

BHARATHIARUNIVERSITY: COIMBATORE-641 046
DIPLOMA IN NAUTICAL SCIENCE

(For the CCII students admitted from the academic year 2016-17 onwards)

SCHEME OF EXAMINATION

Sl.No	Course Title	Examination	
		Dur. Hrs.	Total Marks
	SEMSTER - I		
1	Naval Architecture	3	100
2	Nautical Mathematics	3	100
3	Nautical Physics And Electronics	3	100
4	Ship Operating Technology	3	100
5	Practical - CAD /CAM	3	100
	SEMESTER - II		
6	Navigation	3	100
7	Cargo Handling And Stowage	3	100
8	Voyage Planning, Collision Prevention And Marine Communication	3	100
9	Ship Management	3	100
10	PROJECT	3	100
	TOTAL		1000

1 - NAVAL ARCHITECTURE

OBJECTIVE:

On successful completion of this course the students should have understood the basic principles of floating, pressure exerted by the liquid and stability of the ship

UNIT I HYDROSTATICS

Pressure exerted by a liquid, load on an immersed place, load, diagram, shearing force on bulkhead stiffeners, Archimedes' principle, displacement, T.P.C. immersion, coefficients of form, wetted surface area, similar figures, shearing force and bending moment - problems.

UNIT II GEOMETRY AND SHIP FORM CALCULATIONS

Ship lines, first and second moment of area, Simpson's first and second rules, application to area and volume, use of intermediate ordinates, trapezoidal rule, mean and mid - ordinate rule, Tchebycheff's rule and their applications, centre of gravity, effect of addition and removal of masses, effect of movement of mass and suspended masses - Problems

UNIT III TRANSVERSE STABILITY AND HEEL

Statical stability at small angles of heel, calculation of BM and Metacentric height, inclining experiment, free surface effect, stability at large angles of heel, curves of static stability, dynamic stability, angle of loss, stability of wall sided ship - Problems.

UNIT IV LONGITUDINAL STABILITY AND TRIM

Longitudinal BM, MCTI cm, change of trim, change of LCB with change of trim, alteration of trim due to adding or deducting weights, change in mean draught and end draughts due to density and due to bilging, flooding calculations, floodable lengths, factors, of sub division, loss of stability due to grounding - Problems.

UNIT V LAUNCHING AND DOCKING

Launching curves, construction of launching curves, ground ways, the dynamics of launching, strength and stability, sideways launching - Docking - Docking stability, pressure on chocks, load distribution, block behavior, strength of floating docks, stability during docking, ship lifts – Problems

Text Books:

1. Eric. Tupper, "Introduction to Naval Architecture." 3rd Edition, Butter worth - Heinemann, London, 2001.
2. G.N. Hatch, "Creative Naval Architecture", 1st Edition, Thomas Reed Publications, London, 1971.

2 - NAUTICAL MATHEMATICS

OBJECTIVE:

The students will understand the mathematics required for nautical sciences

UNIT-1

Measure of central tendency, dispersion - R.V. Discrete -Correlations and Regression - vectors, multiplication of vectors by scalars - Position vector, resolution of vectors - vector triple products - theorems of probability - random experiments – sample

UNIT-2

General equations of circles, tangent , parabola, ellipse, Hyperbola - Conic's focus and directory property - Symmetry of curves - Properties of conics for application to navigation - Area and volume of simple shapes (Plane, Sphere, Cone and Cylinder) - Simpson's rules

UNIT-3

Properties of spherical triangle - sine and cosine formulae – Advantage of Haversine formulae - Solution of Spherical triangles – quadrantal spherical triangle - polar triangles and their applications in the solution of spherical triangles

UNIT-4

Formulae for the derivatives of algebraic, trigonometric, inverse, exponential and logarithmic functions - derivative of a quotient -Differentiation of implicit functions, trigonometric, inverse and logarithmic differentiation - Algebraic/ trigonometric transformations - Define integral and their properties

UNIT-5

Matrices- definition – types - equality, additions, subtraction, multiplication of matrices-rank matrix- Elementary transformations of a matrix- Elementary Matrix- Normal form of a matrix- Linear dependence of vectors- Orthogonal transformations- characteristic equations- Eigen values and Eigen vectors- Cayley Hamilton theorem (verifications)

