

INDIAN MARITIME UNIVERSITY

FIRST YEAR

SEMESTER – II

UG/MS/BS/T/1201	MARINE ELECTROTECHNOLOGY PAPER - I UG22T2201	72 hrs.
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Theory – 50 marks

SECTION – A (ELECTRICITY) [36 Hrs]

Unit 1 : Basic knowledge

EMF, current, work, power and energy in an electric circuit; conductors, insulators and semi-conductors; Electron drift velocity, Ohm's Law; resistance and governing factors; variation of alpha with temperature, variation of resistivity with temperature, equivalent resistance, open and short circuit, duality between series and parallel circuits, voltage divider circuits, D.C. network theorems, KVL, KCL, determinants, conversion of voltage and current sources, independent and dependent sources, Maxwell's loop current method, mesh analysis, nodal analysis, source conversion, numericals.

Unit 2 : Electromagnetism

Electromagnetism, laws, magnetic field strengths, magnetic potential, permeability, force on a conductor, Ampere's law, Bio Savart's law, force between two parallel wires, magnetic circuits, series and parallel circuits, mmf, electromagnetic induction, Faraday's law, Lenz's law, mutual and self emf, self and mutual induction, hysteresis, magnetic materials, energy stored in magnetic field, lifting power of a magnet, transients in LR circuits, numericals.

Unit 3 : Electrostatics

Permittivity, Coulomb's law, electric field, electric flux, Gauss's theorem. Equation of Poisson's and Laplace, potential, potential of a charged sphere, equipotential surfaces, potential gradient, dielectrics, capacitance, spherical, cylindrical and parallel plate capacitors, cylindrical capacitance with dielectric, potential gradient in a cylindrical capacitor, capacitance between parallel wires, insulation resistance of cable capacitance, energy stored in capacitor, force of attraction between plates, charging and discharging of capacitance, numericals.

Unit 4 : AC fundamentals

Electromechanical energy conversion, energy balance, magnetic field system, Generation of ac voltage, amplitude, phase. rms value, form factor, average values, vector and phasor diagrams, addition of AC values. RC, RL circuits, power calculation, complex numbers and application in phasor calculations, KVL and KCL,

series and parallel ac circuits. conversion of series to parallel and vice versa. Active , reactive and apparent power. resonance. graphical representation of resonance. LC circuits, RLC circuits in series and parallel modes. bandwidth. Q factor. upper and IOWI half frequencies. Numericals.

Unit 5 : Electrochemistry

Laws of electrolysis, electro chemical equivalent, primary and secondary battery, polarization, dry cells, corrosion, Lead – acid batteries , Alkaline batteries , others .

SECTION – B (ELECTRONICS) [36 Hrs]

Unit 6 : Electron emission

Different types of emission, vacuum tubes, space charge, vacuum tube diodes, triodes, tetrodes, pentodes and their characteristics, inter electrode capacitances, related parameters, amplification, application, CRO, numericals.

Unit 7 : Semiconductors

Electronic configuration in atoms, orbitals, bonds, conductors, semiconductors, Insulators, Fermi levels, energy levels, electrons and holes, motion of electrons and holes in semiconductors, doping by impurities, p and n type semiconductors, majority and minority carriers, pn diodes, depletion region, forward and reverse bias, pn rectifier circuits for full wave and half wave operations, use as clipping and clamping circuits, numericals.

Unit 8 : Transistors

Electron and hole movement in transistors, PNP and NPN transistors, CB, CE, CC configurations, biasing, load line, biasing circuits, voltage and current and power gain, application of ac signals, equivalent circuits, transistor parameters, single stage and multistage amplifier, power amplifier, class of amplifiers, feedback in amplifiers, different methods of feedback, effects of feedback in amplifiers, numericals.

Unit 9 : Operational amplifiers .

Use of OPAMP as a mathematical operator, Field effect transistors, UJT, breakdown devices, SCR, triac, diac, opto isolators. Zener diodes, LEDs, photo diodes, photo transistors, LASER diodes, LASCR, varactor diodes, tunnel diodes, Etc

Unit 10 :

Electronic oscillators, positive feedback, conditions for sustained oscillations, Hartley and Colpitt oscillators, multivibrators, phase shift oscillators, negative resistance oscillators, tunnel diode oscillators, etc. applications.

PRACTICAL

Code No. : P1201

Practical : 36 hrs.

