

UNIVERSITY OF MUMBAI
No.UG./ 477 of 2006

CIRCULAR :-

Attention of Principals of the affiliated colleges in the faculty of science is hereby invited to the Ordinance, Regulation and Syllabi relating to the Bachelor of Science (B.Sc.) (Maritime Sciences) degree course vide pamphlet No. 351 and to this office circular No. UG/75 of 2006 dated 16th March, 2006, and they are hereby informed that the recommendation made by the Ad-hoc committee appointed by the Academic Council to advise it on all matters relating to the courses of Study and examinations leading to the degree of B.Sc. Maritime Sciences degree course at its meeting held on 26th July, 2006 has been accepted by the Academic Council at its meeting held on 18th August, 2006 vide item No.4.33 and that in accordance therewith the Syllabi of First Year, Second Year and Third Year B.Sc. (Maritime Sciences) degree course is revised as per Appendix* and that the same has been brought into force with effect from the academic year 2006-2007.

MUMBAI-400 032

4th December, 2006

for REGISTRAR. *4/12*

To,

The Principals of the affiliated colleges in the faculty Science

AC/4.33/18.08.06

No.UG/ 477-A of 2006,

MUMBAI-400032

4th December, 2006

Copy forwarded with compliments for information to :-

1) The Dean, faculty of Science.

for REGISTRAR *4/12*

Copy to:-

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Personal Assistants to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative, Ratnagiri for information.

The officer on Special Duty & Controller of examinations (10 copies), the Finance and Accounts officer (2 copies), Record Section (5 copies), Publications Section (5 copies), the Deputy Registrar, Enrollment, Eligibility and Migration Section (3 copies), the Deputy Registrar, Statistical, Affiliation Section (2 copies), the Director, Institute of Distance Education, (10 copies) the Director University Computer Center (IDE Building), Vidyanagari, (2 copies) the Deputy Registrar (Special Cell), the Deputy Registrar, (PRO) The Assistant Registrar, Academic Authorities Unit (2 copies) and the Assistant Registrar, Executive Authorities Unit (2 copies). They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above Circular and that no Separate Action Taken Report will be sent in this connection. The Assistant Registrar Constituent Colleges Unit (2 copies), BUCT (1 copy), the Deputy Account, Unit V(1 copy), the In-charge Director, Centralize Computing Facility (1 copy), the Receptionist (1 copy), the Telephone Operator (1 copy), the Secretary, (1 copy), the Superintendent, Post-Graduate Section (2 copies), the



UNIVERSITY OF MUMBAI



Revised Syllabus for the First Year, Second Year & Third Year B.Sc. (Maritime Sciences) Degree Course

(with effect from the academic year 2006-2007)

LIST OF SUBJECTS

FIRST YEAR

Sr. No.	Subjects
1	Mathematics
2	Basic Engineering Science
3	Heat & Thermodynamics
4	Marine Electrotechnology Paper - 1
5	Terrestrial and Coastal Navigation Paper -1
6	Bridge Watch Keeping & Emergencies Paper - 1
7	General Engineering Knowledge Paper - 1
8	Motor Engineering Knowledge Paper - 1
9	Marine Auxiliaries Paper - 1
10	Ship Construction, Naval Architecture (Stability), Safety and Environment Protection Paper – 1

MATHEMATICS

Code No. - 101
Max. Marks - 100

Theory - 120 hrs.
Practical - Nil

Unit 1 : A revision of previous knowledge.

Indices , Logarithms, Surds, Arithmetical and Geometrical Progression, Binomial theorem and it's application, Simple & complex numbers , Power & roots of exponential and trigonometric functions; Hyperbolic & logarithmic functions; Inverse hyperbolic & inverse trigonometric functions; Separation into real and imaginary parts of all types of functions , Determination of empirical laws by plotting functions of a data. Basic & advanced trigonometry (Questions not to be set from this part)

Complex variables :Definition ; Cartesian, polar and exponential form, Imaginary quantities ,Complex quantities in terms of an angle, De-Moivre's Theorem.

Unit 2 : SPHERICAL TRIGONOMETRY

Properties of a spherical triangle ; Length of no side of spherical triangle - exceeds 180° ; Sum of the angles of a spherical triangle - exceeds 180° but is less than 540° ; Polar triangles and applications of their properties; Solution of spherical triangles by haversine formula and sine formula; Given two parts of a right-angled spherical triangle, use Napier's rules to solve for any other part ; Solve problems on spherical triangles by dropping a perpendicular and solving the resulting right-angled triangles; What is meant by a quadrantal triangle ; Given two parts of a quadrantal triangle, use Napier's rules to solve for any other part; Solve problems involving oblique spherical triangles by use of the cosine and sine formulas.

Unit 3 : VECTORS

Vector $-\underline{a}$ - of the same magnitude but in opposite direction to $\underline{a}$; Calculate the difference between two vectors by graphical methods; Show that $c(\underline{a} + \underline{b}) = c\underline{a} + c\underline{b}$, where c is a scalar constant; Resolve a given vector into components in two specified perpendicular directions by calculation; Express a vector in terms of components, $\underline{r} = x\hat{i} + y\hat{j}$, where $\hat{i}$ and $\hat{j}$ are unit vectors in the x and y directions respectively;

Calculate sums and differences of vectors by resolution into perpendicular directions; Derive average velocity vector from given position vectors; Derive average acceleration vector from given velocity vectors; Solve problems involving forces, velocities and accelerations.

Unit 4 : CO-ORDINATE GEOMETRY

Circles : Standard and general equations

Conics : Focus directrix property ; standard forms of equations of parabola, hyperbola and ellipse (to be assumed).

Define a hyperbola as the locus of a point which moves so that the difference of its distances from two fixed foci is constant ; Locus of points for which the difference is

zero – the perpendicular bisector of the line joining the foci ; Locus of points for which the difference is equal to the distance between foci – the line joining the foci produced from the nearer focus.
 Symmetry of parabolic, hyperbolic and elliptical curves about their axis and centre.
 Construct a family of hyperbolas ; Explain what are meant by asymptotes to the hyperbola ; Asymptotes – pass through the mid-point of the line joining the foci.
 Draw an ellipse by plotting ordinates equal to, $\frac{b}{a} \times$ the ordinates of a circle of radius a , where a and b are the semi-major and semi-minor axes respectively.
 Properties of conics for application to navigation.

Unit 5 : CALCULUS

Differentiation : The formulae for the derivations of algebraic, trigonometric, inverse, exponential and logarithmic functions (to be assumed) and their applications in examples ; Product & quotient functions of a function and simple implicit functions ; Differentiation of second order; Examples of maxima and minima; Simple cases of points of inflexion; Successive differentiation; Standard form to find the n th derivative; Leibnitz's theorem, Rolle's theorem (with proof), Lagrange's and Cauchy's mean value theorem (with proof), Taylor's theorem, Taylor's and Maclaurin's (without proof); Indeterminate forms; L' Hospital's rule; Expansion of function in power series (all types); Partial derivatives of first and higher orders; Examples of motion of a body; Simple harmonic motion ; Deflection of beams; Total differential, Concept of commutativity of partial derivatives (without proof); Euler's theorem on homogeneous functions, Deduction from Euler theorems; Errors & Approximations; Maxima & Minima of the functions of two variables.

Integration : Integration as a reverse process of differentiation ; Integration of standard forms; Integration by substitution ; Integration by parts; Integration using partial fractions; The definite integral as the limit of a sum ; Mean values, Root mean square values of $\sin nx$ and $\cos nx$; Rectification of plane curves; Double & Triple integrals, their geometrical interpretation and evaluation; Evaluation of double integrals by change to polar form; Application of double & triple integrals to areas under curve, the position of the centroid of an area, volume of revolution, work done by variable forces.

Beta & Gama functions : Beta & Gama functions and their properties, relation between Beta & Gama functions; Error functions; Differentiation under integral sign.

Unit – 6 : 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 7 : 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 8 : 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.

Unit 9 : Probability & Statistics

Probability and Statistics; Concept of Probability; Random Experiments, Sample Space, Events; Axioms of Probability; Some important Theorems on Probability; Mutually exclusive events; Conditional Probability; Independent Events; Babey's Theorem; Problems and application on Combinational Analysis; Probability using Combinatorial Analysis.

Unit 10 : Digital Mathematics.

Binary codes :- Weighted and Non weighted Binary codes, Error detecting codes, Error correcting codes, Alphanumeric codes. Basic logic gates : AND pr NOT gates, combining logic gates, NAND, NOR, Exclusive-OR, Exclusive-NOR gates, converting gates with inverters.

Logic Circuits : - Sum-of-Products Boolean expressions, Product-of-Sums Boolean expressions, use of De Morgan's Theorems, use of NAND logic, USE OF NOR logic Numerical Analysis.

Unit 11 : Computer science

- 1) A brief discussion of the principles of a computer; the hardware configuration including the connection peripherals; setting up a printer, changing paper and ribbons.
- 2) A brief explanation of the operating system, its purpose and how to use it for loading and running programs; storing, naming, renaming and deleting files; arrangement of the directory.
- 3) The care and storage of floppy discs, CD-ROMs and tapes; use of utility programs for formatting and copying discs; keeping back-up copies of files; virus protection.
- 4) C Programming , Operating System Fundamentals , Object Oriented Programming (OOP) Visual Basic (VB) 5.0

NOTE :

Units 1, 2 , 3 , 4, 5, 6 are to be covered in the first term and Units 7, 8, 9, 10 & 11 are to be covered in the second term.

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.

PATTERN OF QUESTION PAPER

F.Y.B.Sc. (Maritime Science)

MATHEMATICS

Duration – 3 hrs.

Max. Marks – 100

Note: Total of NINE questions to be set

Question No1 will be compulsory and carry 20 marks.

Attempt any FIVE from the remaining . Each question will carry 16 marks

BASIC ENGINEERING SCIENCE

Code No - 102
Max. Marks - 100

Theory - 80 hrs.
Practical - 40 hrs.

Theory : 75 marks

MECHANICS OF MACHINES [55 HRS]

Unit 1 : Statics (Revision of previous knowledge)

Polygon of forces , conditions for equilibrium , find resultant of forces, moment of force , Condition of equilibrium of a body Balance of moments; Define a couple and the moment of a couple; Determine the moment produced by a couple; Resolve a single force into components acting in two given directions; Resolve a force into a force and a couple.

