

INDIAN MARITIME UNIVERSITY

THIRD YEAR

SEMESTER – V

UG/MS/MS/T/1501	MARINE ELECTRO-TECHNOLOGY PAPER – 3 UG22T2501	72 hrs.
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Theory – 50 marks

SECTION – A (Electrical Machines)

[36 hrs]

Unit 1 : Induction motor

Principle, construction, types, squirrel cage and phase wound, rotating field, 3 phase supply, mathematical proof, slip, frequency, relation between torque, effect of supply voltage on torque, rotor emf and reactance under running condition, torque under running condition, conditions for maximum torque, effect of frequency on torque and running condition, breakdown torque, slip, full load torque, torque speed curve, current speed curve, plugging of induction motor, induction motor as a generator, measurement of slip, power stages, torque equation, generalised transformer, equivalent circuit, power balance equation, maximum power output, circle diagram, no load test, blocked rotor test, construction of circle diagram, maximum quantities, starting of induction motor, different methods of starting of squirrel cage and slip ring motors, magnetic locking, double cage induction motors, equivalent circuit, speed control using different methods. Classes of induction motors, numericals.

Unit 2 : Single phase induction motors

Principle, self starting, different types of single phase induction motors, equivalent circuit, capacitor start motors, shaded pole induction motors, repulsion type induction motors, AC series motor, universal motor, speed control of universal motors, unexcited single phase synchronous motor, reluctance motor, hysteresis motor.

Unit 3 : Alternators

Principle, construction, different types, windings, two layer windings, star or delta, speed frequency equation, pitch factor, distribution factor, equation of emf, factors affecting size, alternator on load, synchronous reactance, armature reaction, effect of power factor, reactance, phasor diagrams, voltage regulation, methods of determination of voltage regulation, operation of synchronous machines, phasor diagrams and calculations, power developed, synchronizing of alternators, synchronizing current, synchronizing torque, infinite busbars, parallel operation of two alternators, distribution of load, oscillations, maximum power output, numericals.

Unit 4 : Synchronous motor

Principle, method of starting, motor on load with constant excitation, power flow, power developed, motor with different excitation, effect of increased load with constant excitation, effect of changing excitation with constant load, different torques, power developed by synchronous motor, salient pole synchronous motor, power developed by a salient pole synchronous motor, effect of field current on armature current and power factor, methods of starting, procedure for starting a synchronous motor, comparison between synchronous and induction motors, applications, numericals.

Unit 5 : Transformers

3 phase transformer, Y-Y connection, delta-delta connection, Y - delta connection, delta – Y connection, open delta connection, Scott connection, 3 phase to 2 phase conversion and vice versa, Parallel operation of 3 phase transformer, instrument transformer current transformer, potential transformer, numericals.

Unit 6 : Transmission of power

Transmission of power, transmission of DC power, 2 wire and 3 wire systems, voltage drop and transmission efficiency, methods of feeding of distributors, Ring distributor, current loading and load point voltage in a 3 wire system, 3 wire system, balancer, booster, comparison of 3 wire and 2 wire system. High voltage system, distribution and propulsion using high voltage.

Unit 7 : Ship's power supply

Power supply and distribution in ships, main switch boards and sub switchboards and safety devices fitted, main circuit breaker, trips and protective devices, preferential trips, synchronizing and paralleling by synchroscope and 3 lamps, load sharing between alternators, frequency and voltage droop, slipping and brushless alternators, earthing, starters for marine motors, protective devices in motors, Insulation of marine electrical machines, measurement of insulation, improvement of insulation, flameproof and intrinsically safe equipment for tankers. Maintenance of switch boards and circuit breakers, safe electrical equipment in tankers, emergency power supply in different ships, emergency switch board, basic regulations regarding marine electrical equipment and their operation. High voltage generation, distribution, uses & safeties.

Unit 8 : Emergency power source

Acid and alkaline batteries, construction and chemical reactions, charging and discharging diagrams, Ampere hour and watt hour efficiency, properties of acid and alkaline batteries, trickle charging circuit diagram ; description of emergency generator, starting arrangement , maintenance ; emergency power supply circuit diagram. Shore connection.

Unit 9 : Marine electrical equipment & Alarm System

Engine Room Telegraph, Rudder Angle Indicator, RPM. & 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.

Unit 10 : Maintenance of Electrical Systems

Fault finding & Repair : Type of faults & indications on Generator, motor & distribution systems, Use of different Testing equipments & meters (multimeter/ megger, clampmeter, etc.), Salvaging a motor Detection of faults on electronic circuits & cards - Indications & corrective arrangements, Necessary Precautions & care while fault finding and Repair, preventative maintenance, periodic surveys, spares requirement.

Unit : 11 : Electric propulsion

Diesel-electric and Turbo electric propulsion system, Azipod drive unit, superconductivity applied in propulsion

Unit 12 : Regulations

Regulations for marine electrical equipment, emergency power supplies in passenger ships, cargo ships, main switch boards, protection systems, steering, shore supply, submersible bilge pumps, fire protection systems, short circuits and overloads, reverse power trips, navigation lights, installation of batteries.