1. Familiarisation with all portable electrical testing instruments.
2. Colour coding of electronic components and identification and testing of all electronic components.
3. Characteristics of germanium and silicon diodes.
4. Characteristics of zener diodes.
5. Characteristics of npn transistors in different modes.
6. Characteristics of pnp transistors in different modes.
7. Characteristics of FET
8. Characteristics of UJT.
9. Characteristics of SCR.
10. Characteristics of DIAC.
11. Characteristics of triac.
12. Characteristics of photo diode.
13. Characteristics of LED.
14. Characteristics of photo transistor.
15. Characteristics of VDR, LDR.
16. Characteristics of opto coupler.
17. Characteristics of PTC & NTC thermistor.

- 1) There will be continuous assessment of skills being acquired through class-work, practical and periodic assignments / project works / tests / orals etc.
- 2) At least 15 experiments must be undertaken by every student .
- 3) Laboratory journal to be submitted at the end of each term for assessment .

REFERENCES BOOKS :

1. A text Book of Electrotechnology, volume 1, Basic Electrical Engineering, by B.L. Theraja and A. K. Theraja.
2. A text Book of Electrotechnology, volume 4, Electronic Devices and Circuits, by B. L. Theraja and A. K. Theraja.
3. Basic Electronics, volumes 1 to 7, by Harry Mileaf.

INDIAN MARITIME UNIVERSITY

FIRST YEAR

SEMESTER – II

UG/MS/MS/T/1202	BRIDGE WATCH – KEEPING AND EMERGENCIES PAPER - I UG22T2202	72 hrs.
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Theory : 50 Marks

SECTION – A (COLLISION PREVENTION) [20 Hrs]

Unit 1: International Regulations for prevention of collisions at sea, 1972, covering Rules 1 to 20.

Unit 2: The IALA system of Buoy age – lateral and cardinal systems.

SECTION – B (BRIDGE EQUIPMENTS) [40 Hrs]

Unit 3 : Satellite Navigation Systems

Describe the principles of operation of satellite navigation systems aboard ship. State that the system will provide continuous world-wide position-fixing capabilities, intended level of accuracy of the system.

Unit 4 : Maintain a safe Navigational Watch (watch-keeping)

- (i) Watch-keeping arrangements and procedures.
- (ii) The content, application and intent of COLREG 72 : Rules 1 to 38.
- (iii) Keeping a safe navigational watch as per Section A-VIII/2 and B-VIII/2 of STCW. Principles observed in keeping safe navigational watch. Relieving of duties, procedure of taking over watches, action on receiving storm warning entries in logbook, bridge manning levels. Bridge procedures guide and its contents, bridge navigation watch alarm system (BNWAS), Ship Security Alert System (SSAS).
- (iv) Keeping an effective anchor watch : Relieving of duties, procedure of taking over watches, action on receiving storm warning, entries in logbook.
- (v) Thorough knowledge of effective bridge team work procedures and maintaining situational awareness.
- (vi) The use of routeing in accordance with the general provisions of Ship's routeing.
- (vii) The effective use of information from navigational equipment for maintaining a safe navigational watch and regular checks to monitor their proper operation.
- (viii) The use of reporting in accordance with general principles for ship reporting systems and with VTS reporting procedures.
- (ix) Navigational Techniques used for safe navigation in restricted visibility (blind navigation / blind pilotage techniques).

Unit 5 : Contribute to the safety of personnel and ship

- (i) Knowledge of personal survival techniques.

- (ii) Knowledge of fire prevention and ability to fight and extinguishing fires.
- (iii) Knowledge of elementary first aid.
- (iv) Knowledge of personal safety and social responsibilities.

Unit 6 : GPS Systems

Describe the basic principles of the Global Positioning System (GPS), the system configuration. State the frequencies that are used. Describe the CIA a P codes, how the basic line measurement is obtained, the Dilution of Precision (DOP). State the various DOPs that are used.

Describe the various errors of GPS, the reasons for selective availability and the effect it has on the accuracy of a fix, differential GPS. State the accuracy obtainable with GPS and how the accuracy can be downgraded.

Explain WGS 84, why a fix obtained from the GPS receiver cannot be plotted direct onto a navigational chart, datum shifts.

Unit 7 : Echo-Sounders

Describe the basic principles of marine echo-sounding equipment, identify the main components on a simple block diagram of an echo-sounder, state the function of each.

State the accepted value of the velocity of sound in seawater and the limits within which the true value may lie, the physical factors which affect the velocity of sound in seawater, operates a typical echo-sounder and demonstrates basic user maintenance, e.g. clean platen, change paper, change and adjust stylus.