Unit - 2 , Dynamics (Revision of previous knowledge)

DYNAMICS : Relationship between Speed, Acceleration, Mass, Force and Resistance , Define relative velocity; Define velocity as a graphic representation; Use the parallelogram and the triangle of velocities to obtain resultant velocity, Newton's Laws of Motion , Mass, Weight and Force , Law of conservation of momentum; Relationship between forms of Energy, Work and Power , Define Centroides : Centre of gravity. Centroids of areas, Centroids of lines, Centroids of volume, Centroids of masses , Define the factors which govern the stability and overturning of a box; Describe the conditions of stable, unstable and neutral equilibrium; Solve simple numerical and graphical problems involving forces, moments of forces and equilibrium conditions Define . 'potential energy'; & 'kinetic energy', conversion of energy;

Motion of rigid bodies : Rotation about fixed axis. Rotation under constant moment. Periodic motion, simple Harmonic motion; Application of S.H.M. to masses and springs Simple Pendulum and Compound Pendulum Work, power and energy.

Unit - 3 :Light

Spherical mirrors, real and virtual images ; converging and diverging mirrors; location of principal focus of a spherical ; Draw scale diagrams to find the position and size of the image in a spherical mirror; Define linear magnification.

Laws of refraction; refractive index , total internal reflection, 'critical angle'; Derive the relationship between the critical angle and the refractive index; use of prisms as reflectors; optical fiber.

lenses; Define 'principal axis', 'principal foci' and focal length' of a lens; image formed by a lens; function of magnifying glass; function of binoculars, effect of Dispersion of light , scattering.

Unit - 4 , Inertia

Centre of mass , Moment of Inertia , deduction of formula ,Transfer formula. Product of inertia and its transfer formula. Maximum and minimum moment of inertia. Neutral axis , Mass moment of inertia and its transfer formula. Radius of gyration.

Unit – 5 , Machines

Ideal machines. Law of machines. Reversibility and irreversibility of lifting machines and its application to different types of lifting machines, Define the velocity ratio ; Define efficiency of a machine; Solve the problems on the following machines : lever ; moving pulley; block and tackle ; inclined plane ; wheel and axle ; gears ; screw jack.

Unit – 6 , Friction

Static and Kinetic Friction. - Laws of Friction; Effort required to pull a body up or down an inclined plane. Friction in Square and V-threaded screws, friction in pivots and collars; Conical bearings and thrust bearings plates. Plate clutch, Cone clutches and Centrifugal clutches.

Unit – 7 , Dynamics of Rotation

Dynamics of rotation of particle and rotating bodies, velocity and acceleration in terms of path variables, Torque equation; Work done by application of torque; Kinetic energy of rotation. Total Kinetic energy of a rolling wheel. Gyroscope and it's characteristics ; Precession of gyroscope , gyroscopic effect of engine flywheel and reaction on bearings . Application to Ship's stabilization & steering

Unit – 8 , Belt Drives and Brake

Belt and Rope drives; Open and Cross Belt drive; Belt dimensions; Ratio of belt tension; Modification for V-groove pulleys; Power of Belt drives , and maximum power transmitted. Effect of Centrifugal tension; Different types of band brakes . Dynamometers and their working principles; Absorption Dynamometer Band & Rope Brake Dynamometer, Hydraulic Dynamometer.

MECHANICS OF SOLIDS, [25 HRS]

Unit – 9 , Stress and strain (Revision of previous knowledge)

Concept of Elasticity and Plasticity , Stress and Strain, Hooks law, Young's modulus , Modulus of rigidity , Relationship between E & G , testing of material , , limit of proportionality , yield point , breaking stress , UTS, Factor of safety ,

Unit - 10 , Torsion & Composite material.

Torsion , Normal & complementary shear and the corresponding strains. Poisson's Ratio and. Relationship between three elastic constants. Uni-axial loading and deformations; Thermal Stress; Axial Stresses in composite materials. Strain Energy in Simple Stresses; Concept of Strain Energy; Strain Energy due to normal and Shear Stresses; Strain Energy due to impact loads; Resilience.

Unit - 11 , Beams

Types of beams, reactions, Sign Convention, Relation between Intensity of Loading, Shearing Force and Bending Moment. Graphical construction of Bending Moment & Shear Force diagrams. Introduction to Built-in and continuous beams Use of empirical formulae for Deflection of beams .

Unit - 12 , Bending Moment & Stress

Pure Bending, 2nd moment of area, Stresses due to bending. Position of Neutral axis, Radius of Curvature, Combined bending and direct stress. Short Column with eccentric loading. RCC beams.

NOTE :

Units 1, 2 , 3, 4 and units 9 & 10 are to be covered in the first term and Units 5, 6, 7, 8 and units 11 & 12 are to be covered in the second term. Special emphasis to be given on marine applications of the theories .

PRACTICAL

Maximum marks -25

Contact Hours : 40 Hrs

1. Demonstration of a Weston Differential pulley.
2. Demonstration of Block and tackle arrangements.
3. Demonstration of Wheel and axle arrangements.
4. Demonstration of Gears.
5. Demonstration of Screw jacks.
6. Investigation of Hooke's Law by plotting a graph of its extension against the load on a spring.
7. Determination of the elastic constant in the previous objective.
8. A single cantilever (loaded at one end). Determination of E.
9. Use of CRO to study the characteristics of an audio oscillator (frequency, period, amplitude).
10. Determination of velocity of sound in air (using a CRO).
11. Determination of velocity of sound in sea water.
12. Moment of inertia of a rectangular lamina.
13. Moment of inertia of a circular lamina.
14. Moment of inertia of flywheel and frictional torque.
15. To prove that if a system of uni-planar forces are in equilibrium, the links respectively given in magnitude and direction taken in order, form a closed polygon.
16. To determine the reactions of a Loaded Beam.

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 undertaken by every student .
- 3) Laboratory journal to be submitted at the end of each term for assessment .

RECOMMENDED BOOKS :

- | | | |
|-------------------------------------|---------------------------|------------------------------------|
| 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 |

PATTERN OF QUESTION PAPER

F.Y.B.Sc. (Maritime Science)

BASIC ENGINEERING SCIENCE

Duration – 3 hrs.

Max. Marks – 75

Question No 1 will be compulsory and carry 15 marks .

Section – A , Mechanics of Machines, will have FIVE questions . THREE to be attempted [Total 36 marks]

Section – B , Mechanics of Solids , will have THREE questions . TWO to be attempted . [Total 24 marks]

HEAT & THERMODYNAMICS

Code No. - 103
Max. Marks – 100

Theory – 80 hrs.
Practical – 40 hrs.

Theory – 75 marks

Unit : - 1 , Thermodynamic Definitions :

Heat, Work, Enthalpy , Entropy, Energy, System, Boundary, Control, Working substance, Phase Properties, Phase Diagrams. Point Function, Path Function, Reversible and Irreversible Process; P-V Diagram for Work Transfer in Reversible Processes; Closed System and Open System; Steady Flow Process and Non-flow Process;

Unit – 2, Laws of Thermodynamics :

First Law of Thermodynamics and its application to various Processes;

The second Law of Thermodynamics :-Different statements of the second Law of Thermodynamics. Thermodynamic Reversibility.

Unit – 3 , Properties of Gases:

Characteristic Equation of State for a Perfect Gas; Isothermal, adiabatic and polytropic processes; Relationships between pressure, temperature and volume; Sketch P-V diagrams; work transfer in different processes ; Equation of State for Real Gas; Internal Energy of a Gas and Joule's Law; Two Specific Heats of a Gas and relation between them. Different Gas Processes and Heat & Work Transfer in various Gas Process; Temperature-Entropy Diagram; Applied Problems.

Unit – 4 , Thermodynamic cycles :

Carnot cycle, Carnot Principle, Carnot cycle for a gas, Deductions from Carnot cycle. Steam and Gas Processes on T-s and h-s charts, Constant Volume Cycle; Constant Pressure Cycle; Diesel Cycle; Dual Combustion Cycle; Application in 4Stroke & 2-Stroke IC engines ; Criteria of Performance; Compression Ratio and Thermal Efficiency; Air standard efficiency .

Unit – 5 , Properties of steam :

Steam and Two Phase System:: Phase: Equation of Steam; Temperature – Pressure Diagrams; Specific Enthalpy and Entropy, Saturated steam; Dry and wet steam; Dryness fraction; Super-heated steam; throttling , Separating and throttling calorimeters. Use of Steam Tables , Enthalpy-Entropy Diagrams; Applied Problems.

Unit – 6 , Vapour cycles :

Carnot cycle for steam and Ideal Efficiency. Rankine cycle with dry saturated steam and superheated steam , superheat cycle, reheat cycle, regenerative cycle for Steam machinery plants, combined steam & gas plant . Feed Pump work. Rankine Efficiency, cycle Efficiency, Isentropic Efficiency, work Ratio, Reheating and Regenerative Feed Heating and their effect on Thermal Efficiency. Applied Problems,

Unit – 7 , Air compressors :

Elementary principles and cycles of operation; Calculation of work done; volumetric efficiency, ideal compression ratio , effect of clearance on volumetric efficiency , Indicator diagrams. FAD ,capacity .

Unit – 8 , Properties of Mixtures of Gases and Gas & Vapours :

Dalton's Law of partial pressure, Amagat's Law of partial volume, volumetric and Gravimetric Analysis of Gas Mixtures, Gibbs -Dalton Law, Mean value of a Gas constant. Equivalent Molecular weight, Density, specific volume, specific Heat and Molar Heat capacity of gas mixture. Problem on Adiabatic Mixing Air and Water vapour mixture, Specific Humidity, Relative Humidity, Dew point, unsaturated and saturated Air. Principle of Cooling Tower and surface condenser . Applied Problem

Unit – 9 , Fuels & Combustion :

Definition of Fuel, combustion. Combustion Equation, Analysis of the Products of Combustion, stoichiometric combustion, Actual combustion, Excess Air, Mixture strength.

Unit – 10 , Steam turbines :

Isentropic flow, Effect of Friction, Flow through Nozzles and Diffuser. Critical condition, Mach number, Subsonic. Sonic and Supersonic Flow. Flow of steam through Nozzles and Diffusers . Principles of steam turbine, Impulse and Reaction Turbines-Velocity Diagrams for simple impulse and Impulse-Reaction Turbine. Compounding of Impulse Turbine -Pressure and velocity compounding. Forces on blades, Work done by Blades, Axial Thrust, Blade or Diagram Efficiency.

Unit – 11 , Refrigeration:

Reversed Carnot cycle, Vapour compression cycles, Refrigerating Effect, Co-efficient of performance, cooling capacity, rating of a Refrigerating Plant, Methods of improving COP Use of Vapour Tables, Describe how the vapour-compression cycle can be used as a heat pump.

