

SEMESTER-VI

UG11P3601	FIRE CONTROL AND LIFE SAVING APPLIANCES LABORATORY	54 HRS
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1. Testing and Operation of Jet and spray type Nozzles and Fire hoses.
2. Operation of Emergency Fire Pump
3. Operation, Charging and maintenance of Portable Fire Extinguishers
 - (a) Water type
 - (b) Foam type
 - (c) Dry Powder type
 - (d) CO₂ type
4. Operation, use and functions of breathing apparatus
 - (a) Self contained type
 - (b) Bellow Type
5. Use of Fireman's outfit, Immersion suit, TPA, SCBA, EEED.
6. Study and operate total CO₂ flooding of Engine room and Cargo holds.
7. Operation of different types of Fire detectors.
8. Study of working of life boat and provisions for life boat, Use of life jackets.

And use of on-board Life Saving Appliances.
9. Construction and operational details of life raft giving importance to manual and hydrostatic release device.
10. Study of high expansion foam applicator system

SEMESTER VI		
UG11P3602	MARINE POWER PLANT	54 HRS
	OPERATION – II	

OBJECTIVE: *To develop skill of operation & maintenance of marine machinery among cadets.*

[Note : The teacher–in-charge of the class will brief the cadets before starting an assignment and de-brief at the end.]

Running of 2 Stroke/4 Stroke Diesel Engine (Coupled to Dynamometer / Alternator): Methods of starting, running under different load conditions. 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 Lub. Oil pump.

Boiler Operation:

i) Smoke Tube Boiler : Raising steam from cold condition up to its working pressure and maintaining the same while operating the Reciprocating engine and the auxiliary machinery, maintenance schedule for the smoke tube Boiler. Blowing of gauge glasses with precautions involved-Necessity and procedure of cross Blowing. Overhauling of mountings. Dismantling, overhauling and adjustment of High lift Safety Valve, Studying the working of Boiler plant auxiliary machinery.

ii) To study the operation of the water tube boiler Firing from cold condition, raising steam up to 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.

Running of Steam Reciprocating Engine / Steam Turbine Test Rig: Warming up of the engine, Lubrication of moving parts and precautions involved. Starting of the engine, Reversing procedure. Running the engine at full power, performance monitoring.

Operation and Maintenance of Diesel Propulsion Engine: Preparing the engine for operation, Running engine in ahead & astern directions, taking indicator cards, cutting out fuel pumps, Opening up unit for maintenance, checking clearances of bearings.

Electrical Maintenance and Repair: Generator, switch board, electrical motor, starter, distribution system, transformer, distribution cable, DC, electrical system and equipment, battery system, automation control system.

Project Work: Every cadet will be required to make model of any machinery or part found onboard a ship or maritime industry. Working model would be appreciated

SEMESTER – VI

UG11P3603	ELECTRICAL MACHINES LABORATORY	54 HRS
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1. Study of the equivalent circuit of a single-phase transformer
2. Parallel operation of single-phase Transformers.
3. Polarity test on single phase transformer and study of the parallel connections of three-phase transformer.
4. To determine the phase-sequence of 3-phase line by using resistance and capacitance in two ways.
5. To study the slip-torque characteristics of an induction motor and to find out the full load slip.
6. To compute full load, input, output, torque, slip, power factor and efficiency of a 3-phase induction motor from circle diagram. Also to compare the results from the circle diagram with actual full load test on the motor.
7. Determination of characteristics 2 or 4 pole single phase Induction Motor.
8. Speed control of 3 phase squirrel cage induction motor by different methods & their comparison (voltage control & frequency control).

9. Different method of starting of 3 phase squirrel cage Induction motor & their comparison (D.O.L, Auto transformer & Star-Delta).
10. Determination of regulation of an Alternator by Synchronous Impedance & Potier reactance method.
11. To determine the direct axis reactance (X_d) & quadrature axis reactance (X_q) of three phase synchronous machine by slip test.
12. Synchronization of 3-phase alternator.
13. To perform different types of Electrical Machines experiments [preferably on Scan Drive System (TERCOSCAN) – Electrical Machine Tutor – Simulator or similar simulator] such as D.C. Machines, Induction Machine, Synchronous Machine and Transformer – mainly Motor Generator characteristics, Control and Transformer tests to be performed – Monitoring & control to be studied with the help of a Personal Computer and different vector quantities seen in the oscilloscope.

