

# INDIAN MARITIME UNIVERSITY

SECOND YEAR

SEMESTER – III

UG/MS/MS/T/1301	MARINE ELECTROTECHNOLOGY PAPER – 2 UG22T2301	72 hrs.
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Theory – 50 marks

SECTION –A (ELECTRICITY) [ 54 Hrs ]

## **Unit 1 : AC network analysis**

KVL, KCL, mesh analysis, Kirchoff's Law , Superposition theorem, Thevenin's and Norton's theorem, input and output resistances, reciprocity theorem, delta to star and star to delta conversion, compensation theorem, Millman's theorem, generalized form of Millman's theorem, maximum power transfer theorem, power transfer efficiency, simple transmission line circuit, numericals.

## **Unit 2 :Polyphase circuits**

Generation of polyphase voltages, phase and frequency, star and delta connection, line and phase currents, line and phase voltages, balanced star to delta and delta to star conversion, star and delta connected loads, power factor, power correction, parallel loads, power measurement In three phase circuits, 3 wattmeter and 2 wattmeter methods, balanced and unbalanced loads, leading power factor, one wattmeter method, balanced loads, unbalanced delta connected loads, 4 wire star connected loads, unbalanced Y connected loads without neutral, Millman's theorem, KVL and KCL in 3 phase, star to delta and delta to star conversion

## **Unit 3 :Wave forms**

Fundamental wave and harmonics, different complex waveforms, rms of a wave, form factor, power supplied by a wave, harmonics in single phase circuits, effects of harmonics, harmonics in single phase and 3 phase systems, circulating current in delta alternator, numericals.

## **Unit 4 :Electrical measurements**

Indicating instruments, deflecting and controlling torque, damping torque, moving iron ammeter and voltmeter, attracting and repulsion type instruments, shunts and multipliers, moving coil instruments permanent magnet instruments, extension of range, sensitivity, multi range voltmeter, thermocouple ammeter, megger, induction type voltmeter and ammeter, electrostatic voltmeter, watt meters, induction type single phase watt hour meter, energy meter, frequency meter, vibrating reed frequency meter, power factor meter, instrument transformers, current transformer, potential operation of single phase transformers,

### **Unit 5 : Transformers**

Principle and construction, types of transformers, theory of ideal transformer, emf equation, magnetic leakage, transformer on no load, transformer on load, equivalent resistance, equivalent circuit, phasor diagrams, transformer with reactance and leakage reactance, open and short circuit tests, equivalent resistance, reactance, impedance, voltage regulation, losses in transformer, maximum efficiency, all day efficiency, auto transformer, numericals.

### **Unit 6 : DC generators**

Principle, construction, armature, field, commutator, pole pitch, coil span, wave winding and lap winding single and multilayer windings, types of generator, self excitation, critical resistance, emf equation, losses, power stages, armature reaction and commutation, compensating windings, interpoles, parallel operation, equalising connections, paralleling DC generators, shunt generators in parallel, compound generators in parallel, series generators in parallel, load sharing, generator characteristics, separately excited generator, OCC, on load curves, internal and external characteristics, voltage build up in shunt generator, compound wound generators, voltage regulation, application, numericals.

### **Unit 7 : DC motors**

Principle, construction, back emf, voltage equation, torque equation, conditions for maximum power, motor characteristics, different types of motors, shunt. Series, compound motors, performance curves, losses and efficiency, power stages, speed control of DC motor, factors affecting motor speed, flux control, armature control, voltage control, speed control of shunt and series motors, rheostatic control, series parallel control, Ward Leonard system, speed control of series motors, electric braking, regenerative braking, methods of electronic speed control by controlled rectifier and bridge rectifiers, necessity of starters, different types of DC starters, testing of DC motors, brake test, Swinburnes test, Hopkinson test, retardation or running down test, Field's test for series motors, application, numericals.