PRACTICAL

Code No. : P1501

Practical : 36 hrs.

1. AC three phase generator testing.
2. AC brushless generator testing.
3. AC single phase motor testing.
4. AC repulsion motor testing.
5. AC synchronous motor testing.
6. Single phase induction motor.
7. Study of three phase induction motor and maintenance training .
8. Study of pole changing in three phase induction motors.
9. Training on Safe watch-keeping, precautions against electric shock and related hazards.
10. Tracing of wiring of a motor starter.
11. Training on Switch gears & equipments.
12. Training on microprocessor control and maintenance.
13. Training on electrical starters (Soft starter , DOL starter, Star-delta starter, Auto Transfer starter)
14. Testing of transfer and calculation of efficiency.
15. D.C. position control demonstration system.
16. D.C. speed control demonstration system.

NOTE :

- 1) There will be continuous assessment of skills being acquired through class-work, practicals and periodic assignments / project works / tests / orals etc.
- 2) At least 14 experiments must be conducted by each student .
- 3) Laboratory journal are to be submitted for assessment at the end of each term .

References :

1. A text Book of Electrotechnology, volume 1, Basic Electrical Engineering, by B. L. Theraja.
2. A Text Book of Electrotechnology, volume 2, AC and DC machines, by B. L. Therraja and A. K. Theraja.

3. A Text Book of Electrotechnology, volume 3, Transmission Distribution Utilisation, by B. L. Theraja and A. K. Theraja.
4. Marine Electrotechnology by Reeds, volume – 6 and 7.
5. Marine Electrotechnology by Mc George.
6. Marine Control Practice by Taylor.
7. Instrumentation and Control Systems by Reeds, volume – 10 (new edition).

INDIAN MARITIME UNIVERSITY

THIRD YEAR

SEMESTER – V

UG/MS/MS/T/1502	PRACTICAL CELESTIAL NAVIGATION (THEORY) UG22T2502	72 hrs.
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Theory - 50 Marks

SECTION – A (CELESTIAL NAVIGATION) [36 Hrs]

Unit 1.- RISING SETTING OF CELESTIAL BODIES AND TWILIGHT

Twilight - Civil, nautical and astronomical - conditions necessary for twilight all night; calculation of time of twilight by perusal of almanac with appropriate corrections, simple calculations based on above. Theoretical Sun rising and Sunset, Moon rise and Moon set.

Unit 2 : CIRCUMPOLAR BODIES

Circumpolar bodies; conditions necessary for a body to be circumpolar. Maximum azimuth. Problems based on these topics.

Unit 3 : ERRORS IN POSITION LINES

Error in Intercept due to error in altitude, Error in long due to error in altitude, Error in long. due to error in time, Error in longitude due to error in latitude, Error in intercept due to error in latitude.

Unit 4 : TIDES

Relationship between tides & phases of the moon - spring and neap tides; priming & lagging.

Unit 5 : CALCULATION IN NAUTICAL ASTRONOMY

Calculations based on 1st & 2nd year's portion of Principles of Navigation. together with (1) to (4) above.

SECTION – B (PRACTICALS OF NAVIGATION) [36 Hrs]

Unit 6 : OBSERVATION OF CELESTIAL BODIES

- (a) To find the true Azimuth of a heavenly body, the compass error and hence the deviation of the magnetic compass for the direction of the ship's head (ABC Tables).
- (b) To find the compass error and deviation from amplitude of sun and moon.
- (c) To find the latitude by meridional altitude of a heavenly body. To calculate meridian passage time and approx. Meridian altitude for setting on the sextant (computed altitude). Latitude and position line by observation of polaris.
- (d) From an observation of any heavenly body near the meridian, to find the direction of the position line and the latitude corresponding to the D.R. longitude through which the PL passes. Time limits for Ex – meridian sight.
- (e) To find the longitude corresponding to the D.R. latitude through which the position line passes and the direction of position line from an observation of any heavenly body. (Long. by chron)
- (f) To find the intercept, Intercept termination point and direction of position line from an observation of any heavenly body. (Intercept Method)

Unit 7 : COMPUTATION OF ALTITUDES

Computation of altitudes for Sun, Polestar, Planets and Moon.

Unit 8 : STAR

Star identification, Stars suitable for observations.

Unit 9 : ALTITUDES

Altitudes above and below the pole of Celestial Bodies.

Unit 10 : SPHERICAL TRIANGLES

Solution of Spherical triangle by Haversine formula. Sine formula. Cosine formula,

Four part formula & Napier's Analogies.

Application of right angled & quadrantal spherical triangles.

Unit 11 : GRAPHICAL COMBINATION OF SIGHTS

To obtain a position by use of position lines obtained from two more observations with or Without run (Simultaneous or staggered). The cocked hat and its interpretations.

Unit 12 : GREAT CIRCLE SAILING

Practical problems on Great Circle sailing. Use of ABC tables to find initial course, final course. Pole and Vertex of a Great Circle, & great circle distance. Practical problems on composite circle.