Unit – 12 , Transfer of heat :

Theory of conduction, convection and radiation; Fourier's Law of Heat conduction. Thermal conductivity of Insulating materials. Conduction through flat & cylindrical, spherical surfaces in series. Heat Transfer from fluids to fluids through walls. Natural and Forced Convection .Application of Heat Transfer in Marine Heat Exchangers, like Coolers, Heaters, Condensers. Prediction of convection Heat Transfer rates. Use of Non-Dimensional Groups. Prandtl No. Nusselt No., Reynolds No., Stanton No., Grashof No, Graetz No., etc, . Radiation : Basic, Stephen-Boltzman law, Grey / Black bodies etc.

NOTE :

Units 1, 2, 3, 4, 5 & 6 are to be covered in the first term and Units 7, 8, 9, 10, 11 & 12 are to be covered in the second term.

PRACTICAL

Maximum marks - 25

Contact Hours – 40 Hrs

- 1) Study of Thermistor as a thermometer and Calibration of mercury thermometer .
- 2) To determine Absolute Viscosity and Kinematic Viscosity of oils by Red Wood Viscometer.
- 3) Stefan's Law of Radiation using a filament lamp.
- 4) To determine specific heat capacity of substances.

- 5) To determine final temperature of mixtures, and verification of the observed value by calculations.
- 6) To verify the law of conduction and thermal conductance.
- 7) To demonstrate the "corresponding" relationship that exists between pressure and temperature for a saturated liquid or saturated vapour.
- 8) To read a wet – and dry – bulb hygrometer and to use tables to determine the relative humidity.
- 9) To determine the Flash Point of a given sample of oil.
- 10) To determine the Calorific value of the fuel with the help of a Bomb Calorimeter.
- 11) To determine thermal efficiency of a boiler and steam turbine plant
- 12) To determine thermal efficiency of a diesel engine .
- 13) To study various types of blades for steam turbine .
- 14) To study COP of a refrigeration plant .
- 15) To study operation of a compressor and calculate volumetric efficiency of the compressor .
- 16) To study operation of a refrigeration plant on computer based software .
- 17) To study performance of a Diesel Engine on Turbo- Diesel soft ware ..

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 15 experiments must be undertaken by every student .
3. Laboratory journal to be submitted at the end of each term for assessment .

RECOMMENDED REFERENCE BOOKS :

- | | | |
|-----------------------------------|--------------------------|------------------------|
| 1) University Physics | : Young Sears & Zemansky | Narosa Publishing |
| 2) Heat & Thermodynamics | : Brijlal & Bedi | Ratan Prakashan Mandir |
| 3) Heat & Thermodynamics | : Zemansky | |
| 5) Basic Engineering | : Joel, R. | Longman, Harlow |
| Thermodynamics | | |
| 6) Physics - Classical and Modern | : Gettys, Keller, Skove | McGra – Hill |
| | | International Edition |
| 7) Heat & Thermodynamics | Eastop & McKonky | |

PATTERN OF QUESTION PAPER
F.Y.B.Sc. (Maritime Science)

HEAT & THERMODYNAMICS

Duration – 3 hrs.

Max. Marks – 75

Note : Total NINE questions are to be set .

Q.No 1 will be compulsory and will carry 15 marks .

FIVE questions are to be answered from the remaining , each of which will carry 12 marks .

MARINE ELECTROTECHNOLOGY PAPER - 1

Code No. - 104
Max. Marks - 100

Theory - 80 hrs.
Practical - 40 hrs.

Theory - 75 marks

ELECTRICITY [40 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 α 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 lower 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.

ELECTRONICS [40 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.

NOTE :

Units 1, 2 , 3 & 6, 7 are to be covered in the first term and Units 4, 5 , & 8, 9, 10 are to be covered in the second term.

PRACTICAL

Maximum Mark – 25

Contact Hours : 40 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 :

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.

PATTERN OF QUESTION PAPER F.Y.B.Sc. (Maritime Science)

MARINE ELECTROTECHNOLOGY PAPER - 1

Duration – 3 hrs.

Max. Marks – 75

Note: Q.No1 will be compulsory and will carry 15 marks .
Answer FIVE from the rest taking at least TWO from each section Each question will carry 12 marks .

Section – A , Electricity – FOUR questions to be set

Section – B , Electronics – FOUR question to be set

TERRESTRIAL & COASTAL NAVIGATION PAPER - 1

Code. No. - 105
Max. Marks - 100

Theory - 80 hrs.
Practical - 40 hrs.

Theory - 75 Marks

TERRESTRIAL NAVIGATION

[35 hrs]

Unit - 1.

The shape of the earth, Poles, Equator, Great circles, Small circles, Parallels of Latitude, D'Lat, Meridians, Prime Meridian, Longitude, D'Long, Position by latitude & longitude; Departure. Relationship between Departure and D'Long. Parallel sailing. Rhumb Line. Mean Latitude. Plane sailing. Relationship between departure, d'lat, course and distance. Middle Latitude.

Unit - 2.

Measurement of distance : Nautical, Geographical and Statute mile. Knot. Effect of polar compression on nautical mile.

Principle of Mercator projection: Mercators chart, Nautical Scale, Meridional Parts; DMP. Latitude and longitude scales and conversion of one to the other; Mercators Sailing. Relationship between Course, D'long and DMP.

Principle of Gnomonic projection. Gnomonic chart.

Unit - 3.

Compass Points, True and Magnetic north. Magnetic variation and changes in its annual value. isogonals. Deviation of magnetic compass, compass error. Course & Bearing. Conversion of compass course to true course and vice versa.

Dead Reckoning position (DR). Estimated position (EP) & Observed position (Fix). Set and drift of current. Leeway.

Unit - 4.

Spherical Triangle. Great circle sailing : initial course, final course, distance and vertex.

COASTAL NAVIGATION

[45 hrs]

Unit - 5.

The nautical chart. Nautical scale, types of projections, Title of chart, Number of Chart, Date of publication. The Compass Rose. Correction from notices to mariners. To find the date the Chart was last brought up to date. Small and large Correction. Degree of reliability of information shown on the chart. Types of charts - Ocean charts, Coastal charts, Harbour plans, Decca charts, Consol charts, Loran charts, Routing charts.

Unit - 6.

Deciphering the symbols and abbreviations used on a nautical chart. Units of sounding used. How to read latitude and longitude. The distance scale. Use of dividers to measure distances. Reason for using the nearest latitude scale for measuring distance. Nature of bottom. Depth Contours.

Unit – 7.

The use of the Admiralty Catalogue to identify the charts required for voyage. Meaning of chart Datum. Reference point used for heights. Information regarding lights.

Unit – 8.

The use of parallel rulers to lay down or read courses and bearings. Height, colour and characteristics of lights. Use of leading lights for safe navigation in harbour. Horizontal sectors of lights and their use by navigators in keeping clear of submerged dangers to navigation. Use of sectors in laying courses. Use of clearing marks and horizontal and vertical danger angles. Sailing round an arc.

Unit – 9.

True Magnetic and Compass North. Variation. Annual rate of change of variation. How to obtain variation from date given on the Compass Rose. Deviation of the compass. The deviation card. True Magnetic and Compass course. Conversion of one to another. The compass error for the ship's head. True Magnetic and Compass bearings. conversion of one to another. Gyro Error. High and Low. Conversion of Gyro courses to True course and vice versa. The effect of current on course made good. Set and drift. The effect of wind on course made good. Leeway. The Dead Reckoning Position, Estimated position and Observed position.

Note: Units 1,2,5,6,7 are to be covered in the First Term and Units 3,4,8,9 are to be covered in the Second Term.

PRACTICAL

Maximum Marks - 25

Contact Hrs : 40 hrs.

TERRESTRIAL NAVIGATION

1. The chronometer. Checking chronometer error by radio signals. Finding U.T. and correct data.
2. The micrometer Sextant . Arc of access . Error of perpendicularity . Side error. Index error on the arc and off the arc. Collimation error. Taking vertical and horizontal angles. Position fixing by bearing and vertical sextant angle of a light- house. Position fixing by horizontal angle between three or more points.
Recognition of important stars with reference to stellar constellations.
3. The use of Azimuth mirror and Pelorus. Procedure for checking accuracy of Azimuth mirrors.
4. The use and care of magnetic compasses. Precautions to be observed while taking compass bearings. Practical limitations of the magnetic compass.
[At least 3 tasks to be completed]

COASTAL NAVIGATION

1. To find compass error by transit bearings.
2. To find the position of a point on the chart by its latitude and longitude.
3. To find the position of a point on the chart by its bearing and distance from a navigational mark.

4. To plot ship's position given the compass bearings of two or more shore objects. The 'Cocked hat' and the reasons for its formation.
 5. To plot ship's position, given the rising or dipping bearing of a light.. Caution during abnormal refraction.
 6. To plot ship's position using three shore objects by horizontal sextant angles (given Horizontal sextant angle less than 90, equal to 90, or greater than 90). .
 7. To plot ship's position, given vertical sextant angles and bearing of a light house.
 8. To plot position lines obtained by Radio Aids to navigation.
 9. To plot a Position line obtained by an astronomical observation.
 10. To find compass course between two positions on the chart.
 11. To find compass course to steer between two positions on the chart so as to counteract the given set and drift of current and given leeway.
 12. To find the course and distance made good, given course steered, set and drift of current and leeway.
 13. To find the course and speed made good and the set and drift, given the course steered, speed, duration and the initial and final observed positions.
 14. To find the course from a given position so as to pass a lighthouse at a given position so as to pass a lighthouse at a given distance when abeam:
- [At least 12 tasks to be completed]

BOOKS RECOMMENDED FOR REFERENCE:-

- | | |
|---|--|
| 1. Practical Navigation | : Capt.H.Subramaniam |
| 2. Principles of Navigation | : Capt. P.M. Sarma. |
| 3. Principles of Navigation | : Capt. T.K.Joseph and Capt.S.S.S.Rewari |
| 4. Admiralty Manual of | : Navigation Vol. I & II. HMSO |
| 5. Navigation | : A. Frost. |
| 6. Nicholl's Concise Guide Volumes I & II.. | : Brown Son & Ferguson Ltd. |
| 7. Chartwork for Mariners | : Capt. Puri, S.K. |
| 8. Voyage Planning & Chartwork | : Capt.M.V.Naik & Capt. Warty |

PATERN OF QUESTION PAPER **F.Y.B.Sc. (MARITIME SCIENCE)**

TERRESTRIAL & COASTAL NAVIGATION PAPER - 1

Duration : 3 Hours

Max. Marks – 75

SECTION A: COMPULSARY QUESTION

(15 marks)

SECTION B: TERRESTRIAL NAVIGATION

(30 marks)

Attempt any THREE questions. All questions carry equal marks. A total of four questions to be set.