## **SECTION – B (ELECTRONICS) [ 18 Hrs ]**

### **Unit 8 : Digital techniques**

Digital numbers, binary to decimal conversion and vice versa, logic gates, logic circuits truth, tables, electronic switches, binary additions, subtraction, multiplication, division, octal system, Boolean algebra, De' Morgan's law, realisation of circuits of De' Morgan's octal system, laws.

### **Unit 9: Electronic communication**

Electronic communication signals, dc and ac signals, frequency bands, modulation, different types of modulation, demodulation, mixers, converters, detectors, antennas, transmission and reception, transmission of waves in space, block diagrams of communication systems, digital communication.

## PRACTICAL

Code No. : P1301

Practical : 36 hrs.

1. Verification of logic gates and circuits using digital IC trainer.
2. Testing of ICs.
3. Study of RC high pass and low pass filters.
4. Study of RC and LC series circuits.
5. Study of parallel RC and LC circuits.
6. Study of RLC series and parallel resonant circuits.
7. Study of clipping and clamping circuits.
8. Study of cascaded amplifier.
9. Study of power amplifier.
10. Study of feedback amplifiers using different types of feedback.
11. Study of RC phase shift oscillator.
12. Study of astable, monostable, bistable multivibrators.
13. Study of Schmitt trigger circuit.
14. Characteristics of DC separately excited generator.
15. Characteristics of DC shunt generator,
16. Characteristics of DC series generator.
17. Characteristics of DC compounded generators.
18. Characteristics of DC shunt motor.
19. Characteristics of DC series motor.
20. Characteristics of DC compounded motors.

### **NOTE :**

- 1) There will be continuous assessment of skills being acquired through class-work, practicals and periodic assignments / project works / tests / orals etc.
- 2) Atleast 18 experiments are to be conducted by each student .
- 3) Laboratory journal is 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 and A. K. Theraja.
- 2) A text Book of Electrotechnology, volume 2, AC and DC machines, by B. L. Theraja and A. I. Theraja.
- 3) A text Book of Electrotechnology, volume 4, Electronic Devices and Circuits, by B.L. Theraja and A. K. Theraja.
- 4) Basic Electronics, volumes 1 to 7, by Harry Mileaf.



# INDIAN MARITIME UNIVERSITY

SECOND YEAR

SEMESTER – III

UG/MS/MS/T/1302	METEOROLOGY UG22T2302	72 hrs.
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## Theory : 50 Marks

### **Unit 1 : Shipborne Meteorological Instruments**

The principles, construction and uses of various meteorological instruments, maximum and minimum thermometers, psychrometer / hygrometer, anemometer, wind vane. Barometers (aneroid and mercury) and Barograph Stevenson's Screen.

The atmosphere and its composition and physical properties :

Composition, hydrostatic equation, equation of state for dry air and moist air, Density variation, Vertical layers of the atmosphere, Ozone depletion, air pollution, latent heat, dewpoint, absolute humidity, relative humidity, vapour pressure.

### **Unit 2 : Atmosphere**

Atmospheric pressure, change of pressure with height, average pressure and isobar. Wind : Beaufort scale of wind force, pressure gradient force, Coriolis force, Buys-Ballot's Law, apparent and true wind.

### **Unit 3 : Cloud and Precipitation**

Formation of clouds, as per height, precipitation, drizzles, hail, snow and sleet.

Visibility : Formation of fog, mist and haze, different types of fog, effect of fog, mist and haze and other meteorological conditions on visibility.

### **Unit. 4 : Oceanography**

Introduction of Major Oceans and their Characteristic, Temperature of the Ocean Water, Salinity of Ocean Water, Density of Ocean Water, Wind and Pressure system over the Ocean

### **Unit 5 : Atmosphere over the oceans**

Wind and pressure systems over the ocean : Mean surface, surface pressure and wind distribution, doldrums, inter-tropical convergence zones, westerlies, polar easterlies, monsoon, land and sea breeze, anabatic and katabatic winds.

### **Unit 6 : Air Masses and Fronts**

Air masses : Basic concepts, Factors governing developing and properties; Classification; Convergence and Divergence. Fronts : Types; Associated weather; Frontal Depressions – Origin, life and movement; Forecasting Techniques. Non-Frontal Depressions.