Distinguish between range and phase, and demonstrate a awareness of the dangers of using the wrong phase. Distinguish between inaccuracies caused by instrument and scale error and those caused by false echoes. Explain the causes of inaccuracies due to instrument or scale error and states their likely magnitude and measures that may be taken to eliminate them. Recognize the various types of 'false' echo that may be recorded, describe their formation and states the possible action to remove them from the trace. Describe the potential errors due to trim, heel and transducer separation

Unit 8 : Speed Logs

State the difference between ground-reference speed and water-reference speed. Describe the basic principles of the electromagnetic speed log, the basic principles of the acoustic-correlation log and the Doppler speed log.

Explain the "Janus" configuration to counteract the effect of ship's trim, explains the dual-axis configuration and its use during docking operations and list the main error sources on the various types of logs. State the accuracies of the various systems and explain calibration of the log.

Describe how ship's speed is transmitted to remote displays and draw a schematic diagram showing how a indication of distance run is derived from a speed log.

Unit 9 : The Automatic Pilot

Explain the principle of an automatic pilot system. List and explain the functions of the manual settings. Describe the procedures for change-over from automatic to manual steering and vice versa. Explain what is meant by an adaptive automatic pilot and briefly explains how it functions.

Describe the course monitor and the off-course alarm, lists the other alarms fitted to the system. State that the automatic pilot should be included in the steering gear testing prior to the ship's departure.

Explain the regulation regarding the use of the automatic pilot, in the recommendation on performance, standards for automatic pilots and the need for regular checking of the

automatic pilot to ensure that it is steering the correct course, state that the automatic pilot should be tested manually at least once per watch. State the factors to take into account regarding the change-over to manual control of steering in order to deal with a potentially hazardous situation.

SECTION – C (GENERAL SHIP KNOWLEDGE) [12 Hrs]

Unit 10 : GENERAL

- (a) Names of various parts of ship. Sea terms.
- (b) Safety wearing apparel - Safety goggles, helmet, safety shoes.
- (c) Removing rust by chipping hammers. Preparing a surface for painting. Paint brushes.
- (d) Painting defects and their prevention. Cleaning of wooden decks.
- (e) Cleaning and polishing of brass and copper.

Unit 11 : ROPES AND WIRES

- (a) Types of material used, natural fibers, synthetic fibers.
- (b) Types of lay of ropes and their advantages. Plaited ropes. Characteristics of different types of fibre ropes.
- (c) Comparison of strength and elasticity of different ropes.
- (d) Care and maintenance of fibre ropes. Damage caused by surging. Meaning of Marline, spunyarn, oakum, tarred hemp, 3 ply and 5 ply twines, halliards, loglines, leadlines.
- (e) Grades of steel used for making wire ropes. Construction of wire ropes. Advantage of a fibre heart. Factors determining flexibility. Meaning of 6/12, 6/24, 6/37 etc. Plaited wire rope.
- (f) Plastic covered wire rope. Non-rotating wire rope.
- (g) Care and maintenance of wire ropes.
- (h) Measuring sizes of ropes, wires and chains.
- (i) Breaking strength and safe working load of ropes, wires and chains.
- (j) To calculate the size of rope or wire required for lifting a weight with a tackle.

Unit 12 : DECK APPLIANCES

- (a) Description of the handlead line. Procedure for taking a cast. Different types of logs. Patent log, impeller log, electromagnetic log, pilot log. Principles of their operation.
- (b) The electric telegraph, description and its operation.
- (c) Windlass & Cargo winches - description and their operation.
- (d) Interswitching of follow-up and Non follow-up steering systems.

PRACTICAL

Code No. : P1202

Practical : 36 hrs.

COLLISION PREVENTION

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

[At least 3 tasks to be completed]

BRIDGE EQUIPMENT

- (1) **ECHO SOUNDER:** Use and care of both visual and graphic types. To take soundings using Echo sounder or simulator.
- (2) **RADAR:** Practical adjustment of operational controls to their optimum setting. To carry out performance check, using performance monitor. To take ranges and bearings of fixed and moving objects. To identify land objects using radar observations. Evaluation of risk of collision. Use of reflection plotter.
- (3) **Decca Navigator:** To take readings on the Decca Navigator, receiver/Simulator and determination of the. Ship’s position. use of Decca Chart.
- (4) **GPS:** Familiarity with usage of a GPS set. (to be done in simulator)

[At least 3 tasks to be completed]

BOOKS RECOMMENDED FOR REFERENCE :