SECTION C – COASTAL NAVIGATION

(30 marks)

Attempt any THREE questions. All questions carry equal marks. A total of four questions to be set.

BRIDGE WATCH KEEPING & EMERGENCIES PAPER - 1

Code No. - 106
Max. Marks - 100

Theory - 80 hrs.
Practical- 40 hrs.

Theory : Marks 75

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.

BRIDGE EQUIPMENTS [40 Hrs]

Unit 2 : Basic Principles of Hyperbolic Navigation Systems :

Describe, with reference to position fixing, the nature of a hyperbola. Draw a hyperbolic pattern associated with two foci, with the baseline divided into an exact number of equal divisions. Explain the principles of the hyperbolas being position lines. Describe the causes of ambiguity and reduced accuracy in the baseline extension area. Combine two hyperbolic patterns to illustrate the method of ascertaining position.

Unit 3: Loran-C System:

Describe the basic Loran-C system. Draw a block diagram of a Loran-C receiver, showing how time differences are measured. Describe how ambiguity in a position line is resolved. Explain why third-cycle matching is used. Explain how the use of sky waves affects the measured time difference. State typical radii of coverage areas. Switch on equipment; select chain and relate the time differences obtained to the correct station pair. Recognize warnings which indicate that the system may be faulty.

Unit 4 : 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 5 : GPS Systems :

Describe the basic principles of the Global Positioning System (GPS), the system configuration. State the frequencies that are used. Describe the C/A and 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 6 : 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 7: 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 8 : 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.

GENERAL SHIP KNOWLEDGE: [20 Hrs]

Unit – 9 : 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 – 10 : 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 – 11 : 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.

NOTE :

- 1) Units 1, 2, 3, 4, 5 & 9 are to be covered in first term and units 6, 7, 8, 10 & 11 to be covered in the second term .

PRACTICAL

Maximum mark : 25

Contact Hours : 40 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 :

- | | |
|---|---------------------------|
| 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 |

PATTERN OF QUESTION PAPER F.Y.B.Sc. (MARITIME SCIENCE)

BRIDGE WATCH KEEPING & EMERGENCIES PAPER - 1

Duration : 3 HOURS

Max. Marks : 75

SECTION A - COLLISION PREVENTION.

(15 marks)

SECTION B: BRIDGE EQUIPMENT

(40 marks)

Attempt any FOUR questions. All questions carry equal marks. A total of FIVE questions to be set.

SECTION C - GENERAL SHIP KNOWLEDGE

(20 marks)

Attempt any TWO questions. All questions carry equal marks. A total of three questions to be set.

GENERAL ENGINEERING KNOWLEDGE PAPER -1

Code No. - 107
Max. Marks - 100

Theory - 80 hrs.
Practical - 40 hrs.

Theory - 75 marks

WORKSHOP TECHNOLOGY

[40 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 .

MATERIAL SCIENCE

[40 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.

NOTE :

Units 1, 2, 5 & 6 to be completed in first term and units 3, 4, 7 & 8 to be completed in second term .

PRACTICAL

Maximum Marks – 25

Contact hours : 40 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, Blacksmithy and welding jobs .

Familiarisation with safety equipments

Familiarisation 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 :

- | | | |
|---------------------------------------|----------------------------|--|
| 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) Ltd, New Delhi 110055 |

PATTERN OF QUESTION PAPER F.Y.B.Sc. (Maritime Science)

GENERAL ENGINEERING KNOWLEDGE PAPER -1.

Duration – 3 hrs.

Max. Marks – 75

NOTE :

- 1) Total NINE questions are to be set.
- 2) Question No 1 is Compulsory and will have several short questions. [15 marks]
- 3) Attempt FIVE Questions from Section-B (Workshop Technology) & Section-C (Material Science) taking at least two from each section. Each section will have four questions. [60 marks]

MOTOR ENGINEERING KNOWLEDGE PAPER - 1

Code No - 108
Max. Marks - 100

Theory - 120hrs.
Practical - Nil

Theory - 100 marks

Unit 1 : Theory of I.C Engines :

Introduction to Internal Combustion Engines, working cycle – four and two stroke cycle engines; cylinder constants; thermal efficiency; mechanical efficiency; 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. General knowledge of Components of a diesel engine, timing diagram , general concept of indicator diagram , 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 ,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 , fuel oil supply , and system components .

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 ,

Unit 6 :Components of slow speed diesel engines:

Bed plate and frames; 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

Note : Units 1, 2, 3 are to be covered in first term units 4, 5, 6 to be covered in second term

RECOMMENDED BOOKS :

- | | |
|--|---------------------------------|
| 1) Sothorn'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 |

PATTERN OF QUESTION PAPER F.Y.B.Sc. (Maritime Science)

MOTOR ENGINEERING KNOWLEDGE PAPER - 1

Duration – 3 hrs.

Max. Marks – 100

Note :

- 1) Total NINE questions to be set .
- 2) Question No-1 will be compulsory and contain several short questions .
[15 marks]
- 3) FIVE questions are to be answered from the remaining , each will carry 12 marks
[60 marks]

MARINE AUXILIARIES PAPER - 1

Code No. - 109

Max Marks - 100

Theory : 80 Hrs

Practical : 40 Hrs

Unit - 1 : General arrangement of engine room

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 bilge, ballast, fresh water, fuel oil, lubricating oil, steam and condensate, engine cooling - lubricating and fresh water, compressed air and sea water cooling systems; Hydrophore system. Emergency bilge pumping arrangement.

Unit - 3, Pumps & pumping

Types of pumps and purpose, classification : positive displacement and roto - dynamic pumps. Reciprocating, rotary and centrifugal pumps. 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; 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.

Unit 6 : Heat exchangers:

Circulating systems for motor ships. Control of temperatures in heat exchangers; shell and tube type heat exchangers; plate type heat exchangers; 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.

NOTE :Units 1, 2, 3 are to be covered in the first term and Units 4, 5, 6, 7 are to be covered in the second term.

PRACTICAL

Maximum Mark - 25

Contact Hours : 40

1. Disassemble a globe valve. List the defects in the components. Assemble the valve with new packing and joints.
2. Disassemble a sluice valve. List the defects in the components. Assemble the valve with new packing and joints.
3. Disassemble a reducing valve. List the defects in the components. Assemble the valve with new packing and joints.
4. Disassemble a centrifugal pump, inspect and record findings, assemble the pump with new gasket.
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 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.
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 carry out 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) Sothorn'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 |

PATTERN OF QUESTION PAPER F.Y.B.Sc. (Maritime Science)

MARINE AUXILIARIES PAPER - 1

Duration - 3 hrs.

Max. Marks - 100

Note :

Total NINE questions to be set. [15 marks]
Question No-1 will be compulsory and contain several short questions ; each of which will carry 12 marks.
FIVE questions are to be answered from the remaining ; [60 marks]

**SHIP CONSTRUCTION, NAVAL ARCHITECTURE (STABILITY), SAFETY &
ENVIRONMENT PROTECTION PAPER - 1**

Code No. - 110
Max. Marks - 100

Theory - 40 hrs
Practical - 40 hrs.

Theory - 50 marks

SHIP CONSTRUCTION

[20 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'castle, 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.

NAVAL ARCHITECTURE

[10 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 .

SAFETY & ENVIRONMENT PROTECTION

[10 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.

Note : Units 1, 2, 4, 5, 8 will be covered in first term and units 3, 6, 7 & 9 will be covered in second term .

PRACTICAL

Maximum mark: 50

Contact Hours : 40 hrs.

01. Study flow through orifice .
02. Study flow through pipes .
03. Study flow through open channel .
04. Study function of a ventury and co-relate to Bournauli's theorem .
05. Study effect of a pitot tube .
06. Calculate GM of a floating body .
07. Carryout experiment on Cavitation Test Rig and evaluate.
08. Carryout experiments on Mitchell tilting pads bearing test rig.
09. Carryout experiments on Journal bearing test rig .
10. Operate Hydraulic Circuit Trainer and study the system components and their functions.

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 8 experiments must be undertaken by every student .
- 3) Laboratory journal to be submitted at the end of each term for assessment .

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 |
| 17) Marine Engineering Practice Series | | |

PATTERN OF QUESTION PAPER

F.Y.B.Sc. (Maritime Science)

SHIP CONSTRUCTION, NAVAL ARCHITECTURE (STABILITY), SAFETY & ENVIRONMENT PROTECTION PAPER - 1

Duration - 2 hrs.

Max. Marks - 50

- Section 'A' - One compulsory question will cover all sections . [20 marks]
Section 'B' - Ship Construction , answer one question out of two . [10 marks]
Section 'C' - Naval Architecture , answer one question out of two . [10 marks]
Section 'D' - Safety and Environment Protection, answer one question out of two. [10 marks]

LIST OF SUBJECTS

SECOND YEAR

Sr. No.	Subjects
1	Marine Electrotechnology Paper – 2
2	Celestial Navigation
3	Terrestrial and Coastal Navigation Paper – 2
4	Bridge Watch Keeping & Emergencies Paper – 2 (Training)
5	Meteorology
6	General Engineering Knowledge Paper - 2
7	Motor Engineering Knowledge Paper - 2
8	Marine Auxiliaries Paper – 2
9	Ship Construction, Naval Architecture (Stability), Safety and Environment Protection Paper – 2

MARINE ELECTROTECHNOLOGY PAPER - 2

Code No. – 201
Max. Marks – 100

Theory – 80 hrs.
Practical – 40 hrs.

Theory – 75 marks

ELECTRICITY

[60 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, 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.

Electronics

[20 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.

Note : Units 1, 2, 3, 4 & 8 will be taught in first term and items 5, 6, 7 & 9 will be taught in second term .

PRACTICAL

Maximum marks - 25 marks

Contact Hours – 40 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.

PATTERN OF QUESTION PAPER
S.Y.B.Sc. (Maritime Science)

MARINE ELECTROTECHNOLOGY PAPER - 2

Duration – 3 hrs.

Max. Marks – 75

Note :

- 1) A total of NINE questions to be set.
- 2) Question No1 will be compulsory and will carry 15 marks .
- 3) Section–A (Electricity) will have SEVEN questions FOUR to be answered . Each question will carry 10 marks .
- 4) Section-B (Electronics) will have TWO questions , ONE to be answered . Each question will carry 10 marks .

CELESTIAL NAVIGATION

Code No. - 202
Max. Marks - 100

Theory - 120 hrs.
Practical - NIL.

Theory - 100 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.