Unit 13 : CALCULATION IN NAUTICAL ASTRONOMY

Calculations based on 1st & 2nd year's portion of Practical Navigation. together with (1) to (8) above.

PRACTICAL

Code No. : P1502

Practical : 36 hrs.

1. SEXTANT:

- (i) To use Sextant for the accurate measurement of vertical & horizontal sextant angles.
- (ii) To identify adjustable errors of the sextant and to correct such errors.
- (iii) To measure altitudes of heavenly bodies when possible and do sight calculation.
- (iv) To use sextant for altitude of heavenly bodies viz. Sun, Stars, Planets and Moon – thence to correct the sextant altitude to 'True ah. Required for astronomical calculations.

2. GYRO COMPASS :

- (i) To know procedure of starting & stopping of Gyro Compass.
- (ii) Routine maintenance.
- (iii) Use of Azimuth ring to take bearings of both celestial and terrestrial objects.

3. MAGNETIC COMPASS :

- (i) To know working of and procedure to take bearings of both celestial and terrestrial from Magnetic Compass.
- (ii) To know Routine maintenance.

4. AZIMUTH MIRROR AND PELORUS

- (i) To know working of and procedure to take bearings of both celestial and terrestrial. From Azimuth Mirror.
- (ii) To know working of and procedure to take bearings of both celestial and terrestrial. From pelorus.

Books recommended for reference:

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|------------------------------------------------|-------------------------------------------|
| 1. Principles of Navigation | : Capt P.M. Sarma |
| 2. Practical Navigation | : Capt. H. Subramaniam |
| 3. Principles of Navigation | : Capt. T.K. Joseph & Capt. S.S.S. Rewari |
| 4. Principles and Practice of Navigation | : A. Frost |
| 5. Admiralty Manual of Navigation Volume I& II | : HMSO |
| 6. Nicholls Concise Guide Vol. I& II | : Brown & Ferguson |

INDIAN MARITIME UNIVERSITY

THIRD YEAR

SEMESTER – V

UG/MS/MS/T/1503	BRIDGE WATCHKEEPING & EMERGENCIES PAPER - 3 UG22T2503	72 hrs.
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Theory - 50 marks

SECTION – A (COLLISION PREVENTION) [12 hrs]

Unit 1 :

International Regulations for prevention of collisions at sea, 1972 , covering all the Rules along with Annexes with thorough knowledge

Precautions while using floating navigational aids, such as buoys, light vessels etc.

SECTION – B (BRIDGE WATCHKEEPING & EQUIPEMENTS) [30 hrs]

Unit 2 : The Magnetism of the Earth and the Ship's Deviation

Theory of magnetism as applied to ferromagnetic materials, simple magnet, magnetic field around a magnet, qualitatively flux density and field strength. Magnetic induction and differences between 'hard' and 'soft' iron.

Explain (a) Intensity of magnetization (b) Permeability (c) Magnetic susceptibility (no mathematical formula required).

Magnetic field of the earth, 'magnetic poles' and 'magnetic equator, 'angle of dip'.

Explain how the earth's total field can be split into horizontal and vertical components. Define 'magnetic variation' and changes. Behaviour of a compass needle .

Effect of introducing a disturbing magnetic force on compass needle, represent magnetic field by a vector and use vector diagram to find the field at a point resulting from two given fields. State that a compass needle will align itself with the resultant field, magnetic moment of a bar magnet

. Show that in magnetic field, T^2 is proportional to $1/H$, where T is the period of vibration and H is the field strength.

Unit 3 : The Magnetic Compass

Construction of a liquid card magnetic compass, show parts by sketch , operation & operational problems , handling , maintenance , care required for proper operation of compass , checking errors , finding error of standard compass by gyro-compass . Use of compass for taking bearings of celestial bodies and land mark .

Unit 4 : The Gyro-Compass

Describe a free gyroscope and its gimbal mountings. Effect of absence of disturbing forces. Gyroscopic inertia and precession. Precession resulting from a torque about axes perpendicular to the spin axis. Friction at gimbal pivots . State that the rate of precession is proportional to the applied torque. Define 'tilt' & 'drift' , apparent movement of a free gyroscope on the earth's surface, given its position and initial attitude. Use the apparent motion of a celestial body in the direction of the gyro axis to aid the description in the above objective. North-seeking . Damping in azimuth and damping in tilt . control and damping by ballistic elements . Support, control and damping arrangements of gyro-compass . Maintaining the heading indication in line with the axis of the gyro , transmission of heading to repeaters .

Starting of the gyro-compass , time required to settle , reduction of settling time . List the settings to be made or adjusted while the compass is in use. Starting & alignment of repeater system . Use of gyro input to the direction-finder. Gyro heading input to supplied to a radar installation , alarms fitted to a gyro-compass

Unit 5 :

Compass Corrections

Defines true, magnetic and compass north. Find deviation and variation from tables and charts. Calculate true course from compass course, compass course from true course. Measure compass error, using a transit bearing. Apply compass error to the ship's head and compass bearing to convert to true. Take a compass bearing of a charted object and lays the true bearing off on the chart.