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|---|---------------------------|
| 1. Shipborne Radar | : Capt. H. Subramaniam |
| 2. Nicholls Concise Guide Volume I. | |
| 3. Manual of the Rule of the Road | : Capt. S. K. Puri. |
| 4. Rule of the road. | : Bhandarkar publications |
| 5. International light, shape & sound signals | : Moore |
| 6. Maritime buoyage system. | : I.A.L.A.:- |
| 7. Electronic navigation aids | : Sonnenberg |
| 8. International code of signals | : HMSO |
| 9. SOLAS | : I.M.O. Publication |
| 10. MARPOL | : I.M.O. Publication |
| 11. Search and Rescue Manual | : I.M.O. Publication |
| 12. Mariner’s Hand Book | : HMSO |

INDIAN MARITIME UNIVERSITY

FIRST YEAR

SEMESTER – II

UG/MS/BS/T/1203	GENERAL ENGINEERING KNOWLEDGE PAPER - I UG22T2203	72 hrs.
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Theory – 50 marks

SECTION – A (WORKSHOP TECHNOLOGY)

[36 Hrs]

Unit 1 : Common workshop Tools

Description and uses of different types of Calipers, Straight edges, Try squares, Vices, Hammers, Chisels, Scrapers, Files, Drills, Reamers, Tapes, V-Blocks, Face plate, Marking blocks, Carpentry tools, pattern maker's tools, Smithy tools and Moulding tools.

Unit 2 : Safety Measures

Sources of danger and methods of protection. Types of guards and safety devices, Factory Act regulations and Industrial safety, common causes of accidents; good housekeeping; Safety guards; general safety precautions.

Unit 3 : Machine Process & Machine Tools

The geometry of cutting processes Machines of cutting, Chip formation,. Standard nomenclature for cutting tools. Cutting speeds and feeds. Classification of manufacturing process – Shaping, machining, surface finishing, joining processes and processes affecting change in properties. Cutting process, Application of hand tools like chisel, file and saw; geometrical control of the cutting edge. Operation and inspection of the more important types of metal cutting machine tool including Centre lathes, Capstan and turret lathes, Automatic lathes, drilling and boring machines. Shaping slotting and planning machines, Milling machines. Turning, Screw cutting and taper turning processes on Centre lathe, Abrasive process; Grinding and lapping by hand and machines. Shears and punches. Wood working machines. Principles of jigs and fixtures Standardization.

Unit 4 : Welding

Welding Equipment & Applications, Electric welding (A.C & DC.) Types of welding; Welded joints, Welding positions, Preparation for welding, welding defects . Selection of current , welding rods, storage of welding rods, flux .

SECTION – B (MATERIAL SCIENCE)

[36 Hrs]

Unit 5 : Structure of Atom

A brief overview of the subject: Electrons and Bonding , Wave Mechanics and electronic Behaviors, Covalent bonding; Metallic bonding; Ionic bonding and Secondary bonding. Atomic packing-directionally and non- directionally bonded ; atoms; Crystal structure-space lattices; Ionic and molecular crystals; Interfacing in crystal's points; fine surface and volume imperfections; Non-crystalline solids; Elastomers; Long chain and molecular

compounds and three dimensional net work .

Unit 6 : Mechanical properties

Strength; elasticity; stiffness; resilience; plasticity; ductility and malleability; toughness; hardness & hardenability , brittleness; fatigue; fatigue strength, Factors affecting fatigue strength; creep. Testing of mechanical properties, stress and strain; Hooke's law and different modulus of material; stress-strain relation. Factors affecting mechanical properties: effect of grain size; effects of heat treatment; effect of atmospheric exposure; effect of low and high temperatures.

Chemical Properties : Corrosion and prevention ; electro chemical corrosion ; galvanic series of metals and alloys;

Electrical: resistivity; conductivity; super conductivity; semi- conductors; insulators; dielectrics.

Magnetic properties – Magnetic hysteresis.

Technological properties – weldability; machinability; formability; castability;

Unit 7 : Metals and Alloys

Ferrous metals & alloys:

Different types of iron and steel; Pig iron; cast iron; wrought iron; carbon steel; Stainless steel; alloy steels: tool steels, high speed steels , spring steels; stellites. Brief description of their manufacture , properties and uses in industry.

Non ferrous metals and alloys :

Aluminium and its alloys, Copper and its alloys; Lead and its alloys; tin, nickel, magnesium, cadmium, vanadium, antimony; bearing metals; Copper-tin alloys – bronzes, gun metal and bell metal. Copper-zinc alloys; Muntz metal. Nickel and its alloys

Unit 8 : Ceramic materials

Mechanical, electrical and thermal properties of ceramics and their application in marine field; refractory materials; abrasives.

Polymers in marine applications – plastics, fibres and elastomers.

Miscellaneous Engg. Materials :

Insulating materials; Plastics and Rubber; PVC, Polyurethane foam (PUF) Resins, Paints etc. Manufacture, properties, use and their selection for various engineering applications.