Unit : 6. POSITION LINES

Terrestrial Position Lines, Position circle, Transferred PL, Position Line from Celestial Observation, Astronomical Position lines, Latitude by Meridian Altitude, Circumpolar bodies Observation of Celestial bodies off the meridian, Noon position, Ex Meridian Sights, Polaris sights, Errors in position Lines. Azimuths and amplitudes; Derivation of formula: $\sin \text{amp} = \sin \text{decl} \times \sec \text{lat}$. Apparent altitudes of sun, Moon at time of theoretical rising or setting. Rising, culmination and setting of heavenly bodies To find time of meridian passage, sunrise, sunset, moon rise and moon set by calculation and by perusal of nautical almanac

with Appropriate corrections. Principles of position lines. Geographical position, circle of position, why P/L is at right angles to the azimuth – exceptions position to draw the P/L – intercept method; longitude by chronometer method and Ex – meridian method. Effect of change of Dr Position on position fir P/L and practical applications.

Unit 7.- NAUTICAL ALMANAC

Information in Nautical Almanac and using it for celestial observation.

Unit 8.- RISING SETTING OF CELESTIAL BODIES AND TWILIGHT

Twilight, Theoretical Sunrise and Sunset ,Moonrise and Moon set

Unit : 9. CALCULATIONS IN NAUTICAL ASTRONOMY.

Simple calculations based on (1) to (8) above.

NOTE :

Units 1, 2, 3, & 4 to be covered in first term and units 5, 6, 7, 8, & 9 to be covered in second term .

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 |

PATTERN OF QUESTION PAPER **S.Y.B.Sc. (MARITIME SCIENCE)**

CELESTIAL NAVIGATION

Duration - 3 Hrs

Max. Marks - 100

Note :

All total ten Question are to be set.

Question No 1 will be compulsory and consist of several short questions. [16 marks]

Attempt any Seven questions out of the remaining. All questions carry 12 marks.
[84 marks]

TERRESTRIAL AND COASTAL NAVIGATION PAPER - 2

Code No. - 203
Max. Marks - 100

Theory - 80 hrs.
Practical - 40 hrs.

Theory : Marks 75

COASTAL NAVIGATION

[50 Hrs]

Unit : 1. GEOGRAPHICAL AND TOPOGRAPHICAL KNOWLEDGE

Elementary Knowledge of Passage Planning and its execution. Landfall in thick and clear weather. The selection of a suitable anchorage.

Unit : 2. TIDES

To find the time and height of high and low water at Standard Ports. The use of Admiralty Tide tables and tidal curves, correction to be applied to soundings or charted heights of shore objects.

Unit : 3. NAVIGATION CHART

The interpretation of a chart or plan, wrt Lights, Buoys, Radio Beacons and other Navigational Aids. Depths and height contours. Traffic lanes and separation zones. Recognition of the coast and radar responsive targets, Chart correction.

Unit : 4. RANGE OF LIGHTS

Geographical Range, Luminous Range, Nominal Range; and their significance.

Unit : 5. ELECTRONIC CHART

Development of electronic Chart display system

TERRESTRIAL NAVIGATION

[30 Hrs]

Unit – 6. PLANE & PARALLEL SAILING

Practical problems on parallel sailing using formulae.

Practical problems on plane sailing using formulae.

Unit – 7. RHUMB LINE SAILING

Practical problems on Mercator sailing using formulae.

Unit – 8. DAYS WORK

The use of Transverse Tables to obtain the position of the ship at any time, given compass course, variation, deviation, and the run recorded by the log or estimated speed or engine speed allowing for the of wind and current, if any. Day's work.

PRACTICAL

Maximum marks - 25

Contact hours - 40

COASTAL NAVIGATION

- (1) To determine ship's position by the 'Running Fix' method with and without current.
- (2) To find the ship's position by 'Doubling the angle on the Bow' method
- (3) The use of a station pointer to plot ships position - given two horizontal angles.

- (4) Fixing the position of a ship using bearings obtained from a D.F. set. Conversion of DF bearing to Mercator bearing
- (5) To find course made good using the three point bearing method.
[at least 4 tasks to be performed]

COASTAL :

- (1) Practicals of first Year pertaining to Position fixing by various methods, current & Leeway.
- (2) Running fix and three-point bearing, using transfer of Position circle, rising / dipping and the use of hyperbolic charts, to a higher degree. to find course made good
- (3) Demonstration of the ability to plan a passage taking into consideration important factors such as depth of water, distance off dangers. current, traffic separation, schemes. navigation aids available, etc.

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. 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. Navigation | : Frost A. |
| 7. Nicholl's Concise Guide Vol. I & II. | |
| 8. Nutshell Booklet on Sextant. | : Capt. H. Subramaniam |
| 9. Chartwork | : Capt. S. S. Chaudhari |
| 10. Capt. S.K.Puri | : Chartwork |
| 11. Squair | : Modern Chartwork |
| 12. Capt.M.V.Naik & Capt.Warty | : Voyage Planning & Chartwork |
| 13. Moore, D.A. | : Marine Chartwork |

PATTERN OF QUESTION PAPER S.Y.B.Sc. (MARITIME SCIENCE)

TERRESTRIAL AND COASTAL NAVIGATION PAPER - 2

Duration : 3 hrs.

Max. Marks – 75

SECTION A: One compulsory question with multiple choice (15 marks)

SECTION B: TERRESTRIAL NAVIGATION (30 marks)
Attempt any THREE questions out of FOUR questions . All questions carry 10 marks each .

SECTION C – COASTAL NAVIGATION (30 marks)
Attempt any THREE questions out of FOUR questions . All questions carry 10 marks each .

BRIDGE WATCH KEEPING & EMERGENCIES PAPER – 2 (TRAINING)

Code No. - 204

Theory - NIL

Max. Marks - 100

Practical -120 hrs.

MARINE COMMUNICATION

[20 Hrs]

- (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.

COLLISION PREVENTION

[20 Hrs]

- (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

[10 Hrs]

- (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]

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. Slings 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 |

METEOROLOGY

Code No. - 205
Max. Marks - 100

Theory - 80 hrs.
Practical - 40 hrs.

Theory : Marks 75

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 Characteristics, 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; Macro, 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.

NOTE :

Units 1, 2, 3, 4, & 5 are to be covered in first term and Units 6, 7, 8, 9, 10 & 11 are to be covered in second term .

PRACTICAL

Maximum Marks - 25

Contact Hours – 40 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.

PATTERN OF QUESTION PAPER S.Y. BSc (MARITIME SCIENCE)

METEOROLOGY

Duration : 3 Hours

Max. Marks 75

NOTE :

- 1) There will be total EIGHT questions
- 2) Question No 1 will be compulsory and carry 15 marks .
- 3) Attempt any SIX questions from the remaining, each carrying 10 marks .

GENERAL ENGINEERING KNOWLEDGE PAPER - 2

Code No. - 206
Max. Marks - 100

Theory - 80 hrs.
Practical - 40 hrs.

Theory - 75 marks

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, 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.

Unit - 4, Drawing

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

MATERIAL SCIENCE [50 hrs]

Unit - 4 : 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 -5 : 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 - 6, 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 – 7: Corrosion and its prevention :

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

Unit – 8 :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 - 9 : 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.

Note : Unit 1,2 , 4, 5 & 6 to be taught in first term units 3, 7, 8, & 9 to be completed in second term .

PRACTICAL

Maximum marks - 25

Contact hours : 40

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 :

1) Materials Science and Processes : Hajra Choudhary S.K

2) A text book of Workshop Technology : Khurmi R.S & Gupta J.K.;

India Book Distributing Co., Calcutta.

Nirja Construction and Development Company (P) Ltd, New Delhi 110055

PATTERN OF QUESTION PAPER
S.Y.B.Sc. (Maritime Science)
GENERAL ENGINEERING KNOWLEDGE PAPER - 2

Duration - 3 hrs.

Max. Marks - 75

NOTE :

- 1) Q. No1 will be Compulsory and will contain several short questions . [15 marks]
- 2) Section-A (Workshop Technology) will have THREE questions & Section 'B' (Material Science) will have FIVE questions . Answer FIVE questions taking at least two from each section . Each question will carry 12 marks . [60 marks]

MOTOR ENGINEERING KNOWLEDGE PAPER - 2

Code No. - 207
Max. Marks - 100

Theory - 120 hrs.
Practical - NIL.

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 .

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_x, SO_x 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 .

- 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.

Unit 4: Medium speed engines:

Medium Speed Engines : Different types of medium speed marine diesel engines, Special references wrt engine components . Development in exhaust valve design, V-type engine details. safety devices; control; maintenance; remote operations; coupling engine to transmission - slip coupling; elastic coupling ; reduction gear for variable pitch propeller. diesel electric considerations. Use of poor quality residual fuels and their consequences. Improvements in designs for higher power output,

Unit – 5 , Starting & Reversing System :

Starting and reversing systems of different Marine Diesel engines (like MAN- B&W , Sulzer) with safety provisions. Emergency starting , interlocks .

Unit 6: Operation of the diesel engines:

Preparations for starting the engine; Starting the engine; checks during normal operations; instructions concerning overload operation; instructions concerning manoeuvring; running at minimum speed; operation in heavy seas; instructions concerning the cutting out of individual cylinders; instructions concerning the operation of defective turbocharger; safety measures to be taken before overhaul.

NOTE :

Units 1, 2 , 3 & 4 are to be covered in the first term and Units 5 , 6 & 7 are to be covered in the second term.

Reference books:

- | | |
|-----------------------------|--|
| J.K.Bowden; | Sothorn'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 |

PATTERN OF QUESTION PAPER

S.Y.B.Sc. (Maritime Science)

MOTOR ENGINEERING KNOWLEDGE PAPER - 2

Duration – 3 hrs.

Max. Marks – 100

NOTE :

- 1) Total NINE questions to be set .
- 2) Question No-1 will be compulsory and will consist of short questions .
[20 marks]
- 3) Answer FIVE questions from the remaining , each carrying 16 marks.
[80 marks]

MARINE AUXILIARIES PAPER - 2

Code No. - 208
Max. Marks - 100

Theory - 80 hrs.
Practical - 40 hrs.

Theory - 75 marks

Unit 1 -Oil treatment :

Theory of oil purifications, various methods of oil purifications, various type of filters , micro filters , types of marine filters, auto-cleaner and Duplex filters, Static filters. Priming and core maintenance of filters, batch purification & by- pass purification principles of operation and construction of different Centrifuges for heavy fuel and lubricating oil, Self de-sludging purifier , ALCAP system etc , automation of purifiers, operation and maintenance , trouble shooting. Uses of Homogenizers. Use of settling & service tanks .Receiving, and transfer arrangements of fuel. Precautions and procedure.

Unit - 2 , Fresh water generation:

Vacuum evaporators, Construction and Operation of different types of evaporators. Fresh Water generators and distillers. Conditioning arrangements of distilled water for drinking, reverse osmosis type equipment; operation and maintenance; salinity monitoring; sterilisation of water.