SEMESTER-VI

UG11T3601	SHIP FIRE PREVENTION AND CONTROL	54 HRS
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OBJECTIVE: *To provide sound knowledge of fire prevention and control to the students.*

Fire Hazard Aboard Ships:

Fire triangle, Fire Tetrahedron, Fire-chemistry, Spontaneous Combustion, Limits of inflammability. Advantages of various fire extinguishing agents including vaporizing fluids and their suitability for ship's use. Control of Class A, B, C & class D fires, Combustion products & their effects on life safety.

4 Hrs

Fire Protection Rules in Ship's Construction:

SOLAS convention, requirements in respect of materials of construction and design of ships, (class A , B, C type Bulkheads), fire detection and extinction systems, Fire test, means of escape, fire doors & fire zones, electrical installations in hazardous zones, ventilation system and venting system for tankers. Statutory requirements for fire fighting systems and equipments on different vessels.

6 Hrs

Fire Detection System:

Types of detectors, Selection of fire detectors and alarm systems and their operational limits. Commissioning and periodic testing of sensors and detection system.

8 Hrs

Fire Fighting Equipment and Relevant Rules as per SOLAS:

Fire pumps, hydrants and hoses, Couplings, nozzles and international shore connection. Construction, operation and merits of different types of portable, semi-portable and fixed fire extinguishers installations for ships. Properties of Chemicals used, Water Sprinkler system, Water-mist Fire suppression system. Bulk and bottled Carbon Di-Oxide system. Inert gas systems. Fireman's outfit, its use and care. Maintenance, testing and recharging of appliances. Fire Fighting Appliance Survey. Breathing apparatus types, uses, method of operation. Fixed Fire Fighting installation on LPG & LNG. 18 Hrs

Fire Control:

Fire Control Plan and IMO Symbols, Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler front, Cargo holds, galley, pump room, paint locker. Fire fighting in port and dry dock. Procedure for re-entry after putting off fire, Rescue operations from affected compartments.

First aid, Fire organization on ships, shipboard organization for fire and emergencies. Combustion products and their effects on safety of life. Fire signal and muster. Fire drill. Leadership and duties, Human behaviour, Special precautions for prevention/fighting fire in tankers, chemical carriers and gas carriers, Safe working practice. 18 Hrs

REFERENCE BOOKS:

- 1. Marine Engineering Practices - IME Publication
- 2. SOLAS - Bhandarkar Publication
- 3. FSS / FTP Code - IMO Publication
- 4. Fire aboard - Frankrush Brook.
- 5. Fire fighting aboard ships - M . G Stavitsky
- 6. General Engineering Knowledge for Marine Engineers- Reeds Volume - 8
- 7. Fire Appliance Rules - DGS/Bhandarkar Publications

SEMESTER VI

UG11T3602	MARINE INTERNAL COMBUSTION ENGINES -II	72 HRS
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OBJECTIVE: To develop knowledge in marine diesel engines construction, fundamentals and latest developments.

Forces and Stresses: Balancing, overloading, Different types of moments & couples, Different type of vibrations (axial, torsion and radial) & its effects, methods of vibration damping . 4 Hrs

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.

- Effects of viscosity on liquid fuel combustion.
- Necessity of variable fuel injection system.
- Necessity for adoption of fuel quality setting system.
- Incorporation of FQSL along with the V.I.T. system on the engine.

10 Hrs

Manoeuvring Systems: Starting and reversing systems of different Marine Diesel engines with safety provisions. Actions on emergency situation.

10 Hrs

Indicator Diagrams and Power Calculations: Construction details of indicator instrument. Study of different types of indicator cards, Significance of diagram. Power Calculations, fault detection, simple draw cards and out of Phase diagrams. Power balancing, Test bed and Sea trials of diesel engines.

6 Hrs

Lubrication Systems : Lubrication arrangement in diesel engines including Coolers & Filters, Cylinder-lubrication, Liner wear and preventive measures, various grades of lubricating oil its effect and preventive measures.

- Improvements in Lubricating oils through use of additives. Types of additives
- Monitoring engines through lubricating oil analysis reports.
- Synthetic Oils & their uses.

10 Hrs

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

- Use of poor quality residual fuels and their consequences.
- Improvements in designs for higher power output.