### **Unit 7 : Cyclones**

Anticyclones and other pressure systems : Anticyclone, ridge, col. Weather Services for shipping : World Meteorological Organization, weather information available to shipping meteorological offices, facsimile machine.

### **Unit 8 : Tropical Revolving Storms**

Characteristic areas & Nomenclature, origin, structure & movements, associated weather ,forecasting techniques-past & present; cyclone tracking &warning bulletins for merchant ships under international conventions; practical rules of navigation for maneuvering in the vicinity of a T.R.S

### **Unit 9 : Meteorological Analysis & weather forecasting**

Sources of meteorological data; principles of weather analysis ; Weather forecasting; principles &practices; Marco, Meso & Micro level forecasting. Weather forecasting : Interpretation of symbols and isobaric patterns on weather charts and facsimile machine.

### **Unit 10 : Meteorological & Reporting Systems**

Voluntary observing fleet under I.M.D; type & nature of information collected; Ships' Weather Code ; weather reporting from ships and its significance in weather forecasting. International system of weather reporting. Recording and reporting weather observation Meteorological codes, coding and decoding of weather messages. International system of weather reporting.

### **Unit 11 : Voyage planning & Weather Routing of ships**

Basic consideration in voyage planning; selection and use of data. Weather Routing; Basic parameters; least time track and ship's performance curves.

## **PRACTICAL**

Code No. : P1302

Practical : 36 hrs.

## **METEOROLOGY**

- (1) Reading and interpretation of topographical maps for coastal areas.
  - (2) Reading and interpretation of hydrographic charts.
  - (3) Preparation and interpretation of tidal charts.
  - (4) Plotting of weather details at surface stations
  - (5) Plotting telegrams and their interpretation.
  - (6) Tracking of cyclones.
  - (7) Estimation of geostrophic wind speed from geostrophic scale.
  - (8) Reading and interpretation of I.M.D. synoptic maps.
  - (9) Interpretation of upper air charts.
- [ At least 7 experiments must be performed ]

## **METEOROLOGICAL INSTRUMENTS :**

- (1) To take observations and apply corrections to obtain accurate barometric pressure using both Mercurial & Aneroid Barometers.
- (2) To take readings on Barograph and measure pressure tendency.
- (3) To obtain Relative Humidity using dry & wet bulb thermometer.
- (4) The use of Psychrometer. Use of anemometer and wind vane.

## **NOTE:**

- 1) There will be continuous assessment of skills being acquired through class-work, practicals and periodic assignments / project works / tests / orals etc.
- 2) Laboratory journal to be submitted at the end of each term for assessment .

### **BOOKS RECOMMENDED FOR REFERENCE:**

1. Wooldridge, S.W. and Morgan, R.S. (1988), 'An outline of Geomorphology', Orient Longman, Calcutta.
2. Tarling, D.H. and Tarling, M.P. (1971), 'Continental Drift', G. Bell and Sons Ltd., London.
3. Birkland, P.W. and Larson, E.E. (1978), 'Putnam's Geology', Oxford University Press, New York.
4. Monkhouse, F.J. (1971), 'Principles of Physical Geography', University of London Press.
5. Thornbury, W.D. (1960) 'Principles of Geomorphology', John Wiley, New York,
6. Bhatt, J.J. (1978), 'Oceanography: Exploring the Ocean', Von Norstrand, New York,
7. Sharma, R.C. and Vatal, M. (1970), 'Oceanography for geographers', Chaitanya, Allahabad.
8. Sharma, R.C. (ed) (1985), 'The Oceans: Realities and Prospects', Rajesh Publications, New Delhi.
9. Birla Economic Research Foundation (1992) 'The Oceans', Allied Publications, New Delhi.
10. Barry, R.S. and Chorley, R.J. (1971), 'Atmosphere, Weather and Climate', ELBS, Methuen, New York.
11. Flohn, H. (1969), 'Climate and Weather', World University Library.
12. Petterssen, A. (1969) 'Introduction to Meteorology', McGraw Hill London.
13. Ayoade, J.O. (1983), 'Introduction to Climatology for the Tropics', John Wiley, New York.
14. Anthes, R.A. et al. (1978), 'The Atmosphere', Charles E. Merrill, Columbus (Ohio).
15. Barrett, E.C. (1974), 'Climatology from Satellites', Methuen, London.
16. Riley, D. and Spolton, I. (1974), 'World Weather and Climate', Cambridge University Press.
17. Cole, F.W. (1970), 'Introduction to Meteorology', John Wiley, New York.