Errors of the Compass and Azimuths

Obtain the error of the magnetic compass or gyro-compass by standard procedure using data from various established sources Application of variations to the error of the magnetic compass to find the deviations for the direction of the ship's head. Calculate compass error and gyro error, from transit bearings and bearings to distant fixed objects.

Electronic Charts Display and Information System (ECDIS) : Principle of ECDIS;
Comparison of ECDIS and paper charts : IMO requirements for ECDIS.

Unit 6 :

Rate of turn indicator :General Description, advantages and precaution while using rate of turn indicator.

Automatic identification system : General Description and working of AIS.

Voyage data recorder : General Description, advantage, working and precaution while using voyage data recorder.

SECTION – C (WATCH KEEPING & EMERGENCIES)

[36 hrs]

Unit 7 : WATCH KEEPING

Watch keeping at sea. at anchor & in port. Taking over. keeping and handing over of a watch.

Preparation for proceeding to sea. making port and entering harbours.

Berthing alongside and leaving quays under various conditions of wind & tide.

Knowledge of manoeuvring trials. measured mile, angle of heel when turning, stopping distance, turning circles, advance, etc. Shallow water effect, Interaction. Turning ship short round, emergency manoeuvres , Man overboard.

Unit 8 : CONTINGENCY PLANNING

Contingency plans for response to emergencies, Contents of muster list; Remote control operations; command team; Emergency team; Back-up team and engine room team; Need of good communication; actions taken in various emergencies.

Unit 9 : PASSENGER PROTECTION & SAFETY

Measures which should be taken in emergencies for the protection and safety of the ship, passenger and crew, Precautions for the protection and safety of passengers in emergency situations, Warning the passengers; evacuating all passengers; taking a roll call; instructing passengers during drills and supply of blankets.

Unit 10 : GROUNDING (BEACHING AND STRANDING)

Precautions to be taken when beaching a vessel, circumstances when the vessel can be beached; Procedure of beaching. Actions to be taken on stranding / grounding Initial damage assessment and control; sounding of compartments.

Unit 11 : COLLISION

Actions to be taken following a collision, Initial damage assessment and control; stoppage of engine; repairing lifeboat; distress or urgency signals.

Unit 12 : FIRE / EXPLOSION

Means of limiting damage and salving the ship following a fire or explosion, Cooling of compartment boundaries; inspection for damage.

Unit 13 : ABANDON SHIP

Procedure for abandoning ship, Transmission of distress call until acknowledged; extra food and blanket; emergency radio; warm clothing and life jackets; launching of boats and life rafts in heavy weather; use of rocket line throwing appliances and breeches buoy.

Unit 14 : STEERING GEAR FAILURE / LOSS OF RUDDER

Use of auxiliary steering gear and the rigging and use of jury steering arrangements
Arrangement of auxiliary steering gear; securing the rudder in the event of a broken rudder stock; constructing a jury rudder.

Unit 15 : TOWING

Arrangements for towing and being taken in tow , Towing gears on board ship; method of towing disabled ship; communication between two ships. Rescue of persons from sea or from a vessel in distress. Use of oil in rough weather; waiting for day light; Providing a lea; Method of rescue when sea conditions are too dangerous to use boat, Actions for emergencies in port.

Unit 16 : IMO INTERNATIONAL AERONAUTICAL AND MARITIME SEARCH AND RESCUE MANUAL

Knowledge of the contents of the IMO International Aeronautical and Maritime Search and Rescue Manual (IAMSAR).

Unit 17 : MAN OVERBOARD

The effects of various deadweight, draughts, trim, speed and under full clearance on turning circles and stopping distances, Advance; Transfer; Drift angle; Tactical diameter; Track reach; Head reach; Side reach; Turning circles of a ship; Directional stability. Effect of wind and current on ship handling, Effect of wind on a given ship while moving and when making large turns; effect of current on the motion of the ship; use of anchor to dredge down with a current. Squat, shallow-water and similar effects, Shallow water, squat and blockage factor. Manoeuvres for the rescue of a man overboard, Immediate action, delayed action and person missing situations; single term; Williamson turn and Scharnow turn; Sequence of actions when a person is seen to fall overboard.

Unit 18 : ANCHOR, CABLES AND WINDLASS

Anchor work - different types of anchors, their advantages/disadvantages, cables & their care, Anchoring to single anchor. Proper procedures for anchoring and mooring, Procedure for anchoring; use of anchor buoys; marking of the cable; sealing of spurling pipes; joining of two mooring ropes; shipwise; rigging pilot ladder; making fast tugs; using fender during berthing.

PRACTICAL

Code No. : P1503

Practical : 36 hrs.

COLLISION PREVENTION

- (i) To identify various collision situations by day and by night. Practicals to be held using a magnetic board, wooden models, overhead projector, video tapes or any other aid to simulate such conditions.
- (ii) To be required to deal with each collision situation broadly under the headings – ‘recognition’, ‘responsibility’, ‘action’, ‘appropriate sound signal’ and ‘ordinary practice of seamanship’.
- (iii) To identify Collision situations in restricted visibility with or without Radar. Statutory obligations under both circumstances.
- (iv) To recognise various buoys and mark under IALA system and appropriate actions required under the rules.