8 Hrs

Automation in Modern Diesel Engine Plants: Remote operation, Alarm and fail safe system, Governors and their basic functions, Constant and variable speed governors. Constructional details and hunting of governor. Electronic governors.

- Computerised monitoring and diagnostic applications in propulsion engines
- Concept of intelligent engine.

6 Hrs

Maintenance of Diesel Engines : Inspection and replacement of various Component members such as Piston, Piston ring, X-head & other bearings, Cylinder Head, Liner, Driving Chain and gears. Crankshaft deflection and alignment, Engine holding down arrangements, Tightening of Tie bolts.

6 Hrs

Trouble Shooting in Diesel Engines: Hot & Cold Corrosion, Overloading, high exhaust temperature, misfiring, Crankshaft web slip, X-head bearing problems, starting failure. Microbial degradation of fuel of lub oil

4 Hrs

Modern trends in Development: Current Engines (Sulzer RTA, B&W LMC & SMC, SEMT Pielstick) Intelligent Engine (Cam less concept), improvement in design for increased Time Between Overhaul. NO_x – Control of marine Diesel Engines. SO_x Control, and IMO regulations in ECA & SECA. MCR & CSR with Propeller curve relationships. All latest Technology incorporated in a modern propulsion machinery ships.

8 Hrs

REFERENCE BOOKS:

1. Wood yard, Goug, “Pounder’s Marine Diesel Engines”. Butter Worth Heinemann Publishing, London.
2. “Slow speed Diesel Engines”, Institute of Marine Engineers, India
3. S H Henshall, “Medium and High Speed Diesel Engines for Marine Use”. Institute of Marine Engineers, India.
4. D K Sanyal, “Principle & Practice of Marine Diesel Engines”, Bhandarkar Publication, Mumbai.
5. “Marine Low Speed Diesel Engine”, Denis Griffiths.
6. “Lamb’s Question and Answer on Marine diesel Engines”.
7. “Diesel Engines”, A.J. Wharton.

SEMESTER VI

UG11T3603	MARINE ELECTRICAL TECHNOLOGY	72 HRS
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OBJECTIVE: *To develop skills in marine electrical technology including the knowledge of the regulations observed on board ships regarding electrical equipments.*

Power Generation: Merits & 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. Effects of loading of generators on rated voltage and RPM of the prime mover

8 Hrs

Alternative Source of Power : Emergency Generator & Different Starting method including auto start, emergency batteries construction and its different types & duties, Location of emergency power, Different Emergency loads, Rules & Regulation, emergency power, Maintenance of emergency power source on board. Shore Supply – Specifications as per Voltage / frequency, precautions while taking shore supply. Navigation and signalling lights

7 Hrs

Distribution: Different electrical diagrams and their uses. Type of Distribution, Distribution network on board; Main & emergency switch board, construction, different switch gear & protective devices, Grounded and Insulated neutral systems, . Cables & temperature classification. Electrical signals. 5Hrs

Motor and Control Equipments
: Types of marine motor, types of enclosures, protective devices on motors, sequential starting (e.g. Refrigerating plants, automatic fired boiler). - 3Hrs

Miscellaneous Marine Electrical Equipment Alarm System : Synchros and its working Engine Room Telegraph, Rudder Angle Indicator, R.P.M. & Revolution Counter, Centralised Salinity Indicator, Watertight door operation, Alarm system (types, supply) on board's oxygen analyzer, High & low level arms, Navigational lights, Emergency Radio Operation, Electrical Deck auxiliaries. 8 Hrs

Maintenance of Electrical Systems, Fault finding and Repair : Type of faults & indications on Generator, motor & distribution systems, Different Testing equipments & meters (multi meter / megger, clampmeter), Salvaging a motor Detection of faults on electronic circuits & cards – Indications & corrective arrangements, Necessary Precautions & care while fault finding and Repair, preventive maintenance, periodic surveys, spares requirement. 9 Hrs