Reference Books:

1. Kreyszig.E, “Advanced Engineering Mathematics (8th edition)
2. Veerarajan. T, “Engineering Mathematics” Tata McGraw Hill- New Delhi
3. Grewal.B.S, “Higher Engineering Mathematics”- Khanna Publishers

3 - NAUTICAL PHYSICS AND ELECTRONICS

OBJECTIVE:

In this course the student will learn fundamentals of physics and electronics and will enable him to understand nautical sciences

UNIT-1

Planetary motion and Kepler's laws, center of gravity, Vectors- Resultant of a system of Coplanar Forces acting at a point, Three force problems, Lami's theorem, Impulse, Impact-

Direct and oblique impact, Newton's experimental law - Machines- Weston Differential Pulley, Hydrograph, Projectile, Surface tension, Capillary

UNIT-2

Batteries in common use, their characteristics, care and precautions to be followed, simple electric lighting circuits, fuses -Introduction of AC Theory, R.M.S and Peak values, Phase, Transformers, Toroid, Solenoid, Insulation Tester and its use - Hysteresis, Magnetic elements of the earth, Determinations of Variations, Dip and H, Isogonic and Isoclinic lines

UNIT-3

Viscosity and hydrostatics - Streamline and Turbulent Flow, Bernoulli's Equation and its applications, Flow of viscous fluid through pipes, Stokes's law and Poiseuille's method - Bourdon Pressure Gauge, Plimsoll mark, Marine Hydrometer

UNIT-4

Luminous Intensity, Photometers, Photovoltaic cell, Photo Electric Effect, Einstein's equations, Diode, LDR and LED – Diffraction- Resolving Power of a Telescope. Applications -Optical Pyrometer, Sextant, Azimuth Mirror, Astronomical Telescope

UNIT-5

Semiconductors-their characteristics and uses, N-type and P-type semi conductors, PN Junction diodes, Diodes as Half- Wave, Full Wave, Bridge Rectifier, Zener Diode as a Voltage regulators, Thermistor- characteristics and application, Junction Transistors- Construction and Characteristics.

BOOKS FOR REFERENCE

1. Applied Physics- Clough and Smith
2. Principles of Physics- Brij, Lal and Subramaniam
3. Modern Physics- Murugesan
4. The Elements of Statics and Dynamics Part I and II- S.L. Loney

4 - SHIP OPERATION TECHNOLOGY

OBJECTIVE:

The students will learn about the practical equipment, accessories and gadgets required for operating the ship

UNIT-1 GENERAL

Names of various parts of ship, names and timing of watches, types of Merchant Navy Vessels Sea terms, lookout - Compass points, safety wearing apparel- Removing rust by chipping hammers - painting - cleaning of wooden decks, brass and copper.

UNIT-2 LIFE SAVING APPLIANCES

Classification of ships for v-life saving appliance - LSA requirement for cargo ships, life boat - description of life boat. Construction and parts of life boat - Buoyancy tanks - Means of propulsion - Different classes of lifeboats used - life raft - inflatable and rigid construction, ration and distress signals - Repairing leaks and punctures - life jacket - line throwing appliances: description and use of line throwing appliance

UNIT-3 FIRE FIGHTING APPLIANCES:

Fire hydrants and hoses - International shore connection - various types of fire. -extinguishing used in each type

UNIT-4 SAFETY APPLIANCES

Safety devices – Safety - Fire axe. Asbestos suit - smothering system - inert gas system, flue gas system, halon system, foam smothering system for liquid fires - maintenance of all firefighting appliances

UNIT-5 ROPES AND WIRES:

Types of rope - plaited ropes, fiber ropes, maintenance ropes– Damage caused by surging, meaning of marlin, spun yarn, oakum, tarred hmp,3ply and 5ply twines, halyards, loglines, lead lines–wire ropes– Construction of wire ropes–meaning of 6/12,6/24,6/37 types of wires –Plastic covered wire rope - Non-rotating wire rope - wires and chains

Reference Books:

1. Theory and Practice of Seamanship - G. Danton
2. Seamanship Notes - Kemp and Young

5 – PRACTICAL- CAM /CAM

Solid Modeling

Creation of IIID models Wireframe, Surface and Solid modelling techniques using CAD packages Parametric

Modelling Drafting Generation of orthographic IID views from models Sectioning, Detailing – Exposure to Industrial components Application of Geometrical Dimensioning & Tolerance.