PRACTICAL

Code No. : P1203

Practical : 36 hrs.

Cadets will carry out bench fitting work involving use of bench fitting hand tools, machining operation on a lathe of a given round M. S. bar and perform the operations to make the given job as instructed in the drawing .They will also carry out Carpentry, Black smithy and welding jobs .

Familiarization with safety equipments

Familiarization with workshop tools .

Identify and demonstrate ability to select, and use appropriate measuring instruments and tools to carry out marine machinery maintenance and repairs.

Fitting Shop (Bench Work):

To make a hexagon block from a round bar.

To make male-female square fitting from a 10mm thick plate.

Machine Shop (Lathe Work):

To prepare a specimen with straight turning, Taper turning, Undercut , thread cutting, knurling operation with hex head as per drawing .

Welding Shop:

1. Lap joint (down hand weld), 2. Butt joint (Single V & Double V-welding ,on opposite faces, down hand. 3. T-welding (on inner side) , T-welding (both inner sides), T-welding (both outer sides) 4. L-welding (outside corner)

Carpentry shop :

Prepare wooden box.

General overhaul work like dismantling, refitting and studying various types of valves like globe v/v , gate v/v, butterfly v/v, etc.

Workshop Maintenance work

NOTE :

- 1) Evaluation will be on a continuous basis during the practical, on the ability to carryout the above tasks competently with demonstration of safe techniques.
- 2) There will be continuous assessment of skills being acquired through class-work, practical work and periodic assignments / project works / tests / orals etc.
- 3) Workshop journal to be submitted at the end of each term for assessment .

RECOMMENDED BOOKS :

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| 1) Materials Science and Processes | : Hajra Choudhary S.K | India Book Distributing Co., Calcutta. |
| 2) A text book of Workshop Technology | : Khurmi R.S & Gupta J.K.; | Publication division of Nirja Construction and Development Company (P) |

INDIAN MARITIME UNIVERSITY

FIRST YEAR

SEMESTER – II

UG/MS/MS/T/1204	MARINE AUXILIARIES PAPER – 1 UG22T2204	72 hrs.
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Unit 1 : General arrangement of engine room

Engine location, Engine room layout : General layout of main and auxiliary machinery on steamships, motor ships and electric propelled ships. List of auxiliaries that can be found on board. A brief account of all shipboard machinery, their location, use and importance.

Unit 2 : Pipeline layout

Different pipe lines in engine room and on deck. Colour coding of pipelines. expansion arrangement; Joints; Pipe-line layout for sludge, bilge, ballast, fresh water, fuel oil, bunkering system, lubricating oil, steam and condensate, engine cooling – lubricating and fresh water, compressed air and sea water cooling systems; Hydrophore system. Emergency bilge pumping arrangement & its importance.

Unit 3 : Pumps & pumping

Types of pumps and purpose, classification: positive displacement and roto - dynamic pumps. Reciprocating, rotary and centrifugal pumps, starting procedure, Description of each type of pumps , marine applications of reciprocating, centrifugal, rotary, gear, screw displacement; mono, axial flow propeller type, turbo multistage feed pumps; hydraulic balance of steam driven pumps., advantages and disadvantages ; operation & operational problems, maintenance , material of construction ; emergency bilge pump; Location, Marpol regulation, ejectors ,safety , tests. Types of valves, cocks, strainers & filters in pumping systems. pipes, and fittings; steam traps; inspection/ survey and maintenance;

Unit 4 : Compressors & blowers

Description of parts, volumetric efficiency, cooling, valves, capacity & control, Assembly, operation, care and maintenance of two stage reciprocating air compressors; rotary blowers, ventilation blowers; emergency air compressor; automatic operation , Air receiver and mountings. Safety fittings on air compressors and receivers. Automatic operation of compressors.

Unit 5 : Pollution prevention equipments

Oily bilge separator and accessories; sewage treatment (biological and chemical), Bio-chemical oxygen demand; effluent quality standards. coliform count, holding tank ; incinerator, pumping out engine room bilge water as per marpol regulations.

Unit 6 : Heat exchangers :

Sea water circulating systems for motor ships. Control of temperatures in heat exchangers; construction shell and tube type heat exchangers, plate type heat exchangers; advantages / disadvantages, charge air coolers; maintenance of heat exchangers. Operation & operational problems, testing, material.

Unit 7 : Bearings

Bearings in engines – purpose and types of bearings. Ball bearings, roller bearings, journal type bearings, bearings material, bedding / running in of bearings , modern tri metal bearings , bearing alignment, defects of bearings and maintenance, inspection .