Special Electrical Practice : Rules and Regulations & operation of all Electric Steering gear, Electric propulsion, selection of motor for propulsion(DC motor & AC motor).Limitation of power of a dc motor. Working of frequency converters(PWM, Static frequency converter, cyclo converter) Diesel electric and Turbo electric propulsion system, pod / Azipod drive unit, superconductivity applied in propulsion, special electrical practice for oil, gas and chemical Tankers (Tanker classification, Dangerous spaces, Hazardous zones, Temperature class), Flame proof Ex 'd' and intrinsic safety Ex 'i', Ex 'e', and Ex 'n' equipments and their applications in zones, Maintenance of Ex-protected apparatus. 18 Hrs

High Voltage: With regard to merchant vessels: Introduction, safety briefing and objectives of the course. High voltage technology and application on board ships, concepts and definitions. Electrical hazards associated with high voltage system e.g. electrical shock, arc flash and arc blast and their precaution. Earthing system (NER). Permits (EPW) and procedures for preventing accidents while carrying out maintenance and repair. High voltage circuit breakers (Vacuum type and sf₆ Type), Personal Protective Device. 8 Hrs

Safe Electrical Practice : Safe watch

keeping, points to check on electrical machineries, Switch gears & equipments, microprocess or control and maintenance, electrical fire fighting, precautions against electric shock and related hazards. 6 Hrs

REFERENCE BOOKS:

1. Marine Electrical Technology by Elstan a Fernandez
2. Marine electrical practice by BOWIC
3. Electricity applied to Marine engineering W. LAW
4. Marine Electrical Practice G. O. Watson
5. Practical Marine Electrical Knowledge Dennis T. Hall
6. An Introduction to Electrical Instrumentation B.A. Gregory
7. High voltage Engineering by M. S. Naidu, V. Kamaraju Tata McGraw-Hill Education
8. High voltage Engineering fundamentals by Kuffel

SEMESTER VI

UG11T3604	MARINE AUXILIARY MACHINERY – II	72 HRS
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OBJECTIVE: *To impart sound knowledge about working principle, system components, operation of refrigeration and air conditioning, deck machinery and pollution prevention methods.*

Refrigeration: Principles of refrigeration, overview of refrigeration cycles, different refrigeration systems, classifications of refrigerators, cryogenic technology – definition, temperature range, insulation.

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

Design and construction of various components of refrigeration plants, i.e, compressor, condenser, evaporator, expansion v/vs, control & safety equipments.

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

16 Hrs

Reefer Ships: Refrigeration of cargo holds, brine system and it’s operation & maintenance, methods of air circulation in holds, insulating materials, micro-organism control, dead and live cargo, factors affecting refrigerated cargo. Container ship refrigeration, preparation for loading, cargo survey of refrigeration equipment

6 Hrs

Air Conditioning and Air Handling Unit (AHU): Necessity on board ships, different systems, control of room air temperature, humidity, noise, dust and purity. Construction of duct, arrangement of Cooling & dehumidification, heating and humidification. Fans and diffusers – types and selection, ventilation of accommodation, fire safety of the system.

6 Hrs

Ventilation : Ventilation of engine room – principles, volumetric calculations – combustion air requirement etc., fan / blowers types, pressure loss in ducting, noise and power consumption, safety trips testing of flaps / fire dampers. Pump room, CO₂ and battery rooms, air change requirements (as per SOLAS), design considerations, maintenance.

6 Hrs

Noise and Vibrations: Elements of aerodynamics and hydrodynamics sound, Noise Sources on Ships and noise suppression techniques, Noise level measurement. Various modes of vibration in a ship (i.e. free, forced, transverse, axial, torsional – Their sources and effects), Resonance and critical speed, Structure borne and air borne vibration, Anti vibration mountings of machineries. De-tuners, Dampers with reference to torsional vibration, use of torsionographs

9 Hrs

Overhauling of Auxiliary Machinery: Planning for overhaul, stand-by equipment, tools, spares, manpower, Safety procedures - work permit, isolation - lock out / Tag out. Overhauling machinery like - a compressor, pumps – one for each type, purifier, generator engine, oil burning equipment, valves, cleaning filters etc.

8 Hrs

Technical Specification for Ship Stores and Spares: Introduction to types, measurement and identification of industrial supplies – tools, bearings, sealings – O-rings, Gaskets, Gland Packing & other sealants – silicon, forma-gaskets, Valves, Pipes, Steels – bars, bulbs, angles etc.