Assembly Design

Assembling of various machine parts and tolerance analysis, generation of IID drawings and bill of materials from assembly Mechanism Design synthesis and design of mechanisms animations exercises on various mechanisms like four bar chain, slider crank mechanism and its inversions System Design Schematic and non-schematic driven routing of pipes and tubes

Computer aided manufacturing

Part programming fundamentals manual part programming and computer aided part programming hands on training in computer controlled turning and milling operations tool path generation and simulation exercises on CNC lathe and machining centre / milling machines Generation of STL files and rapid prototyping of CAD models

Exercises

- 1) Modeling of machine parts, brackets using IID drawings
- 2) Modeling of surfaces using given master geometry
- 3) Parametric modeling of standard parts such as nuts, bolts, rivets, washers etc

- 4) Assembling of machine parts
- 5) Generation of manufacturing drawings from IIID models/assembly
- 6) Synthesis of four bar mechanism and its simulation using software packages
- 7) Synthesis of slider crank mechanism and its simulation using software packages
- 8) Schematic and non schematic routing of pipes/tubes
- 9) Manual/Computer aided part programming for turning and milling operations
- 10) Rapid prototyping of simple CAD models

Reference Books

- I. CAD and Solid Modeling Software Packages CATIAVV, UNIGRAPHICS and PROE Manuals of Latest Version
- II. Ibrahim Zeid, R Sivasubrahmanian CAD/CAM: Theory & Practice *Tata McGraw Hill Education Private Limited, Delhi,*

SEMESTER II

6 - NAVIGATION

OBJECTIVE:

The student will understand the basics required for the navigation of ship in this course

UNIT-1

Shape of the Earth, Poles, Equator, parallel of latitude, Meridians, latitudes and longitude, D'Lat and D'Long Distance, Units of measurements, Geographical Mile, Nautical Mile

UNIT-2

Parallel Sailing, To convert distance sailed to Difference of longitude, Rhumb line sailing, Plane sailing and Middle lat sailing, Relationship Meridional parts, DMP, D'Long and Course, Mercator sailing, Boxing the Compass, Days work problems

UNIT-3

Lay out Transverse Table, Obtain the position of the ship at any time given the compass course, variation and deviation and the run recorded by log, Time and Estimated Speed, Navigational Charts, Mercator and Gnomonic Projections, Natural Scale, Advantage and Disadvantage of Mercator and Gnomonic Charts, Cardinal points, true and magnetic north, magnetic variation and Change in Annual Value, Isogonal, Deviation of Magnetic Compass, Compass Error

UNIT-4

The use of traverse table 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 allowing for the effect of the effect of wind and current; day's work; calculation of ship

UNIT-5

Principle of sextant; dip, reflection, semi-diameter and parallax; index error; Errors of sextant; reading a sextant (vertical and horizontal angles); principle and use of azimuth

mirrors ; procedure for checking accuracy of azimuth mirrors ; finding errors by radio signals
- correct UTC

Reference Books:

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|--------------------------------------|---|---|
| 1. Principles of Navigation | · | Capt. T.K. Joseph and Capt. S.S.S. Rewari |
| Admiralty Manual of Navigation Vol:I | | |
| 2. &Vol:II | · | HMSO |
| 3. Navigation | · | A. Frost |

7 - CARGO HANDLING AND STOWAGE

OBJECTIVE:

The students will learn the cargo handling system and stowage plan in this course

UNIT-1 INTRODUCTION

General Cargo - Ship's cargo gear- derricks and cranes – types of cargo -methods of loading by conveyor and discharging by grab - Container Ships with cell guides, Tankers for liquid cargoes using pumps and piping - lift cargoes, refrigerated ships and reefer cargoes, dangerous goods, multipurpose ships, ro-ro ships and their cargoes+

UNIT-2 BASIC ASPECTS OF CARGO WORK

Importance of cargo care to economical operation of the ship, Care of cargo on board, Bale and Grain Capacity – Stowage plan - Ullage and soundings - Measurement Cargo, Safe Working Load (SWL) - Duties of the Officer on Cargo Watch, Log Book Entries