### **JOURNALS:**

'Mausam' IMD.

# INDIAN MARITIME UNIVERSITY

SECOND YEAR

SEMESTER – III

UG/MS/BS/T/1303	GENERAL ENGINEERING KNOWLEDGE PAPER - 2 UG22T2303	72 hrs.
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Theory – 50 marks

## SECTION – A (WORKSHOP TECHNOLOGY)

[ 30 hrs ]

### **Unit 1 : Instruments**

Measuring Instruments & Inspection : Description and use of Vernier scale & caliper, Micro-meter, Dial gauge, Depth gauge, thread gauge, Feeler gauge, Wire gauge, pattern maker's scale, Taper gauge, snap gauge, Plug gauge, , limit system, Use of limit gauge.

### **Unit 2 : Welding**

Modern welding processes such as TIG , MIG etc, spot welding. Gas welding. Soldering & Brazing. Different welding & Electrodes, Solders & Brazing Fluxes. ; Study of gas flame for various applications; Welding of various metals. Tests of welded joints; Soldering; brazing. Forging processes. Hand tools and appliances in blacksmith shop.

### **Unit 3 : Drawing**

Concept Geometrical & Engineering drawing .  
( Students will carry out exercise during additional practical class )

### **Unit 4 : Fitting work**

Fitting and Overhauling : Types of packing and jointing materials and their uses, Design considerations and construction of various types of valves and cocks . Bedding of bearings, marking of engine parts for fitting, machining operations fitting of keys, cotters, etc.

## SECTION – B (MATERIAL SCIENCE)

[ 42 hrs ]

### **Unit 5 : Solid Solution**

Properties of solid solutions and alloys. Types of Binary alloys & Equilibrium Diagrams, Cooling curves, Eutectic and peritectic alloys, Intermetallic compounds. Phase transformation in metals; allotropy. Allotropy of Iron, Iron-carbon Equilibrium diagrams. Equilibrium Diagrams for Ferrous and Non-ferrous metals and alloys.

### **Unit 6 : Heat treatment**

Heat treatment of metals and alloys : Purposes of heat treatment; Effect on structures and properties . Methods of heat treatment – annealing; normalising; hardening; tempering; Case hardening and; surface hardening, work hardening. Deformation of materials: elastic deformation; plastic deformation, strain ageing; fracture in materials.

### **Unit 7 : Fatigue**

Fatigue loading, Mechanisms of fatigue, fatigue curve, Fatigue tests. Design criteria in fatigue, Corrosion fatigue. Stress concentration.



Creep phenomena and creep-resisting alloys. Creep curve. Short time and long time creep tests. Development of creep resisting alloys.

### **Unit 8: Corrosion and its prevention**

Mechanism of corrosion, crevice corrosion, Chemical corrosion, Electrochemical corrosion, Anodic and Cathodic protection, Forms of metallic coatings. Anodizing, Phosphating.

### **Unit 9 : Uses of materials in shipboard application**

Chromium, Ceramic, Titanium, PTFE in shipboard Systems. Characteristics of above materials.

Selection of Materials in Shipbuilding & Marine Engineering : Boilers, Steam and Gas turbine, Purifiers and Diesel engine components, Pumping Machinery, Components and Piping System, Engine seating. Propellers and Rudders. Composition, strength value and other requirement for materials used.