[at least 4 tasks to be completed]

BRIDGE EQUIPEMENT: (On simulator)

- (i) Gyro-compass Familiarization with various types of Gyro-compasses used on Merchant Navy ships Explain procedure starting and stopping and routine maintenance.
- (ii) Familiarization and working of ECDIS.
- (iii) Familiarization and working of AIS.
- (iv) Familiarization and working of VDR.
- (v) Familiarization and working of Rate of turn indicator .

[At least 4 tasks to be completed]

BOOKS FOR REFERENCE

- | | |
|---------------------------------------|----------------------------|
| 1. Ships Magnetism & Magnetic compass | : F.G. Merrifield |
| 2. Compass Work | : Kemp & Young |
| 3. Bridge Equipment | : G.I. Sonnenberg |
| 4. Shipborne Radar | : Capt. H. Subramaniam |
| 5. Radar and ARPA Manual | : A.G. Bole & W.O. Dineley |

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|-----------------------------------------------------|---------------------------|
| 6. Ships Compass | : Klinkert & Grant |
| 7. Magnetic Compass Deviation & Correction | : W. Denne |
| 8. Gyro Compass for Ships' Officers | : A. Frost |
| 9. 9 Radar Observer's Handbook | : W. Burger |
| 10. Marine Electronic Navigation | : S.F. Appleyard |
| 11. Electronic Aids to Navigation; Position Fixing. | : L. Tetley & D. Calcutta |

INDIAN MARITIME UNIVERSITY

THIRD YEAR

SEMESTER – V

UG/MS/MS/T/1504	MOTOR ENGINEERING KNOWLEDGE PAPER - 4 UG22T2504	72 hrs.
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Theory – 75 marks

Unit 1 : Common Engines in use

Brief description of different makes of diesel engines in marine use. Unique features of individual makes. Development Trends including new generation CAM Shaft Less Engines.

Unit 2 : Safety Devices

Safety and prevention of mishaps in I.C. Engines : Causes and Prevention of crank-case explosions, and Scavenge fires. Detection of same and safety fittings provided to prevent damage, Uptake fire, Starting air line explosion thermal stresses.

Unit 3 : Performance Gauging:

Indicator cards, compression cards; mean indicated pressures; cylinder pressures; heat balance; Indicator diagrams; and Power Calculations : Construction details of indicator instrument. Significance of diagram Power Calculations, fault detection, simple draw cards and out of Phase diagrams. Power balancing, Performance Characteristic Curves, Test bed and Sea trials of diesel engines.

Unit 4 : Noise and Vibrations

Elements of aerodynamics and hydrodynamics sound, Noise ,Sources of noise 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 Anti Vibration mountings of machineries, De-tuners, Dampers) Resonance and Critical speed, Structure borne, and air borne Vibration, Vibrations dampers .

REFERENCE BOOKS :

- J.K.Bowden; Sothern's Marine Diesel Oil Engines. Revised ed.
James Munro & Company Ltd., Glasgow.
- C.C.Pounder; Marine Diesel Oil Engines, Newnes-Butterworth, London.
- J.Cowley ; The running and Maintenance of Marine Machinery, the Institute of
Marine Engineers, London.
- D.A.Taylor: Introduction to Marine Engineering, Butterworth-Heinemann, Oxford.
1996.
- Jackson.L and Morton T. D., Reed's General Engineering Knowledge for Engineers
(vol. 8), Thomas Reed Publication, London.
- D. K. Sanyal - Marine Diesel Engines

INDIAN MARITIME UNIVERSITY

THIRD YEAR

SEMESTER – V

UG/MS/MS/T/1505	MARINE AUXILIARIES PAPER - 3 UG22T2505	54 hrs.
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Theory – 50 marks

MARINE BOILERS [54 hrs]

Unit 1 : Types of boilers

Types of marine boilers. Comparison of smoke tube and water tube boiler; Water tube boiler :Location of heating surfaces, drums, superheaters, etc. General description with sketches of principal types of boilers in marine use. Description of superheater, economizer, air pre-heater and steam air-preheaters. superheat temperature control. Attemperators and de-superheaters. Allowance for expansion of parts. ; Auxiliary vertical boiler :la-mont exhaust gas boiler, scotch boiler, cochran exhaust gas and composite boiler , Waste heat recovery calculation, , forced water circulation boiler, auxiliary steam system and exhaust gas heat exchanger. Gas fired boilers in LNG ships.

Unit 2 : Combustion & furnace

Furnace construction & insulation; liquid and gaseous fuels in marine use. Fuel systems - pumps, heaters, filters, burners, etc. Types of burners - pressure jet atomizer, spill type, variable orifice, steam assisted jet burners. automatic combustion control of main and auxiliary boiler.

Unit 3 : Boiler mounting

Safety valves – High lift, improved high lift, and full bore types. Gauge glass - ordinary plate type and remote water level indicator; automatic feed regulator,; high and low water level alarms, main steam stop valve, retractable type soot blower, control of boilers .