UNIT-3 CARGO MAINTENANCE

Ship sweat and cargo sweat and differentiate between them, Factors affecting sweat – ventilation - Various types of deck cargoes, Efficient means of securing of deck cargoes - safe access to equipment and spaces, maximum permissible load

UNIT-4 DERRICK RIGS

Parts of a simple derrick, importance of preventer guys, union purchase system, Rigging of derricks for loading and discharging of cargoes - The working of the Ship's cranes - securing a derrick and crane - Operational checks to be done on ship's cargo gear before handling over to stevedores including checks on limit cut outs, Contents and use of rigging plan

UNIT-5 CONTAINERS

Parts of a container - Features of a container -Types of container - Segregation and care of container carrying dangerous goods, reefer containers and out-of-gauge(OOG) cargoes - Stowage and securing gear of containers - refrigerated cargo

BOOKS FOR REFERENCE:

1. Cargo Work for Ship Officer- Capt Errol Fernandes
2. Cargo Work- Kemp and Young
3. Cargo Work- Taylor
4. Cargo Work- D.J. House

8 - VOYAGE PLANNING, COLLISION PREVENTION AND MARINE COMMUNICATION

OBJECTIVE:

The student will learn the planning of the voyage and reckoning collision issues & communication.

UNIT-1

A nautical chart - Natural scale, type of projection, Title of chart, Number of chart, Date of publication - Deciphering the symbols and Abbreviations used on nautical chart - read courses and bearing - The compass rose - BA chart 5011 - Reason for using nearest lat scale for measuring distance

UNIT-2

Corrections from Notices to Mariners - Small and Large correction - numbers of chart required for any ocean passage - Types of Charts - Reference point use for Heights and Depths, Nature of bottom, Depth contours, Information regarding Lights, Height, Colour, Characteristics - Use of Clearing Marks and Horizontal and Vertical Danger Angles

UNIT-3

True and Magnetic Compass North -Variation - How to calculate variation from the date given on the compass rose, Annual rate of change - Deviation of the Compass - The deviation card - True Magnetic and Compass Course - Conversion to another - Conversion of Gyro Course to True Course and vice versa

UNIT-4

The effect of Current on Course Made Good. Set and Drift. The effect of wind on Course Made Good. Set and Drift. The effect of wind on Course Made Good. Leeway - The DR position, EP and Observed position. Ground Track and water tracks

UNIT-5

COLREG rules from No 1- 19

Reference Books:

1. Chart Work for Mariners - Capt. S.K. Puri
2. Voyage Planning and Chart Work A.V. Naik and Capt. Varty

9 - SHIPPING MANAGEMENT

OBJECTIVE:

The student will learn the management of shipping activities in this course

UNIT-1

Organizational Behavior, Managerial Economics, Probability and Statistics, Decision Making- Formal Safety Management. Written and Oral Executive Communications - Human Resource

UNIT-2

Organization of a shipping Company, Manpower Planning, Cargo Management, Evolution of World Merchant Fleet, With special reference to The Indian Fleet - Types of Shipping Services.

UNIT-3

Role of Port, Port Location, Function and Range of service, Indian Ports, Their organization and Administration, Maritime Fraud, Basic Custom house Procedure.

UNIT-4

Basic structure of shipping industry, Types of shipping services, Liner and tramp, Role of Intermediaries in shipping business. Freight Broker, Clearing and forwarding Agent, Liner trades, how freight rates are fixed - World scale and its advantage

UNIT-5

Procedure of shipping cargoes and related document - Mates Receipt and Bills of lading - Multimodal transport - Tramp trades, Chartering, Different Types of Chartering, Calculations on Lay time

REFERENCE BOOKS :

1. SHIPPING MANAGEMENT - G RAGHURAM

10 – PROJECT

COURSE OBJECTIVE

A requirement of this program is to complete the project work where the students are expected to write reports in their chosen field of interest within the various verticals of the nautical science subjects which will enable the student to gain more in depth knowledge of the chosen vertical.

The completed report which shall be done under the guidance of the respective project guides and shall include the current practices and also suggest improvements.