Unit - 3 , Shafting, propellers and rudder :

Nomenclature of the parts of the shafting system. Design considerations for thrust shaft, intermediate shafts and propeller shaft. Study of thrust block. Adjustments; stern tube bearing; intermediate and propeller shafts and bearings; shaft alignment; checking shaft alignment ; muff coupling, stern tube lip seals, radial face seals. Propeller nomenclature; Types of propellers. Inspection and repairs of propeller and rudder. ; removal and refitting of propeller. Inspection & testing of rudder & it's bearings

Unit - 4 , Steering gears :

Operation and Constructional details of various types of steering machinery. Telemotor systems, transmitters and receivers Variable Delivery Pumps used in steering gears, axial and radial displacement types. Hunting action of Steering gear. Emergency Steering arrangement. Safematic Steering Gear with redundancy concept as per SOLAS. Care and Maintenance of Steering Gear Plants, Stabilizers :Working principle and brief description of fin and tank type stabilizers.

Unit - 5 : Dry Docking :

Periodicity. Necessity. Methods of dry docking; precautions before and after flooding, docking Inspection and routine overhauling of under water fittings. testing of anchor chains.

Unit - 6 : Engine Room Working Equipment :

Engine room cranes, safety requirements and precaution for operations, lifting chains and tackles, testing and survey requirements for the same.

Deck machinery :- Cargo winches, mooring winches, capstan, towing machines, anchor windlass, Water-tight doors.

Unit- 7 : Fire Prevention & Fire fighting :

Theory of Fire , Fire Fighting Equipment Fixed Fire fighting Systems , Fire Detection system and Safety Systems , Fire protection & Ship construction. Fire Fighting Methods , Fire Fighting Organization on ships.

NOTE :

Units 1, 2, 3 are to be covered in the first term and Units 4, 5, 6, 7 are to be covered in the second term.

PRACTICAL

Practical - 25 marks

Contact hours : 40 Hrs.

1. Disassembly of the cylinder head of a two stage compressor after isolating the system. Dismantling of one unit of the compressor including the suction and delivery valves. Identification of the parts. Recording of inspection. Re-assembly of the equipment to original condition.
2. To study operation of helshaw pump
3. To study operation of ram type electro hydraulic steering gear .
4. To operate and study vane type electro hydraulic steering gear .
5. To study construction of Refrigerating compressor .
6. To dismantle reciprocating pump study operation and all components .
7. Alignment of pump with motor .
8. Dismantle clean and study operation oily water separator .
9. To carryout dismantling of a unit (isolating the cylinder unit, removing the cylinder head and mountings, removing the piston/connecting rod assembly of a medium or high speed engine. Clean all parts and assemble for operation . Prepare a list of defects observed during the overhaul work .
10. To disassemble a fuel pump, furnish a report of inspection and assemble the pump.
11. Measure the diameter of the cylinder liner, and gauge the piston ring grooves and piston rings.
12. Adjust the tappet clearance.
13. Study air starting valve of 2- Stroke engine
14. Study relief valve of a two stroke engine .
15. Study stuffing box of a two stroke engine .
16. Study components of a fuel injector .
17. Trace L.O system of a diesel engine .
18. Start a diesel engine and study the performance .

NOTE :

- 1) Evaluation is on a continuous basis during the practical, on the ability to carryout the above tasks competently with demonstration of safe techniques.
- 2) Workshop journal to be maintained and submitted at the end of each term for assessment .
- 3) At least 16 tasks to be completed by each student .

RECOMMENDED BOOKS :

- | | |
|--|---------------------------------|
| 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) Basic marine Engineering, | J. K. Dhar |

PATTERN OF QUESTION PAPER

S.Y.B.Sc. (Maritime Science)

MARINE AUXILIARIES PAPER - 2

Duration - 3 hrs.

Max. Marks - 75

NOTE :

- 1) Total NINE questions to be set .
- 2) Qustion No-1 will be compulsory and will consist of short questions . [15 marks]
- 3) Answer FIVE questions from the remaining , each carrying 12 marks. [60 marks]

**SHIP CONSTRUCTION, NAVAL ARCHITECTURE (STABILITY),
SAFETY AND ENVIRONMENTAL PROTECTION PAPER - 2**

Code No. - 209
Max. Marks - 100

Theory - 40 hrs
Practical - 40 hrs

SHIP CONSTRUCTION :

[20 hrs]

Unit - 1 , Shell & Decks :

Plating systems for shells, Deck plating & Deck girders, discontinuities like hatches and other openings, supporting & closing arrangements, Water tightness of hatches, opening in oil tankers, mid-ship Section of ships.

Unit - 2, Bulk heads & Deep Tanks :

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. Water tight bulkheads, Arrangements of plating and stiffeners. Water tight sliding doors, Water tight openings through bulkheads for electric cables pipes and shafting. Deep tank for oil fuel or oil cargo corrugated bulk heads ; sounding and air pipes.

Unit - 3, Fore-End Arrangements :

Stem construction, arrangements to resist panting, panting stringers, Forepeak - Collision bulk heads. Bulbous bows. Anchor and cable arrangements. chain lockers, and attachments of cables,

Unit - 4, After-End-Arrangements :

Types of Sterns, Stern frame and rudder. Types of rudder. Supporting of rudder, Locking pintle, Bearing pintle, Pallister bearing, stern frame of twin screw ship, Shaft tunnel & it's watertightness, Tunnel bearings, Kort nozzle, fixed nozzles, nozzle rudder, tail flaps .

NAVAL ARCHITECTURE

[10 hrs]

Unit - 5 , Longitudinal Stability and trim :

Longitudinal GM, MCT1 , change of L.C.B. with change of trim, Change of trim due to adding or deducting weights, change in draft & trim because of filling/flooding several tanks with different densities, Change in draft due to change in density, Flooding calculations, Floodable length curves, determination of floodable lengths, factors of subdivision, Loss of stability due to grounding, Docking stability, Pressure on chocks.

Unit - 6 , Cargo loading & Stability:

Solve various numerical problems related to loading of different types of cargo and effect on strength , stability of the vessel .

SAFETY & ENVIRONMENT PROTECTION [10 hrs]

Unit - 7 , SOLAS :

International convention on load lines 1966, SOLAS 1974 as amended, SOLAS - Subdivision stability, SOLAS - Fire Protection, Detection and Extinction, SOLAS - LSA, SOLAS - Radiotelegraphy and R/T, SOLAS - Radio communications, SOLAS - Carriage of Grain, SOLAS - Carriage of Dangerous goods, STCW-1995, ITU Radio Regulations, STP Agreements 1971, SPACE STP, 1973, PAL-1974 and Tonnage 1969, ISPS code .

Unit - 8 , Operation of Life Saving Appliances :

Life Saving : Abandon : ship drills and knowledge of operation of survival craft and rescue boats, their launching appliances and arrangements and their equipment

including radio, life saving appliances, satellite EPIRBs, SARTs, immersion suits thermal protective aids and survival techniques. Knowledge of Codes of Safe Working Practices, Knowledge of Type of Information issued by the Director General of Shipping with regard to Safety at Sea.

Unit – 9 , Control of emissions from ships :

NOx code ,Limit of SOx , NOx in exhaust , Nox technical file , Pollution by VOC , Pollution by ozon depleting substances , CFC , Montreal Protocol , emission from incinerators , documents to be carried as per MARPOL annex – IV .

Unit – 10 , Other sources of pollution :

Prevention of pollution by sewage : Surveys of equipment, discharge of sewage, exception, reception facilities and standard discharge connections ;

Prevention of pollution by garbage : Knowledge of Garbage management system. Garbage Record Book, Special requirements for Disposal of Garbage, Disposal of garbage within special areas and outside special areas, Exceptions; Reception facilities . Pollution by ballast water , management of ballast water , Pollution by antifouling paints . Carriage of chemicals in packaged form , Procedure and arrangements for chemical carriers, record book for chemical cargoes.

PRACTICAL

Maximum marks – 25

Contact hours - 40

- 1) Prepare oil record book with typical entries .
- 2) Training on OMDSS and oily water separator .
- 3) Film on various annexures of MARPOL .
- 4) Familiarisation various life saving appliances .
- 5) Solve practical stability problems on various types of ships [20 hrs]

RECOMMENDED BOOKS :

- 1) Derrett : Merchant ship stability for Masters & mates
- 2) Taylor : Ship Construction
- 3) Eyerer : Ship Construction
- 4) Kemp & Young :Ship Construction
- 5) Reeds : Ship Construction for Marine students
- 6) Naval Architecture :Munro & Smith .
- 7) Kemp & Yong :Notes on Stability
- 8) La Dage & Gemert :Stability
- 9) Capt. Lester :Stability for Merchant Ships
- 10) Capt.H. Subramaniam:Ship Stability I, II, III
- 11) Capt. Joseph & Capt. Rewari :Problems on Hindship

PATTERN OF QUESTION PAPER
S.Y.B.Sc. (Maritime Science)

**SHIP CONSTRUCTION, NAVAL ARCHITECTURE (STABILITY), SAFETY
AND ENVIRONMENTAL PROTECTION PAPER - 2**

Duration – 2 hrs.

Max. Marks – 50

- Section 'A' – One compulsory question will cover all sections . [20 marks]
- Section 'B' – Ship Construction , answer one question out of two . [10 marks]
- Section 'C' – Naval Architecture , answer one question out of two . [10 marks]
- Section 'D' – Safety and Environment Protection, answer one question out of two. [10 marks]

LIST OF SUBJECTS FOR THIRD YEAR

Sr. No.	Subjects
1	Marine Electrotechnology Paper - 3
2	Marine Engineering Drawing & Design
3	Practical Celestial Navigation
4	Bridge Watch Keeping & Emergencies Paper - 3
5	Motor Engineering Knowledge Paper – 3
6	Marine Auxiliaries Paper – 3
7	Cargo Handling & Stowage
8	Ship Construction, Naval Architecture (Stability), Safety and Environment Protection Paper – 3
9	Competency Enhancement modules including GMDSS GOC , Engine Room Simulator modular Course

Code No. - 301
Max. Marks - 100

Theory - 90 hrs.
Practical - 30 hrs.

Theory - 75 marks

Electrical machines

[45 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.

Electrical System & Maintenance

[45 hrs]

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.

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.

Note : Units 1, 2, 3 & 7, 8, 9 are to be taught in first term and units 4, 5, 6 & 10, 11, 12 are to be taught in second term

PRACTICAL

Maximum marks – 25
30hrs

Contact Hours :

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. Theraja 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).