Unit 4 : Operation & care of boilers

Pre-commissioning procedures, hydraulic tests, steam raising and operating procedures. Action in the event of shortage of water, blowing down of boiler, laying up of a boiler; general maintenance, external and internal tube cleaning. Tube renewals, brick work, boiler mountings, boiler casing, boiler water treatment. Survey of boilers and classification societies' requirements. Testing of boiler ,destructive and non-destructive tests on plates, welded seams, tubes, etc. Classification societies' requirements for boiler construction.

Unit 5 : Steam propulsion plant

Construction of condensers, contra-flow and re-generative condenser, tube materials. Open and closed feed systems, advantages of regenerative feed heating; multi-stage air-ejector, feed control valve, extraction pump, de-aerators, feed heaters, control of feed system when maneuvering , Efficient operation of feed system and its maintenance, fault detection and rectification. Control of plant.

Unit 6 : Operation & maintenance of steam plants

Efficient Operation of main propulsion turbines (Steam & Gas), distortion of turbine casing and rotor. Astern operation and heating, opening up turbines for surveys; lifting of turbine casing and rotor and inspection; preventive maintenance, turbine trials, energy losses and heat balance.

RECOMMENDED BOOKS :

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|------------------------------------------------------|---------------------------------|
| 1) The running and Maintenance of Marine Machinery | J. Cowley |
| 2) Marine Auxiliary Machinery | H. D. McGeorge |
| 3) Introduction to Marine Engineering | Taylor D. A |
| 4) Reed's General Engineering for engineers, Vol - 8 | Thomas Reeds publications Ltd . |
| 5) Marine Engineering Practice | IME |

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THIRD YEAR

SEMESTER – V

UG/MS/MS/T/1505	MARINE AUXILIARIES PAPER - 3 UG22T2505	54 hrs.
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Theory – 50 marks

MARINE BOILERS [54 hrs]

Unit 1 : Types of boilers

Types of marine boilers. Comparison of smoke tube and water tube boiler; Water tube boiler :Location of heating surfaces, drums, superheaters, etc. General description with sketches of principal types of boilers in marine use. Description of superheater, economizer, air pre-heater and steam air-preheaters. superheat temperature control. Attemperators and de-superheaters. Allowance for expansion of parts. ; Auxiliary vertical boiler :la-mont exhaust gas boiler, scotch boiler, cochran exhaust gas and composite boiler , Waste heat recovery calculation, , forced water circulation boiler, auxiliary steam system and exhaust gas heat exchanger. Gas fired boilers in LNG ships.

Unit 2 : Combustion & furnace

Furnace construction & insulation; liquid and gaseous fuels in marine use. Fuel systems - pumps, heaters, filters, burners, etc. Types of burners - pressure jet atomizer, spill type, variable orifice, steam assisted jet burners. automatic combustion control of main and auxiliary boiler.

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Safety valves – High lift, improved high lift, and full bore types. Gauge glass - ordinary plate type and remote water level indicator; automatic feed regulator,; high and low water level alarms, main steam stop valve, retractable type soot blower, control of boilers .

Unit 4 : Operation & care of boilers

Pre-commissioning procedures, hydraulic tests, steam raising and operating procedures. Action in the event of shortage of water, blowing down of boiler, laying up of a boiler; general maintenance, external and internal tube cleaning. Tube renewals, brick work, boiler mountings, boiler casing, boiler water treatment. Survey of boilers and classification societies' requirements. Testing of boiler ,destructive and non-destructive tests on plates, welded seams, tubes, etc. Classification societies' requirements for boiler construction.

Unit 5 : Steam propulsion plant

Construction of condensers, contra-flow and re-generative condenser, tube materials. Open and closed feed systems, advantages of regenerative feed heating; multi-stage air-ejector, feed control valve, extraction pump, de-aerators, feed heaters, control of feed system when maneuvering , Efficient operation of feed system and its maintenance, fault detection and rectification. Control of plant.

Unit 6 : Operation & maintenance of steam plants

Efficient Operation of main propulsion turbines (Steam & Gas), distortion of turbine casing and rotor. Astern operation and heating, opening up turbines for surveys; lifting of turbine casing and rotor and inspection; preventive maintenance, turbine trials, energy losses and heat balance.

RECOMMENDED BOOKS :

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| 1) The running and Maintenance of Marine Machinery | J. Cowley |
| 2) Marine Auxiliary Machinery | H. D. McGeorge |
| 3) Introduction to Marine Engineering | Taylor D. A |
| 4) Reed's General Engineering for engineers, Vol - 8 | Thomas Reeds publications Ltd . |
| 5) Marine Engineering Practice | IME |

INDIAN MARITIME UNIVERSITY

THIRD YEAR

SEMESTER – V

UG/MS/MS/T/1506	CARGO HANDLING & STOWAGE <u>UG22T2506</u> PAPER - 1	54 hrs.
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UNIT 1 : CARGO GEAR