8 Hrs

Fuels: Study of primary fuels: Coal, Petroleum, Natural Gas, treatment of fuels for combustion in marine ICE and steam plants, Residual Fuels, Emulsified Fuels

4

Hrs

Lubrication: Theory of lubrication; suitability of lubricant for various uses; Additives in oil and their specific use; Loading pattern of various bearings in marine use and lubrication system adopted.

9Hrs

REFERENCE BOOKS:

1. Marine Engineering Practice - IME Publication
2. Refrigeration at Sea - J . R. Stot
3. Marine Airconditioning - S. D. Srivastava
4. Advanced Marine Engineering - J.K. Dhar
5. General Engineering Knowledge - H.D. McGeorge
6. Marine Auxiliary Machinery - H.D. McGeorge
7. Engine Stores / Spares Catalouges
8. General Engineering Knowledge for Marine Engineers - Reeds Volume:8
9. Marine Machineries- Operation & Maintenance – T.B. Srinivasan, IMEI Publication.
10. The Running & Maintenance of Marine Machinery – J. Cowley by IMEI Publication.

SEMESTER VI

UG11T3605	NAVAL ARCHITECTURE – II	72 HRS
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OBJECTIVE: To impart knowledge of ship resistance, propulsion, manoeuvring and sea keeping to students.

Ship Resistance and Powering: Components of ship resistance; Determination of ship resistance. Model experiments, Froude's Law of comparison, Effective power calculations, Ship correlation factor (SCF), Admiralty coefficient, Fuel coefficient and Fuel consumption. Application of ITTC method.

10 Hrs

Propulsion of Ships and Propellers: Propellers - geometry terminology. Apparent and real slip. Power and efficiencies in ship propulsion system. QPC, Law of similitude and model tests with propellers, Open water characteristics Propeller diagrams. Wake and wake distribution. Thrust deduction fraction, Cavitation – cavitating flows, types of propeller cavitation, detrimental effects of cavitation, criteria for prevention of cavitation. Special types of propeller arrangements – FPP,

CPP, Propellers in Nozzles, Paddle wheel, Vertical axis propellers – Voith Schneider, Jet propellers. Ship model correlation, ship trials.

15 Hrs

Propeller Design Theories: Simple theories of propeller action, Momentum theory of the propeller, Blade element theory, Circulation theory, Lifting line theory.

7 Hrs

Ship Propeller and Machinery Interaction: Propulsion machinery layout, Ship propeller interaction, influence of condition of the ship, number of propeller blades, propeller area ratio, pitch ratio, service condition, wake and thrust deduction, interaction at extreme loading, specification of speed power and rate of revolution, choice of design point, Engine propeller matching, choice of propeller, ship trials, acceleration and retardation tests.

12 Hrs

Rudder Theory: Basic requirements of rudder. Physics of control surfaces Properties of hydrofoils – lift and drag. Action of the rudder in turning a ship. Rudder nomenclature. Types of rudders. Area and shape of rudder, position of rudder, stern rudders & bow rudders, Forces on rudder. Torque on stock. Angle of heel when turning, Controllability of ships, Directional stability definitions, Measures of manoeuvrability. Model experiments and full scale manoeuvring trials – course keeping, course changing, emergency manoeuvre qualities, turning test, Z-manoevre test, modified Z-manoevre test, direct spiral test, reversed spiral test, pull-out test, stopping test, stopping inertia test, new course keeping test, man-overboard test, parallel course manoeuvre test, initial turning test, accelerating turning test, acceleration / deceleration test, thruster test, minimum revolution test, crash ahead test. Manoeuvrability activities of IMO

16 Hrs

Motion of Ship on Waves: Theory of waves. Trochoidal waves. Sinusoidal waves. Irregular wave pattern, Wave spectra, Ship motions – Roll pitch yaw surge, sway and yaw. Forces caused by ship motions. Anti-rolling devices.

