY

LUCKNOW



Syllabus

of

3rd Year (Sem. V & Sem. VI)
4th Year (Sem. VII & Sem. VIII)

B.Tech MARINE ENGINEERING