PRACTICAL

Code No. : P1204
Max. Marks : 25

Practical : 36 hrs.
Pass Marks : 15

1. Disassemble a globe valve. List the defects in the components, rectification of defects. Assemble the valve with new packing and joints.
2. Disassemble a sluice valve. List the defects in the components, rectification of defects. Assemble the valve with new packing and joints.
3. Disassemble a reducing valve, understanding working of valve. List the defects in the components. Assemble the valve with new packing and joints.
4. Disassemble a centrifugal pump, inspect, identification defects and rectification, assemble the pump with new gasket and new packing.
5. Disassemble a gear pump, inspect and record findings, assemble the pump with new gasket, gland packing etc.
6. Dismantle shell & tube type heat exchanger, understand the construction for stack expansion, uses of sacrificial anodes and carry out maintenance work .
7. Dismantle plate type heat exchanger and carry out maintenance and study.
8. Dismantle diesel engine cylinder head and carry out maintenance work, understand pulls exhaust system and air start system.
9. Dismantle diesel engine piston, clean and study piston, bearings and liner.
10. Film show on marine repair .

NOTE :

- 1) Evaluation will be on a continuous basis during the practical, on the ability to carryout the above tasks competently with demonstration of safe techniques.
- 2) Final assessment will be done on the basis of journals / orals etc.
- 3) Workshop journal to be submitted at the end of each term for assessment
- 4) At least 8 tasks are to be completed

RECOMMENDED BOOKS :

- 1) Sothern's Marine Diesel Oil Engines. Revised Ed. : J.K.Bowden
- 2) Marine Diesel Oil Engines : C.C.Pounder
- 3) The running and Maintenance of Marine Machinery J. Cowley
- 4) Marine Auxiliary Machinery H. D. McGeorge
- 5) Introduction to Marine Engineering Taylor D. A
- 6) Reed's General Engineering for engineers, Vol - 8 Thomas Reeds publications Ltd .
- 7) Basic Marine Engineering, J. K. Dhar

INDIAN MARITIME UNIVERSITY

FIRST YEAR

SEMESTER – II

UG/MS/MS/T/1205	MOTOR ENGINEERING KNOWLEDGE PAPER - I UG22T2205	72 hrs.
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Theory – 70 Marks

Unit 1 : Theory of I.C Engines

Introduction to Internal Combustion Engines, working cycle, Basic Principles – four and two stroke cycle engines, cylinder constants; thermal efficiency; mechanical efficiency, simple heat balance chart, cylinder mean pressures, engine dimensions , stroke bore ratio, piston mean speed & significance ; specific fuel oil consumption , engine weight & power to weight ratio , engine ratings , limitations of diesel engines .

Unit 2 : Components of diesel engines and function (General)

Study of the principle of working of a diesel engine, four stroke & two stroke Engines, General knowledge of Components of a diesel engine, timing diagram , general concept of indicator diagram, Power Calculation, normal engine parameters like exhaust , C.W , L.O , and F.O temperatures ; Familiarisation with performance curves .

Unit 3 : Scavenging & supercharging

Scavenging methods & advantages/ disadvantages, supercharging methods & advantages/ disadvantages, air coolers and their importance, problems related to scavenging & supercharging.

Unit 4 : Lubrication , cooling and fuel system

Lubrication Systems : Lubrication arrangement in diesel engines including, pumps, Coolers & Filters, Cylinder-lubrication, Linear wear and preventive measures, quality of cylinder oil, improvements in Lubricating oils through use of additives, Types of additives, Monitoring engines through lubricating oil analysis reports; Cooling of I.C. Engines, cooling of Pistons, cylinder jackets & cylinder heads, Bore cooling, coolant conveying mechanism and systems, maintenance of coolant and Cooling system Various Cooling media used; their merits and demerits, corrosion & scale, treatment, coolers, maintenance of coolers, fuel oil supply, criteria for optimum combustion and system components of fuel supply.

Unit 5 : Properties of oil

Flash point, Specific gravity, Viscosity, Chemical composition, Carbon residue, Asphaltic matters, Combustion of fuel & emission, fuel oil for diesel engines, lubricating oils for diesel engines, Tests of fuel oil, tests of lubricating oil, Maintenance of fuel & lubricating oils.