12 Hrs

REFERENCE BOOKS:

1. Resistance and Propulsion of Ships – Sv AA Harvald
2. Principles of Naval Architecture – Vol II – Edward V Lewis (SNAME)
3. Wind Waves: Their Generation and Propagation on the Ocean Surface – by Blair Kinsman
4. Basic Ship Propulsion – J.P.Ghose & R.P.Gokarn
5. Naval Architecture for Marine Engineers – Reeds Volume:4
6. Marine Propellers and Propulsion – John Carlton
7. Ship resistance and propulsion – F. Mollan
8. Introduction to Naval Architecture – Eric Tupper
9. Ship Structure – IMEI publication

SEMESTER – VI

UG11T3606	MANAGEMENT SCIENCE AND ECONOMICS	72 HRS
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OBJECTIVE: *Introduction to Management, Accounting and Finance Management, Production & Operations Management, HRD and Economics.*

MANAGEMENT SCIENCE:

Introduction to Management Principles and Practice:

Definition and objectives of sound management. Need for Sound Management Principles and Practice & Growth of Modern management thought, Management functions, Process Planning, Corporation / Long term & tactical strategy, Policy distribution, SWOT Analyses, Organising – definition / illustrations, Staffing – manpower, planning, Directing - illustration, Controlling, parameters, application & Co-ordination; communication – efficient process model, communication & barriers, inter-personnel communication skill. Developing Organisation Structure. Various types of organizational structures – Line / staff / matrix, centralization vs. decentralization of decision making, distinction between authority / responsibility / accountability, Basic principles of delegation / empowerment of employees; Authority & Responsibility. Boundaries of Authority.

10 Hrs

Accounting and Finance Management:

Methods of Capital formation & Control of Working Capital, How to read balance sheet / Profit / Loss, Budgetary Control & standard costing – Favourable / Adverse variances. Continuous & Discounted Cash Flow & Project Appraisal, Break even Analysis, Cost Benefit Analysis, Methods of Depreciation, Factory Costing, Estimating, Balance Sheet, Financial & Physical Ratios; Project & Budgetary Control.

6 Hrs

Production and Operations Management:

Factors of production, Distinction between products & services, Types of production system viz. Jobbing / Lot / Mass. Functions of Production Planning and Control, Product Development Principles, Standardization, Simplification & Specialization, Plant Layout, Product / Process, Logistics & supply chain / management. Integrated material management – Functions of material planning, inventory control, safety stock / cycle stock, purchase / stores performance, measurement parameters, standardization / codification, waste control. Introduction to Operations Research. Linear Programming, Distribution Methods, Network Technique in Management – Critical Path Method (CPM), Programme Evaluation & Review Technique (PERT). Resources Allocation & Loading smoothing, Operational Sales Forecasting; Works Study, Job Evaluation & Merit Rating, Total Quality Management – Quality Control, ISO 9000 series, Preventive / condition based Maintenance & spare management.

10 Hrs

Human Resource Development (HRD):

The personnel Function, Selection & Recruitment, Role of Psychological Tests in Recruitments, Training of employees, Performance Appraisal & counseling, Reward System, Legal Requirements and Regulation of Working Condition, Employer's Liabilities for Health and Safety, MBO, Leadership / Group Dynamics and Discipline, Motivation theories and Incentives, Maslow's hierarchy of needs theory, X and Y theory, Herzberg's Hygienic and motivational theory, Elton Mayo's contribution. Problems of Accident – Preventions, Fatigue, Relation with Trade, Union & Workers Participation in Management.

8 Hrs

Ability to apply task & work load management – communication, team building, planning & co-ordination, personal assignments, time & resource constrains. Prioritization. Effective communication onboard & ashore.

2 Hrs

ECONOMICS:

Importance of economics in Marine Engineering study, Basic economic concepts and terms, Demand analysis, Supply analysis, Elasticity of demand, Elasticity of supply.

4 Hrs

Production function, Law of return, Economics of scale, Iso-product and Iso-cost, Cost-concepts, Cost-output relationship and cost curves in short period, Long period, Revenue – concept, Determination of price under free market and price control by Govt. Types of market, Factors governing extent of market, Pricing under perfect competition, Monopoly, Monopolistic competition and oligopoly.

10 Hrs

Money: Types, Functions, Standard. Inflation: Types, Causes. Commercial Banks – Functions, Functions of Central Banks. Features of Money and Capital market. National Income concepts.

4 Hrs

Taxation: Direct and Indirect, Govt. Budgets. Economic development, Growth, features of underdevelopment with reference to India. Globalisation of Indian economics.

4 Hrs

Differences Between Domestic and Foreign Trade. Basis of International Trade:

Trade-theories. Free-Trade Vs Protection. Balance of payments – components, causes of deficit , steps to correct deficit. Exchange-Rates :- Types, determination, Devaluation of currency. Free-convertibility of currency with reference to Indian Rupee. Functions of I.M.F, World Bank, W.T.O.