- (i) Block: Parts of a block, different types of block, non-toppling and snatch blocks. External binding. Internal binding . Strapped . Markings on a block. Size of a block and sheave , size of rope to be used in a block. Relationship between diameter of sheave and diameter of rope.
- (ii) Tackles: Names of pans of a tackle, using a tackle to advantages or disadvantage. Types of tackles/purchases used on ships.
- (iii) Shackles: Various types. Markings on shackles.
- (iv) Cargo hooks: Various types. Markings on cargo hooks.
- (v) Ropes: Care of ropes and wires used for cargo gear.
- (vi) Derrick rigs: The Union purchase. Setting up of a Union purchase. Importance of preventor guys. Maximum load to be used for angle between runners. Swinging derrick with powered guys. Putting winches in double gear. The Yo-Yo gear .The working of ship's cranes. Hoisting, loading and securing a derrick .
- (vii) Overhauling blocks: Care and maintenance. Reeving a three fold purchase.
- (viii) Hatch-covers: Types of hatches. Opening and closing of McGregor and Hydraulic hatchcovers. Closing arrangements. Battening down a hatch.

UNIT 2 : TRANSPORTATION OF GOODS BY SEA

Categories of cargo, bulk solid, bulk liquid, chemicals in bulk, gas, dangerous goods, general cargo, heavy lifts. Methods of carrying cargoes, tanks, containers, holds, portable tanks aboard ship, RO-RO, refrigerated containers and holds.

UNIT 3 : CARGO CARE

Importance of cargo care to economical operation of ship. Care of cargo on board ship. Securing cargo by using Bull-dog grips and bottle screws. Securing by chains and tensioners. Container lashing and securing . Fire prevention ,interaction, temperature variation leading to sweat damage , sea water damage, ventilation to avoid hazardous gas accumulations, dunnage, separations, bulkheads , Shifting boards

UNIT 4 : STRESSES

- (i) Mechanical advantage, velocity ratio or 'power gained', efficiency of a tackle; relationship between pull on the hauling part and load.
- (ii) Stresses: Calculating the stresses in various parts of a derrick rig. Calculating the tension on ropes and wires of a purchase and finding the correct size to be used.
- (iii) Slings: Types of slings used for lifting cargo of different types. Accident prevention when working cargo.

UNIT 5 : CODES & GUIDELINES OF RELATED RULES / ACTS.

Introduction to codes and guidelines for carriage of bulk cargoes, bulk chemicals, bulk gas.

Planning stowage of general cargo taking into account stowage factor, port rotation, hazardous nature, special stowage requirements relating to cargoes not covered by special codes.

Principles of stowage/securing of all types cargoes taking into account ship's motion at sea.

Factory act. Requirements for annealing and periodical testing of cargo gear, chain register. other requirements of the Factory Act.

Safety of personnel in handling any type of goods using EMS, MFAG, code of safety practices for merchant seaman, (General outline of the knowledge of Indian Dock Labour Regulation). Machinery for handling of cargoes such as: Derrick and rigs, cranes, heavy lift crane/derrick, winches including self tension winch, conveyor belt/chute arrangement, container handling systems.

Infrastructure built in ports for loading and discharging ,such as cranes , gantries, conveyor belt system etc

Calculations relating to above topics where applicable.

BOOKS FOR REFERENCE:

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|-----------------------------------------------------------------|------------------------------------|
| 1. cargo work | : Kemp and Young |
| 2. Seamanship and Cargo Work | : Capt: J. Dinger |
| 3. Cargo work | : Capt. L.G. Taylor |
| 4. Stowage of Cargo | : O.O. Thomas |
| 5. Grain Rules I.M 0. | |
| 6. Code of Safe Practice for Bulk Cargo | : I.M.O. |
| 7 . International Bulk Chemicals code 1986. | : I.M.O. |
| 8. I.M.D.G. Code Consolidated edition 1988 | : I.M.O. |
| 9. Marpol73/78 Consolidated Edition | : I.M 0. |
| 10. Load Line convention I966 | : I.M.O. |
| 11. Guidelines for Tank washing with Crude Oil . | : Institute of Chamber of Shipping |
| 12. The Chemistry of Oil Tankers Fires and the Inert Gas System | : Capt. G.S. Heredia |
| 13. Tanker Handbook for Officers | : Capt. C. Baptist |
| 14. Tanker Practice | : G.A.B. King |

15. Tanker Practice : Rutherford
16. International Safety Guide for Oil Tankers & Terminals (ISGOIT) : International Chamber of Shipping, OCIMF, IAPH
17. Amendments to SOLAS Convention Manual for Maritime Mobile Communication and Maritime Mobile Satellite Communication : I.T.U.
18. International Volume of Radio Signals : HMSO
19. International Code of Signals : I.M 0
20. GMDSS for GOC : Clifford Merchant
21. Cargo Work : Dhananjay Swadi

INDIAN MARITIME UNIVERSITY

THIRD YEAR

SEMESTER – V

UG/MS/MS/T/1507	MARINE ENGINEERING DRAWING & DESIGN UG22T2507	72 hrs.
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Design Work : Student will solve simple problems in design of propeller shaft , Crank shaft, Thrust block, Heat exchanger , Steering Gear , Compressor , riveted joints , cotter joints etc .