Unit 6 : Components of slow speed diesel engines

Bed plate and frames; Tie rods, crankshaft; Connecting rod and bottom end bearing; cross-head and cross-head bearing; white metal lining of bearing shells; working piston and piston rod; telescopic pipes; cylinder liner; cylinder head; exhaust gas system;

exhaust valve/exhaust ports; camshaft, fuel injection valve; cylinder relief valve; scavenge valve; indicator gear; thrust bearing; turning gear

RECOMMENDED BOOKS :

- 1) Sothern's Marine Diesel Oil Engines. Revised Ed. : J.K.Bowden
- 2) Marine Diesel Oil Engines : C.C.Pounder
- 3) The running and Maintenance of Marine Machinery : J. Cowley
- 4) Marine Auxiliary Machinery : H. D. McGeorge
- 5) Introduction to Marine Engineering : Taylor D. A
- 6) Reed's General Engineering for engineers, Vol - 8 : Thomas Reeds publications Ltd .
- 7) Basic Marine Engineering, : J. K. Dhar

INDIAN MARITIME UNIVERSITY

FIRST YEAR

SEMESTER – II

UG/MS/BS/T/1206	MATHEMATICS PAPER - 2 UG22T2206	54 hrs.
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Unit 1 :Differential equations

Exact differential equations and those which can be made exact by use of integrating factors by inspection - Linear Equation and reducible to linear (Bernoulli) equations, Method of substitution to reduce the equation to one of the above forms.

Linear Differential Equations of the n th order with constant coefficient; Complimentary function and Particular integral when the function of the independent variable on R.H.S. is e^{ax} , x^n , $e^{ax} V(x)$, $\sin(ax + b)$, $\cos(ax + b)$; Cauchy's Linear equation (homogenous), Legendre's Linear equation; Variation of parameters and method of indeterminate coefficients.

Elementary applications of above differential equations in solving engineering problems such as Electrical Engineering, Mechanical Engineering.

Unit 2 :Infinite series and Fourier series

Convergence of infinite series, uniform convergence, properties of uniformly convergent series, power series and their properties, expansion of a function as power series, Exponential and logarithmic series, definition of Trigonometric and Fourier series, Fourier coefficients; Dirichlet's conditions, statement of Dirichlet's theorem; Expansion of functions in Fourier series, Even and Odd functions, half range Fourier series, Complex form of Fourier series, Differentiation and Integration of Fourier Series, Fourier series with respect to a set of orthogonal functions over (a, b) [Fourier series over $(-\pi, \pi)$, $(0, 2\pi)$ and for arbitrary range $(a, a + 2L)$ must be treated].

Unit 3 : Matrices and Determinants

Matrix algebra, sub matrices, Rank of a matrix, systems of n linear equations in n unknowns, Inverse of a matrix, Hermitian and Skew-Hermitian matrices, Unitary, orthogonal and normal matrices, Eigen values and Eigen vectors, Eigen values of Hermitian, Sjew-Hermitian and Unitary matrices, Bilinear, Quadric, Hermitian and Skew-Hermitian forms, Real life applications.

RECOMMENDED BOOKS :

- 1) Elements of applied mathematics – Vol 1 : Wartikar, P.N. & Wartikar, J.N.
- 2) Text book of applied mathematics – Vol 2 : Wartikar, P.N. & Wartikar, J.N.
- 3) Vector algebra : Shanti Narayan
- 4) Differential calculus : Shanti Narayan
- 5) Engineering Mathematics : Bali, Saxena, Iyengar
- 6) Plain trigonometry Part -II : Loney, S.L.
- 7) Spherical Trigonometry : Capt. H. Subramaniam
- 8) An introduction to spherical trigonometry : Clough & Smith

INDIAN MARITIME UNIVERSITY

FIRST YEAR

SEMESTER – II

UG/MS/MS/T/1207	SHIP CONSTRUCTION, NAVAL ARCHITECTURE (STABILITY), SAFETY & ENVIRONMENT PROTECTION PAPER - I UG22T2207	72 hrs.
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Theory – 75 marks

SECTION-A (SHIP CONSTRUCTION) [30 Hrs]

Unit 1 : Introduction

Different types of ships and their features; Ship dimensions and form; definitions of camber, rise of floor, flare, shear and rake, bilge, keel F'cstle, stern, etc . General concept of stresses on ship ; Hogging, Sagging in still water and waves, six degrees of freedom of ship and effect , racking, panting and pounding, slamming, effects of torsional forces, local loading, docking strains.

Unit 2 : General arrangement

General arrangement of general cargo, tankers, bulk carriers, containers, RO- RO passenger ships, Fore castle , poop deck, accommodation

Unit 3 : Hull Structure

Proper names of various parts, materials used in ship construction; Standard steel & aluminium sections; specification steel used in shipbuilding , General knowledge of Types of welds used in shipbuilding ; Frames and their functions : Construction of double bottom, types of keel, function of deck beams and girders; Bulkheads, subdivision bulkheads, “Margin of Safety line”, Cofferdams.