6 Hrs

Shipping Routes and Ports: Major Shipping Routes & Ports, Types, Problems, factors for good port. Major & Minor ports of India, their location and importance. Deep-sea fishing, Major sea-fishing zones, Off-shore oil producing zones. India’s overseas Trade and Economic Importance with reference to Economic zones.

8 Hrs

REFERENCES BOOKS:

REFERENCES BOOKS:

1. Economics
- Gangopadhyay
2. Modern Office Management
- Mills, Standingford, Appleby
3. Thomas Sowell, Basic Economics- A Common Sense Guide to the Economy, Basic Books
4. Prasanna Chandra –Finance Sense – Mc Graw Hill Education.
5. Dressler G & Varkey, Human Resource Management, Pearson Education.

SEMESTER - VI

UG11T3607	MARINE STEAM ENGINEERING	54 HRS
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Objective: *To develop knowledge of Cadets on various types of Steam machinery
Both construction and operation*

Steam Engines: Rankine Cycle & Modified Rankine Cycle. Comparison between steam Reciprocating Engine and Steam turbine. Reasons why steam Reciprocating Engines could not survive. Basic problems on Rankine Cycle with Superheating & Sub cooling

2 Hrs

Layout of Plant: General layout of plant & description of a modern geared steam turbine installation including auxiliaries in modern steam ships. Details of scoop system & fitting of Astern Turbine

2 Hrs

Types of Steam Turbines: Description of different types of steam turbines. Impulse, Simple, Pressure Compounded, Velocity Compounded, Pressure & Velocity Compounded. Reaction Turbines and Dummy Piston with equalizing pipe. Double flow Turbine, Double Casing Turbine, Reheat Turbine , Single Cylinder Turbine, Single Plane Turbines.

10 Hrs

Constructional Details: Types of blades, method of fixing, End-tightened blades, Taper & twisted Blades, Shrouding & Lacing of Blades. Types of Rotors - solid, built up, drum type & Gashed type Rotors for impulse and reaction turbines. Diaphragms, nozzles, glands, carbon glands, labyrinth packing glands, main bearings, thrust bearing and turbine casing.

12 Hrs

Lubrication of Turbines: Suitable oils and their properties, lubrication of main bearings, thrust bearings and gears. Gravity and pressure lubrication – oil system and emergency lubrication arrangement. Care & Testing of lubricating oil.

3 Hrs

Reduction Gears: Reduction ratio, Hunting tooth arrangement, type of gear teeth, various arrangements of marine gearing. Gear defects, flexible couplings of different types, quill shaft.

5 Hrs

Condensers: Shapes and types of condensers, constructional details, location & method of securing, working principles, contraction and expansion allowances, leak test. Effect of change of temperature, circulating water quantity, change of main engine power, tube leakage & cleanliness.

Protection of tubes and tube renewal. Reasons, sources and prevention of air leakage in condensers, material used for condensers.

5 Hrs

Operation and Maintenance: Turbine drain system, turbine gland steam system, warming through procedure of a turbine plant, control of speed and power of propulsion, throttle valve control and nozzle control, emergency operation of turbines, breakdown and fault finding, emergency control devices and complete emergency control systems for main turbine plant. Bridge control of turbine machinery. Vibration in marine steam turbines, reasons & remedies, steam turbine losses & methods to prevent.

10 Hrs

Alignment Checking: Bridge gauge and Poker gauge, allowances for expansion, sliding foot, thrust bearing, static and dynamic balancing.

3Hrs

Selection of Materials : Materials used in various components like blades, Nozzles, Rotors, Casings, Sealing glands, Gears & their justification.

2Hrs

REFERENCE BOOKS:

1. Steam turbine theory & practice - J. Kearton
2. Boiler Control System - David Lindsley
3. Steam Turbine Operation - J. Kearton
4. Marine Steam Engines and turbines - S C. Mcbirnie
5. Steam Turbine - GJ Roy
6. Applied Thermodynamics – T.D.Eastop and A.Mcconkey
7. Thermodynamics – Yunus A Cengel and M.A. Boles – An Engineering approach
8. Basic Engineering Thermodynamics – Joel Rayner
9. Steam Engineering Knowledge for Marine Engineers – Reeds Volume:9