PATTERN OF QUESTION PAPER

T.Y.B.Sc. (Maritime Science)

MARINE ELECTROTECHNOLOGY PAPER - 3

Duration – 3 hrs.

Max. Marks – 75

Note :

- 1) Total of nine questions to be set.
- 2) Question No1 is compulsory and will carry 15 marks. [15 marks]
- 3) Section – A (Electrical Machines) & Section – B (Electrical System & Maintenance) will have FOUR questions each .
- 4) Answer five questions , taking minimum TWO questions from each of Sections – A & B . All questions will carry 12 marks each . [60 marks]

MARINE ENGINEERING DRAWING & DESIGN

Code No. - 302
hrs.
Max. Marks - 100
hrs.

Theory - 40
Practical - 80

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 . |

PATTERN OF QUESTION PAPER

T.Y.B.Sc. (Maritime Science)

MARINE ENGINEERING DRAWING & DESIGN

Duration – 4 hrs.
100

Max. Marks –

Note : Attempt any ONE question from each section

Section – A :

[75 marks]

This section will consist of TWO questions on DRAWING . ONE to be answered

Section – B :

[25 marks }

This section will consist of TWO questions on DESIGN . ONE to be answered .

PRACTICAL CELESTIAL NAVIGATION

Code No. - 303
Max Marks - 100

Theory - 90 hrs.
Practical - 30 hrs

Theory - Marks 75

CELESTIAL NAVIGATION [40 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.

PRACTICALS OF NAVIGATION [50 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.

NOTE : Units 1, 2, 3, 6, 7, 8 will be covered in first term and units 4, 5, 9, 10, 11, 12, 13 will be covered in second term.

PRACTICAL

Maximum Marks - 25
Hrs

Contact Hours – 30

CELESTIAL NAVIGATION

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 beatings 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:

- | | |
|---|---|
| 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 |

PATTERN OF QUESTION PAPER
T.Y.B.Sc. (MARITIME SCIENCE)

PRACTICAL CELESTIAL NAVIGATION

Duration : 3 hrs.

Max. Marks 75

SECTION A – COMPULSORY QUESTION FROM GRAPHICAL (15 marks)

COMBINATION OF SIGHTS

SECTION B – CELESTIAL NAVIGATION (30 marks)

Attempt any THREE questions from this section. All questions carry equal marks. There will be FOUR questions .

SECTION C – PRACTICALS OF NAVIGATION (30 marks)

Attempt any THREE questions from this section. All questions carry equal marks. There will be FOUR questions .

BRIDGE WATCH KEEPING & EMERGENCIES PAPER - 3

Code No - 304
Max. Marks- 100

Theory - 90 hrs
Practical - 30 hrs

THEORY - 75 Marks

COLLISION PREVENTION [20 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.

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.

WATCH KEEPING & EMERGENCIES [40 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 salvaging 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.

NOTE : Units 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, will be covered in first term and Units 5, 6, 13, 14, 15, 16, 17, 18 will be covered in the second term .

PRACTICAL

Practicals - Marks 25

Contact Hours – 30 Hrs

COLLISION PREVENTION

- (i) To identify various collision situations by day and by night. Practical 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. Radar at Sea | : G.I. Sonnenberg |
| 4. Shipborne Radar | : Capt. H. Subramaniam |
| 5. Radar and ARPA Manual | : A.G. Bole & W.O. Dineley |
| 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 |

PATTERN OF QUESTION PAPER **T.Y. BSc (MARITIME SCIENCE)**

BRIDGE WATCH KEEPING & EMERGENCIES PAPER - 3

Duration. 3 Hours

Max. Marks 75

SECTION A - COLLISION PREVENTION (COMPULSORY QUESTION)

[15 marks]

SECTION B: BRIDGE EQUIPMENT

[30 marks]

Attempt any THREE questions. All questions carry equal marks. A total of FOUR questions to be set.

SECTION C – WATCH & EMERGENCIES

[30 marks]

Attempt any THREE questions. All questions carry equal marks. A total of FOUR questions to be set.

MOTOR ENGINEERING KNOWLEDGE PAPER - 3

Code No. - 305
Max. Marks - 100

Theory - 90 hrs.
Practical - 30 hrs.

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.

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 , Automation :

Automation in diesel engine plant and safety devices, cooling control, bridge control, safety interlocks, wrong way alarm etc. Remote operation, Alarm and fail safe system, governors and their basic functions Constant speed and Over-speed trips. Constructional details and hunting of governor. Load sensing & speed sensing governors, Computerised monitoring and diagnostic applications in propulsion engines. The intelligent engine concept. Condition based maintenance . Temperature controllers

Unit -5 : Likely defects/ failures in diesel engines:

Forces and Stresses : Engine Balancing, overloading, Different type of vibrations & its effects, A/F vibration. running clearances; critical speeds; torsion in crank-pins; movement of crankshaft in bearings; engine balancing; engine chocking; bolt tightening; stress effects of tightening-up and working loads , creeping cracks; heat cracks; welding failures; casting strains, corrosion fatigue , stress corrosion cracking; stress concentration at fillets.

Unit - 6 :Maintenance and overhaul of diesel engine machinery and components:

Inspection and overhaul of the diesel engine machinery components ; gauging clearances, measuring crankshaft deflections, adjustments of bearing clearances, adjusting the fuel injection pump; inspection of the fuel injection valve, priming the fuel injection system; fuel oil system; tightening of piston rod nuts, connecting rod bolts, cylinder head nuts, tie rods, timing of cylinder lubricating oil pump; chain drive and likely trouble areas ; vibrations and noise ; record of engine behaviour.

NOTE :

Units 1, 2, 3 are to be covered in the first term and Units 4, 5, 6 are to be covered in the second term.

Practical – 25 marks

Contact Hours – 30 hrs

1. To carryout dismantling of a unit (isolating the cylinder unit, removing the cylinder head and mountings, removing the piston/connecting rod assembly of a medium or high speed engine. Inspect the components and furnish a report.
2. Measure the diameter of the cylinder liner, and gauge the piston ring grooves and piston rings.
3. Pressure test and set fuel injector pressure.
4. Dismantle and overhaul M. E Exhaust valve .
5. Start a diesel engine and study the performance .
6. Checking timing of a fuel pump
7. Study crankcase relief door .
8. Study operation of cylinder lubricator .
9. Trace cooling water system of an engine and study cooling water temperature controller operation
10. Start a diesel engine and study the performance .
11. Study crankcase mist detector .
12. Study operation of fuel oil viscosity controller .
13. To carryout dismantling of a turbocharger and assemble the same again. Measure all clearances and explain their significance .
14. Trace L.O system of a diesel engine .
15. Operate turbo-diesel soft ware and study performance of diesel engine

NOTE :

1. Evaluation will 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, practicals and periodic assignments / project works / tests / orals etc.
3. Workshop journal to be submitted for assessment at the end of each term .
4. At least 13 tasks to be performed by every student

Reference books:

- | | |
|-----------------------------|--|
| J.K.Bowden; | Sothorn'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 |

PATTERN OF QUESTION PAPER T.Y.B.Sc. (Maritime Science)

MOTOR ENGINEERING KNOWLEDGE PAPER - 3

Duration – 3 hrs.
75

Max. Marks –

NOTE :

- 1) Total NINE questions to be set.
- 2) Question No.1 will be compulsory and consist of several short questions .
This question will carry 15 marks. [15 marks]
- 3) Five questions are to be answered from the remaining ,. Each question will
carry 12 marks . [60 marks]

MARINE AUXILIARIES PAPER - 3

Code No. - 306
Max. Marks - 100

Theory - 90 hrs.
Practical - 30hrs.

Theory - 75 marks

MARINE BOILERS [40 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.

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-regenerative 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 :

Warming through main propulsion turbines and efficient operation, 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.

REFRIGERATION & OTHERS [50 hrs]

Unit – 7, Fuel :

Source of supply, Study of Primary Fuels, Coal, Petroleum, Natural Gas Classification of Fuels. ,treatment in Residual fuels, blending of fuel, Emulsified Fuels, Merits and demerits of such fuel in marine engines.

Unit – 8 ,Lubrication :

Theories of Lubrication, Types of Lubricants and their Properties their specific use. Terminology used in Lubrication systems, Loading pattern of Various bearings in marine use and Lubrication system adopted, Suitability of Lubricants for Various uses; solid and fluid lubricants. Additive Oils. L.O.analysis & monitoring Engine through report..

Unit – 9 , Refrigeration Theory:

Basic theoretical principles. Desirable properties of refrigerent and lubricating oil. Actual refrigerants and their properties; direct expansion plant and brine cooling systems; critical temperature; insulation.

Unit -10 , System components and operation :

Domestic direct expansion refrigeration plants ; description of components. Flow control valves and ancillary fitting. Refrigerant charging , purging : Tests for leak; tests for commissioning after repairs; Maintenance of evaporators for efficient operation; trouble shooting.

Unit - 11 , Cargo refrigeration :

Types of refrigerated cargo, Air refreshing for fruit or other cargoes, temperatures required for different cargoes; insulation of hold , preparing plant for cargo loading .

Unit – 12, Accommodation air conditioning :

Comfort conditions , accommodation ventilation , Need for air conditioning on ships; special design features; Statutory rules for ventilation; Exhaust air; Return air; Ventilation systems. Air-conditioning systems :Central system; Temperature control; Types and selection of central systems; Passenger ship considerations, duct system; air cleaning; sound attenuation; testing & balancing the system; operation & maintenance.

Unit – 13. 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 .

NOTE :

Units 1, 2, 3, 7, 8 & 9 are to be covered in the first term and Units 4, 5, 6, 10, 11, 12 & 13 are to be covered in the second term.

PRACTICAL

Maximum mark -25

Contact Hours – 30 hrs

1. To determine the hardness content of the sample of boiler water in mg/ltr (ppm) in terms of CaCO_3
2. To determine the chloride content of the sample of boiler water in mg/ltr (ppm) in terms of CaCO_3
3. To determine alkalinity due to phenolphthalein caustic alkalinity and total alkalinity of the boiler water sample in mg/ltr (ppm)
4. To determine phosphate content of the sample of water.
5. To determine dissolved oxygen content of the boiler water sample
6. To determine pH Value of the boiler water sample.
7. To determine viscosity, pour point, water content, flashpoint of given sample of lubricating oil / fuel oil.
8. To identify the components, operate and record the parameters using the Refrigeration simulator.
9. To identify the components, operate and record the parameters using the Air-conditioning tutor.
10. To prepare boiler for operation and operate boiler .
11. To carry out hydraulic pressure test of any shell .
12. To study refrigeration plant on computer software .
13. Film shows on marine repair work .