### **Unit 10 : Material Testing**

Mechanical tests of materials – routine tests; exploratory tests; destructive tests; non-destructive tests; tests by inspection.

Destructive testing of Materials : Tensile test; stress strain curve; elastic limit, proportional limit; yield strength/point; tensile or ultimate strength, percent elongation, reduction of area. Compression test; Bend test

Hardness tests; impact tests; fatigue tests. Torsion Test .

Non-destructive Tests :Dye penetrant test, Magnetic Dust Test; Fluorescent Test;

Ultrasonic Test, Radiography Test etc.

### **PRACTICAL**

Code No. : P1303

Practical : 36 hrs.

### **Fitting Shop (Bench Work):**

To make a V-fitting from a 10 mm thick plate.

### **Machine Shop (Lathe Work):**

Straight Turning , Boring , internal thread cutting

### **Welding Shop:**

Lap joint ( down hand weld )

Butt joint ( Sinle V & Double V-welding ,on opposite faces, down hand

Pipe welding , Gas cutting of plate and pipe

Brazing of two rods

Prepare wooden box.

### **General overhaul work :**

Dismantling, refitting and studying various types of ship board equipments

### **Workshop maintenance work**

### **Material testing shop :**

Tensile test of M.S , Hardness Test. Dye penetrant test

### **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.; | Nirja Construction and Development Company (P) Ltd, New Delhi 110055 |

# INDIAN MARITIME UNIVERSITY

SECOND YEAR

SEMESTER – III

UG/MS/BS/P/1304	BASIC ENGINEERING SCIENCE PAPER - 2 UG22T2304	72 hrs.
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**Theory – 50 marks**

## **SECTION-A (MECHANICS OF MACHINES)** [ 50 Hrs ]

### **Unit 1 : Sound**

Characteristics of sound: Intensity and loudness; Decibel; Pitch and frequency; velocity of sound in air ; effect of temperature & humidity : laws of reflection and refraction ; Velocity of sound in water: Effects of pressure, temperature and salinity on velocity of sound in water; Determination of velocity of sound in sea water; Reflection and transmission ; echo-sounder , ultrasonic thickness gauge, siren; formation of beats and explain the beat frequency; effect of atmospheric temperature, humidity gradient and the wind on the audibility of sound ; Siren; Doppler effect & measurement of speed .

### **Unit 2 : Flywheel & Governors**

Function of a Flywheel. Crank effort diagrams. Fluctuation of speed and energy. Function of Governor; Comparison between a Governor and a fly wheel; Various types of Governors; Centrifugal and Inertia types of Governors, Sensitiveness; Stability and Hunting of Governors; Governor effort & Power, Consideration of friction in Governors.

### **Unit 3 : Link-Mechanisms**

Relative motion between bodies moving in different planes. Instantaneous center method; Rubbing velocities at pin joints. Graphical construction for relative velocity and acceleration in different link and sliding mechanisms. Forces in Crank and connecting rods. Inertia force on link connecting rods etc.

### **Unit 4 : Cams**

Types of cam profiles and followers, Cams with Straight flank, Curved flank, Circular flank with various types of followers Spring force and Reaction Torque Displacement , velocity and acceleration of followers. Uniform acceleration and deceleration,

### **Unit 5 : Gears**

Types of gears ,Various definition e.g. p.c.d., module, path of contact, Gear ratio and center distance of simple and compound gear trains.; Transmission of power by gear trains on parallel shafts; Familiarisation of Rack and pinion, Bevel gears, Worm and

Worm wheel, Spur gear Helical gears, Spiral gears; Epicyclic gear trains, Torque on gear trains,

### **Unit 6 : Balancing**

Balancing of masses rotating in one plane and different planes, dynamic forces at bearings; Primary and secondary balance of multi-cylinder in-line Engines and general concept of V- engines .

### **Unit 7 : Vibration**

SHM, Free vibration & Forced vibration & Damped vibration . Differential equation of motion & it's solution . Linear motion & Angular motion of an elastic system , Free Vibration of springs in series and parallel.