SECTION – B (NAVAL ARCHITECTURE) [30 hrs]

Unit 4 : Hydrostatics

Introduction , Definition of Fluid. Different properties like density, R.D, Capillarity, Surface tension , viscosity , etc.; Archimedes' principle; Floating body , Equilibrium of floating bodies; Fluid pressure; pascal's law and application in hydraulic machinery, Measurement of Centre of Pressure; Total force and centre of pressure on immersed surfaces such as tanks, bulkheads, lock gates, manhole doors etc, total thrust due to liquid pressure on immersed plane surface, Curved surfaces, effect due to liquid in 'sounding pipes', 'air release pipes', or other 'stand pipes', use of hydrometer.

Unit 5 : Geometry of Ship & Hydrostatic Calculations

Ships lines, Simpson's rules, application to area and volume, Trapezoidal rule, mean and mid-ordinate rule, Tchebycheff's rule and their applications, Displacement calculation,

Concept of DWT, GRT and NRT, Co-efficient of forms, First and Second moment of area, Calculation of WPA of ship . Familiarisation with hydrostatic curves of ship.

Unit 6 : Draught & Buoyancy

Meaning of buoyancy and reserve buoyancy. TPC , effect of change in density of water. Effect of bilging amidship compartments. Wetted surface area of Similar bodies, Centre of gravity, effect of addition and removal of masses, Effect of suspended mass.

Unit 7 : Transverse Stability of Ships

Statical stability at small angles of heel, Centre of gravity, centre of buoyancy, righting lever, righting moment , Meta centre. Stable, unstable and neutral equilibrium, Calculation of BM, GM (Metacentric height) , Inclining experiment, . Shift of centre of gravity due to addition or removal of mass, transverse movement of mass and effect , Free surface effect, Stability at large angles of heel, angle of loll, curves of statical stability, dynamical stability, Different Characteristic curves of Dynamic stability. ITTC formula. Calculations of damaged stability .

SECTION – C (SAFETY & ENVIRONMENT PROTECTION) [12 Hrs.]

Unit 8 : IMO & Conventions

History of development of various IMO conventions, Basic safety concept on board a merchant vessel & operational knowledge of the relevant IMO instruments like SOLAS, MARPOL, LOADLINE, TONNAGE, COLREG, STCW with latest amendments, how above instruments are adopted under Explicit & tacit acceptance procedures, procedure for issue of statutory/Class certificates and documents obtained under various conventions . Surveys special/intermediate/annual to be conducted on ocean going ships. certificates, period of validity

Unit 9 : Annexures of MARPOL

IMO Convention for the prevention of pollution from ships MARPOL-1973/78 , Introduction to Annexures of MARPOL – 1973/78 .

Regulations for the prevention of pollution by oil. Requirements for control of operational pollution, reception facilities, oil tankers with segregated ballast, segregation of oil and water ballast, retention of oil on board, OMDSS and oily-water separating equipment. Tanks for oil residues (sludge). Pumping, piping and discharge arrangements of oil tankers, standard discharge connection, oil record book. Subdivision and stability criteria of an oil tanker, OPA90 , Control of oil from machinery spaces : Discharge provisions for oil and oily waste from machinery spaces outside special areas, within special areas, bilge water holding tank and oil water separator.

Precautions to be taken to prevent accidental pollution by oil; Checklist while bunkering and transferring oil, precautions while carrying out any oil operations, SOPEP manual .

Oil Record Book (Part I, Machinery Space Operations) and Part II (Cargo and Ballast Operations), entries to be made in the oil record books.

RECOMMENDED BOOKS :

- 1) Derrett : Merchant ship stability for Masters & mates
- 2) Pursey : Ship Construction
- 3) Taylor : Ship Construction
- 4) Eyerer : Ship Construction
- 5) Kemp & Young : Ship Construction
- 6) Reeds : Ship Construction for Marine students
- 7) IMO : Grain Code
- 8) Kemp & Young : Notes on Stability
- 9) La Dage & Gemert : Stability
- 10) Capt. Lester : Stability for Merchant Ships
- 11) Capt. H. Subramaniam : Ship Stability I, II, III
- 12) Capt. Joseph & Capt. Rewari : Problems on Hindship
- 14) General Engineering Knowledge : H.D. Mc Geroge
- 15) SOLAS (Latest Edition) : IMO Publications
- 16) Marine Engineering Practice Series
- 17) Shipboard Operations : H.I. Lavery