NOTE :

- 1) All the practical activities are to be carried out using appropriate tools.
- 2) Evaluation is on a continuous basis during the practical, on the ability to carryout the above tasks competently with demonstration of safe techniques.
- 3) Laboratory journal to be submitted at the end of each term for assessment .
- 4) At least 11 tasks are to be performed by each student .

RECOMMENDED BOOKS :

- | | |
|--|---------------------------------|
| 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 |

PATTERN OF QUESTION PAPER T.Y.B.Sc. (Maritime Science)

MARINE AUXILIARIES PAPER - 3

Duration – 3 hrs.
75

Max. Marks –

NOTE :

- 1) Q. No1 will be Compulsory and will contain several short questions . [15 marks]
- 2) Section-A (Marine Boilers) will have FOUR questions & Section 'B' (Refrigeration & Others) will have FIVE questions . Answer FIVE questions taking at least two from each section . Each question will carry 12 marks . [60 marks]

CARGO HANDLING & STOWAGE

Code No. - 307
hrs.
Max. Marks - 100

Theory - 120

Practical - NIL.

Theory - 100 Marks

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 parts of a tackle, using a tackle to advantage 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.

UNIT 6.- IMO CODES

Study of IMO codes and guidelines for the carriage of dangerous goods, timber, chemicals in bulks, liquefied gases in bulk, grain, and bulk cargoes.

UNIT 7.- STOWAGE & CARRIAGE OF VARIOUS CARGO

Detailed study of stowage and securing of various types of cargoes taking into account safety of ships and cargoes.

UNIT 8.-CARGO HANDLING

Cargo handling gear. designs and strength parameter, special requirements for handling of bulk cargoes and containers.

Study of Bulk carriers with respect to: Loading, discharging, ballasting. Deballasting Operation.

Precautions to be taken for high density cargoes, grain and concentrates.

UNIT 9.- LIQUID CARGOES

Principles involving the carriage of oil, chemicals and gases in bulk. Procedure to follow at tanker terminals, Detail study of tanker terminal codes for handling of petroleum product, bulk liquid chemicals and liquefied gases. Avoidance .of accidental pollution's and precautions to be taken.

UNIT 10.- OIL TANKERS

Study International safety guide for oil tankers and terminals. Study of Tankers with respect to: Types of pumps, valves, pipeline systems, Ullageing, interface, cargo calculation. Operations of loading, discharging, ballasting, de-ballasting, inerting tank washing including COW, gas freeing. Flammability diagram. Instructions for use. of Oxygen and Hydrocarbon analyzer. Man entry procedures. Rescue teams. Control of Oil spill.

UNIT 11.- CARGO CALCULATION

Calculation relating to above topics to ensure safety of the ship and environment .

NOTE : Units 1, 2, 3, 4 & 5 will be covered in the first term and Units 6, 7, 8, 9, 10 & 11 will be covered in the second term .

BOOKS FOR REFERENCE:

- | | |
|---|--|
| 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 O. | |
| 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 O. |
| 10. Load Line convention 1966 | : 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 O |
| 20. GMDSS for GOC | : Clifford Merchant |

PATTERN OF QUESTION PAPER T.Y. BSc (MARITIME SCIENCE)

CARGO HANDLING & STOWAGE

Duration-3 Hours
100

Max. Marks:

NOTE:

- 1) Total NINE questions to be set .
- 2) Question No. 1 will be compulsory and will carry 20 marks. [20 marks]
- 3) Attempt any FIVE questions out of the remainder. All question carry equal marks. [80 marks]

**SHIP CONSTRUCTION, NAVAL ARCHITECTURE (STABILITY), SAFETY AND
ENVIRONMENT PROTECTION PAPER - 3**

Code. No. - 308
hrs.

Theory - 60

Max.Marks - 100
hrs.

Practical - 20

Theory - 75 marks

SHIP CONSTRUCTION

[20 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,

NAVAL ARCHITECTURE

[20 hrs]

Unit - 6 , Strength of Ships :

Curves of buoyancy and weight, Curves of load, Shearing force and bending moments, Approximation for max. shearing force and bending moment, method of estimating B.M. & Deflection. Longitudinal Strength, Moment of Inertia of Section, Section Modulus. Stresses in deck and keel . Motion of Ship on waves, Types of waves, Trochoidal waves, Sinusoidal waves. Irregular wave pattern, Wave spectra, Wave amplitudes, practical aspects of rolling, Anti-rolling devices, Forces caused by rolling and pitching, Heaving and Yawing.

Unit – 7 , Resistance & Powering :

Frictional, Residuary & Total resistance, Froude's Law of comparison, Effective power calculations, Ships co-relation Factor (SCF), Admiralty co-efficient, QPC, Fuel Co-efficient and Fuel consumption. Effect of viscosity and application of I TTC formula.

Unit – 8 , Propulsion & Propellers:

Definitions, apparent and real ship wake, Thrust, relation between powers, relation between mean pressure and speed, relation between speed & fuel consumption , measurement of pitch, interaction between hull & propeller, co-efficients related to propeller, Cavitation. Propeller types, Fixed pitch, Variable Pitch, Ring propeller, Kort nozzles, Voith Schneider propeller, propeller theory .Blade element theory, Law of similitude and model tests with propellers, propulsion tests, Geometry and geometrical properties of screw propellers, ship model correlation ship trials.

Unit – 9 , Rudders :

Rudder Theory : Action of the Rudder in turning a ship, Force on rudder, Torque on stock, calculation of force torque on non-rectangular rudder, angle of heel due to force torque on rudder, Angle of heel when turning. Types of Rudder, model experiments and turning trials, Area and shape of rudder, position of rudder, stern rudders Bow rudders.

SAFETY AND ENVIRONMENTAL PROTECTION

[15 hrs]

Unit – 10 , ISO / ISM

Quality fundamentals, quality concepts, ISO series, requirements of QMS ISO-9000. Clauses of ISO: 9001 : 2000

Role of Government of India in control of merchant ships, ISM code, objectives and functional requirements for safety management system , , issue of DOC/SMC and maintenance of SMC, designated person , safety officer , internal audits, treatment of non conformities , Definition of flag state/ port state. Port state control inspection, Implication of ship's detention , involvement of ISM

Unit – 11 , STCW

STCW- 1978 and modifications under STCW-95. requirements to be fulfilled by government, Training in India , Government and private institutions , MMERT and their role in training , Members of MMERT , IIMS ,

Unit – 12 , 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. (* navigation watch is covered under bridge watch keeping).

Unit – 13 , Health :

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

SHIP MANAGEMENT [5 hrs]

Introduction to Ship Management, Conference systems , Carriage of goods , Shipping Companies , Capitalization and finance , Ship Operations practices , Merchant Shipping act

Note : Unit 1 , 2 , 3 , 6, 7, 10 & 11 are to be covered in first term and units 4, 5, 8, 9, 12 & 13 are to be taught in second term .

PRACTICAL

Maximum mark – 25
20

Contact hours –

- 1) Practical training on solving stability problems of existing vessels in respect of:
 - i) Centre of gravity ,
 - ii) GM,
 - iii) Free surface effect , angle of loll,
 - iv) Hogging ,Sagging loads, Stresses in deck ,
 - v) Safety of bulk carrier and Tankers etc .
- 2) Practical work in ship maintenance :
 - i) welding and inspection of welds ,
 - ii) surface preparation & painting ,
 - iii) SOPEP ,
 - iv) Maintenance of chains, windlass and propeller .
 - v) ISM workshop

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 8 experiments must be undertaken by every student .
- 3) Laboratory journal to be submitted at the end of each term for assessment

REFERENCE BOOKS :

- 1) Derrett :Merchant ship stability for Masters & mates
- 2) Taylor :Ship Construction
- 4) Eyeris :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

PATTERN OF QUESTION PAPER
T.Y.B.Sc. (Maritime Science)

**SHIP CONSTRUCTION, NAVAL ARCHITECTURE (STABILITY), SAFETY AND
ENVIRONMENT PROTECTION PAPER - 3**

Duration – 3 hrs.
75

Max. Marks –

Note: There will be Nine questions. Candidate will be required to answer six questions taking at least one from each section.

Section 'A' - One compulsory question covering all sections (15 marks)

Section 'B' - Ship construction , two questions , each carry 12 marks .

Section 'C' – Naval Architecture , two questions, each carry 12 marks .

Section 'D' - Safety and Environment Protection two questions, each carry 12 marks

Section 'E' – Ship Management two questions , each carry 12 marks .

COMPETENCY ENHANCEMENT MODULES INCLUDING GMDSS GOC,
ENGINE ROOM SIMULATOR MODULAR COURSE

Code. No. - 309

Theory - 20

hrs.

Max. Marks - 100

Practical - 100

hrs.

- 1) DGS Approved Engine Room Simulator Course (for 3 days)
- 2) Familiarisation training on GMDSS.
- 3) Familiarisation training on ROC.
- 4) Familiarisation training on ARPA.
- 5) Training on Ship Handling Simulator
- 6) Practical training on cargo work :
 - i) To overhaul the metallic block and reassemble the sheaves, pin, grease nipple etc.
 - ii) To reeve the tackles - Two block to two block, two block to three block, three block to three block etc.
 - iii) To understand & practice following "KNOTS & HITCHES" as Over Hand Knot, Figure of Eight Knot, Timber Hitch, Sheet Bend, Clove Hitch, Reef Knot, Bow Line, Rolling Hitch, Half Hitch, Marline Spike Hitch, Carrick Band, Cow Hitch, Black Wall Hitch, Marling Hitch, Awning Hitch, Chair Hitch.
 - iv) To practice the use of Bottle - Screws or TURN BUCKLES, BULL - DOG GRIPS etc. and various lashing material.
 - v) To practice the repairs in "PILOT LADDER" and know the various parts.
 - vi) To open and reassemble "Joining Shackle" of an Anchor.
 - vii) Study various types of hooks, shackles and understand the certificate markings thereon.
 - viii) To practice splicing of MANILA & WIRE ROPES with Different Splices
 - ix) Short Splice, Eye Splice, Left Handed Splice, Back Splice
 - x) Making of Monkey Fist for Heaving - Line
 - xi) To splice "Mooring Rope" i.e. 8 - standard Polypropylene rope.
 - xii) To practice on working / simulated model of crane Luffing, hoisting and slewing operations.
 - xiii) To practice on working / simulated model of opening/ closing of hatches.

NOTE :

- 1) There will be continuous assessment of skills being acquired through periodic assignments / project works / tests / orals etc.
- 2) Module No1 is compulsory . At least FOUR modules to be completed from the rest
- 3) Laboratory journal to be submitted at the end of each term for assessment

RECOMMENDED BOOKS : Training Manuals for relevant modules.