### **Unit 8 : Torsional vibration.**

Single rotor system, rotor at end and rotor in the middle. Two rotor system, rotors at both ends and rotors at one end. Three rotor and multirotor system. Torsionally equivalent shafts, Geared system. Whirling of shafts, critical speed .

## **SECTION-B (MECHANICS OF SOLIDS) [ 22 Hrs ]**

### **Unit 9 : Shafts and torsional Stress**

Shear & Torsion : Shear Stress and Strain. Twisting of solid and hollow shafts, Power and Torque relation. Shafts with liner and compound shafts, Partial hollow shafts, Calculation for Coupling bolts, Torsion applied to closed coil springs, springs with axial load, Calculations for mean diameter of springs, wire diameter & number of coils. Strain Energy in torsion.

### **Unit 10 : Compound Stress and Strain**

Stresses on an Oblique section, General two dimensional stress system, Materials subjected to Direct & Shear Stresses, Combined bending and Twisting, Equivalent bending moment and Torque, Theories of failure. Deflection of beams by integration , Macaulay,s method . Thin curved bar & Castigliano's theorem .

### **Unit 11 : Thin & Thick Cylinders**

Stresses and Strains in thin Walled Shells subjected to internal pressure Strengthening of Thin Walled Shells by wire or tape winding. Thick cylinders, Lamé's theory, compound cylinders, solid shaft subjected to radial pressure, shrinkage allowance. Applied problems.

### **Unit 12 : Struts**

Euler's theory and Euler's buckling load. Use of formulae for struts with both ends pin joined, both ends fixed, one end fixed and one end free, one end hinged. Pin joined strut with eccentric load, Rankine-Gordon Formula.

## PRACTICAL

Code No. : P1304

Practical : 36 hrs.

1. Carry out Experiment on governor and study the performance .
2. Study the function of fly wheel .
3. Study various types of gears and their use on ships .
4. Study the effect of combined bending and twisting on propeller shaft .
5. Study the behaviour of struts .
6. Demonstration of thick & thin shell tubes . Demonstration of wire reinforcement .
7. Measurement of thickness by ultrasonic thickness gauging machine .
8. Reciprocating Pumps : Various types, single and double acting, single and Multi cylinder, Co-efficient of discharge; Effect of acceleration ; Use of air vessel.
9. Centrifugal Pump : Calculations of various heads; Losses and Efficiency, Work done per unit weight Dimensions of Impellers; Velocity diagrams at inlet and exit; Calculation for power &put; Torque on shafts, Cavitations in Centrifugal pumps.
10. Study of quick return mechanism of shaping machine .
11. Balancing of masses .
12. Forced vibration and damping .
13. Vibration monitoring .
14. Technical film on vibration .

### **NOTE :**

- 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 12 tasks to be undertaken by every student .
- 3) Workshop journals to be submitted for assessment at the end of each term .

### **RECOMMENDED REFERENCE BOOKS :**

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|-------------------------------------|---------------------------|------------------------------------|
| 1) Applied Physics                  | : J.H. Clough – Smit      | Brown, Son & Ferguson Ltd.)        |
| 2) Sound                            | : Khanna & Bedi           |                                    |
| 3) Physics - Classical and Modern   | : Gettys, Keller, Skove   | McGra – Hill International Edition |
| 4) Advanced Level Practical Physics | : M. Nelkon & J.M. Ogborn | ELBS                               |
| 6) Principles of Physics            | : Fredrick J. Bueche      | McGra – Hill International Edition |
| 7) Mechanics of Machines            | : Hannah - Stephans       | Longman, Harlow                    |
| 8) Strength of Materials            | : G. H. Ryder             | Macmillan                          |

# INDIAN MARITIME UNIVERSITY

SECOND YEAR

SEMESTER – III

UG/MS/MS/T/1305	MOTOR ENGINEERING KNOWLEDGE PAPER – 2 UG22T2305	54 hrs.
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## Unit 1 : Pressure charging a diesel engine

Review of previous knowledge, Importance of adequate scavenging; Types of turbocharging & , Advantages/ disadvantages; grouping of exhaust pipes , charge air cooling; Turbo-blowers : description , lubrication , Capacity of turbo-blowers; matching of turbo-blowers,; Characteristics of turbo-blower; surging , charge air cooler, breakdown of turbocharger and action required .