LIST OF DRAWINGS

SR. NO.	Name
1	Bilge Suction Strainer.
2	Ship's Side Discharge Valve Chest.
3	Cylinder Relief Valve.
4	Control Valve.
5	Duplex Pump - Water End
6	Oil Fuel Strainer.
7	Parallel Slide Stop Valve.-
8	Gauge Cock & Column.
9	Ballast Chest for Oil or Water.
10	Feed Check Valve.
11	Diesel Air Starting Valve.

12	Gear Pump.
13	Starting Air Pilot Valve.
14	4 - Stroke Diesel Piston and Rod.
15	Automatic Valve for Starting Air System.
16	Starting Air Valve.
17	Burner Carrier.
18	Connecting Rod & Bearings.
19	Quick Closing Sluice Valve.
20	Rudder Carrier Bearing
21	Reducing Valve.
22	4 - Stroke Piston & Rod.
23	Upper Piston & Rod.
24	Telemotor Receiver.
25	Generator Pedestal Bearing.
26	Turbine Flexible or Double claw coupling.
27	Turbine Flexible Coupling.
28	Full Bore Safety Valve.
29	Fuel Valve.
30	Air Inlet Valve.
31	Stern Tube & Tail Shaft.
32	Michell Thrust Block.
33	Turbine Main Gear Wheel
34	Hydraulic Steering Gear.
35	Compressor Piston & Suction Valve.
36	Plate Type Gauge Glass.

NOTE :

1. The teacher will select eighteen (18) drawings from the abovementioned list and explain the assemblies to the students, all of which shall be completed in the class. Six from the remaining drawings shall be considered as unseen for test .
2. There will be continuous assessment of skills being acquired through class-work . All students will have to pass in the continuous assessment .

RECOMMENDED BOOKS :

1. Engineering Drawing :Bhatt
2. Engineering Drawing for Marine Engineers :Reeds
3. Pictorial Drawing book for Marine Engineers :McGibbon
4. Geometrical and Engineering Drawing :Jackson
5. Text book of Engineering Drawing :R. B. Gupta
6. Elementary Engineering Drawing (Plane & Solid Geometry) :N.D. Bhatt
7. Machine Design . :Panday & Shah .

INDIAN MARITIME UNIVERSITY

THIRD YEAR

SEMESTER – V

UG/MS/MS/T/1508	SHIP CONSTRUCTION, SAFETY AND ENVIRONMENT PROTECTION PAPER – 3 UG22T2508	54 hrs.
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Theory – 75 marks

SECTION – A (SHIP CONSTRUCTION) [30 hrs]

Unit 1 : Load line and Tonnage

Definition of freeboard and various assigning conditions, List of closing appliances, Load line Surveys, Tonnage regulations, calculation as per 1969 convention, details of markings permanently carved.

Unit 2 : Shipyard Practice

Layout of a Shipyard, Mould loft, fabrication of assembly, subassembly, units in construction, role of Surveyors in construction of Ship; Keel laying, Launching, Sea Trial. Use of computers in ship design with cost implication, Surface preparation and painting of hull ; types of paints ; cathodic protection and I.C.C.P. system.

Unit 3 : Ship Types

Tankers, bulk carriers, container ships. LNG, LPG and chemical carriers, Lash ships, Passenger ships, Dredger, Tugs, etc. -constructional details and requirements,

Unit 4 : Offshore Technology

Drilling Ships and Platforms, Supply/Support Vessels-types and constructions, Dynamic Positioning, Deep Sea diving system, fire fighting arrangement, Cable laying vessels.

Unit 5 : Ship Surveys

Survey rules, Functioning of ship classification Societies, Surveys during construction, Periodical surveys as per statutory regulations, retention/suspension of class of a ship, constructional features and rule guidelines for a merchant vessel as per MARPOL regulations, IBC and IGC codes. Statutory Certificates and their validity, Ships registration formalities intact Stability Criteria under damaged conditions (constructional point of view with statutory regulations), Enhanced Survey requirements, vetting surveys for tankers.

SECTION - B (SAFETY AND ENVIRONMENTAL PROTECTION) [24 hrs]

Unit 6 : Safe Watchkeeping

An overview of watch-keeping system as practised on board ships, procedures for taking over and maintaining an E/R watch* .Guidance to watch keeper in case of emergencies, viz. scavenge fires, crankcase explosions, fire in engine room, flooding in engine room, power failure, maintenance of log book, log abstract, chief engineer's machinery report, Anti Piracy measures. (* navigation watch is covered under bridge watch keeping).

Unit 7 : Health

Crew accommodation, hygiene, crew welfare, Inspection & report , Maritime declaration of health , port health requirements pertaining to BIMMS conference .

REFERENCE BOOKS :

- 1) Derrett :Merchant ship stability for Masters & mates
- 2) Taylor :Ship Construction
- 4) Eyerer :Ship Construction
- 5) Kemp & Young :Ship Construction

- 6) Reeds :Ship Construction for Marine students
- 7) Naval Architecture :Munro & Smith .
- 8) Naval Architecture :Muckle
- 9) La Dage & Gemert :Stability
- 10) SOLAS (Latest Edition) :IMO Publications