New Developments of Turbo-charges (High Pressure Turbo-charges and in series)

## Unit 2 : Combustion of Fuels in I.C. Engines

Grades of suitable fuels., Preparation of fuels for efficient combustion. Fuel atomization, Ignition quality, , after burning , Compression pressure ratio and its effect on combustion , Mean piston speed & effect . Reasons for variations in compression pressure and peak pressure,. Design aspects of combustion chamber. Control of NO<sub>x</sub>, SO<sub>x</sub> in Exhaust emission.

## Unit 3 : Fuel injection

Fuel pumps , 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., adjustment of fuel pump , fuel injectors . Cam shaft less engines.

- Effects of viscosity on liquid fuel combustion.
- Measuring equipment and its working principle.
- 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.

## 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

SECOND YEAR

SEMESTER – III

UG/MS/MS/T/1306	CELESTIAL NAVIGATION PAPER - 1 UG22T2306	54 hrs.
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## Theory - 75 Marks

### **Unit 1 : THE CELESTIAL SPHERE**

The celestial sphere, celestial poles, equinoctial, declination, celestial meridian, vertical circle, prime vertical, Ecliptic, First point of Aries, RA, SHA, GHA, LHA, v & d corrections for moon and planets, position of a heavenly body on celestial sphere by its declination and GHA, or by its altitude and azimuth, or by its celestial latitude and longitude. Visible, sensible and rational horizons, zenith, nadir, sextant altitude, apparent altitude, correction of altitude, dip, refraction, semi-diameter, parallax in altitude, horizontal parallax, augmentation to moon's S.D., reduction to H.P. True altitude and True Zenith distance. Total correction table. Artificial horizon & correction of altitude there from ; back angle altitudes.

### **Unit 2 : CELESTIAL BODIES**

Birth of universe, stars, planets and their satellites. Signs of the Zodiac. Recognition of principal stars with reference to their constellations. Stellar magnitudes. Earth-moon system, moon's orbital and axial rotation, phases of the moon, liberation. Lunar month.

### **Unit 3 : SOLAR SYSTEM**

Planetary Motion, Apparent Motion of Celestial Bodies, Elongation of Planet or the Moon, Venus as a Morning and Evening Star, Apparent Magnitude of Planet

### **Unit 4 : EARTH-MOON SYSTEM**

Phase of the Moon, Daily Retardation of the Moon, Appearance of the Moon Relative to the Horizon ,Liberation of the Moon , Eclipses, Occultation.

### **Unit 5 : TIME**

The day, Mean, Apparent & Sidereal Time, Relationship between Longitude and Time, Standard Time, Zone Time, International Date time, True and apparent motion of bodies. Solar time, Solar day, apparent sun, mean sun & dynamical mean sun; Equation of time. Time and hour angle, Hour circle, Greenwich time, local time, zone time & standard time. Keeping time at sea, advancing & retarding of clock with change of longitudes; International date line. Sidereal time, sidereal day, why stars rise four minutes earlier each day, conversion of solar time to sidereal time and vice-versa.

### **BOOKS RECOMMENDED FOR REFERENCE:**

1. Principles of Navigation : Capt. P. M. Sarma.
2. Principles of Navigation : Capt Joseph and Capt. Rewari
3. Principles & Practices of Navigation : Capt. S. Panda
4. Practical Navigation : Capt. H. Subramaniam
5. Admiralty Manual of Navigation Vol. I & II.
6. Nicholl's Concise guide Vol- I & II
7. Navigation : Frost A

# INDIAN MARITIME UNIVERSITY

SECOND YEAR

SEMESTER – III

UG/MS/MS/P/1307	<b>BRIDGE WATCH – KEEPING AND EMERGENCIES PAPER – 2 (TRAINING)</b> <b>UG22T2307</b>	<b>72 hrs.</b>
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## MARINE COMMUNICATION

- (1) Practical usage of International Code of Signals, To Send and receive signal visually by Morse code,
- (2) Morse signalling with Aldis lamp on mains and battery.
- (3) Morse signalling with Day light signalling Apparatus.
- (4) Bridge Resource Management :
  - (i) Knowledge of bridge resource management principles including.
  - (ii) Allocation, assignment, and prioritization of resources
  - (iii) Effective communication.
  - (iv) Assertiveness and leadership.
  - (v) Obtaining and maintaining situational awareness.

## 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.
- (5) Recognition & use of various shapes  
**[ 4 tasks must be performed ]**

## BRIDGE EQUIPMENT

- (1) **ECHO SOUNDER:** Use and care of both visual and graphic types. To take soundings using Echo sounder or Echo sounder 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.  
( All tasks may be performed on simulator)  
**[ At least 4 tasks must be performed ]**



## **EMERGENCIES / SEAMANSHIP**

1. To make and understand the use of various bends and hitches :- Mousing hooks and shackles. Breaking flags.
2. To apply rope and chain stoppers. To make various types of whippings.
3. To perform various splices on natural and synthetic fibre rope,
4. To perform various splices on wire ropes.
5. Worming, parcelling and serving of hawsers. Throwing a heaving line.
6. Heaving the lead and calling out soundings. Slinging a stage.
7. Precautions when using stages. Oiling wire ropes in situ by use of Bosun's chair. Safety precautions.
8. Canvass sewing. Changing the canvass covering of a lifebuoy.
9. Seizings : Flat. Round, Racking. Parbuckling. Helm orders. Steering practice.
10. Changing boat falls.
11. Taking soundings of tanks and bilges. Measuring ullages.
12. Removing rust by chipping hammers. Preparing a surface for painting.
13. Cleaning and polishing of brass and copper.
14. Swinging out and lowering a lifeboat from luffing and gravity davits. Use of Tricing pendants.
15. Handling of lifeboat under oars - coming alongside, getting away and picking up a man overboard.
16. Handling of lifeboat under sail: Types and parts of sails. Setting sail. Sailing a life boat.
17. Handling of boats in rough weather: Heaving to. Use of sea anchor and steering oar. Rescuing a man overboard.
18. Starting the engine of a motor lifeboat. Man overboard drill.
19. Turning short around, towing other crafts.
20. Hoisting a lifeboat on davits. Checking the working of cut-off switches.
21. Launching of liferafts. Inflating liferafts. Method of righting a liferaft which has inflated upside down.
22. Boarding a liferaft Jumping into the water. Getting away from ship. Artificial respiration.
23. Use of lifeboat WT. Installation of aerial. Tuning the transmitter. Transmitting Automatic Distress signal. Transmitting manually. Receiving. Listening times for distress calls.
24. Donning a smoke helmet and self contained breathing apparatus
25. Boat and Fire drill. Sounding Emergency signal.
26. Action on hearing the emergency signal.
27. Coiling ropes. Cutting wire ropes. Opening a new coil.
28. Charging of various type of fire extinguishers.
29. To make and understand the uses of the knots used on board ships for various purposes.
30. Recognition of national Flag of all countries, Recognition of House flags and funnels of Indian Shipping Companies, Recognition of flag denoting number and flags used as substitutes ,How to bend on or unbend a flag from halyard, Breaking a flag at close up Flag hoisting practice at colour and sunset,  
[ At least 28 tasks must be performed by students ]

**NOTE:**

- 1) There will be continuous assessment of skills being acquired through class-work, practicals and periodic assignments / project works / tests / orals etc.
- 2) Laboratory journal to be submitted at the end of each term for assessment .

**BOOKS RECOMMENDED FOR REFERENCE :**

- |   |                           |
|---|---------------------------|
| 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                    |
| 13. Bridge equipment                          | : G.L. Sonnenberg         |