UNIVERSITY OF MUMBAI

Syllabus for Sem V & VI
Program: B.Sc.
Course: Nautical Science

(Credit Based Semester and Grading System with effect from the academic year 2015–2016)

Theory/Practical : 16 Weeks (15 weeks for lectures/practical & one week for semester end examination)

Semester –V

Course Code	Title of the Course	Per Week		Per Semester		Credits		TOTAL
		L	P	L	P	L	P	
USNSC501	NAVIGATION –IV	3	1	45	15	4	2	6
	SHIPPING MANAGEMENT	4		60				
	MARITIME LAW	4		60				
USNSC502	NAVIGATION –III	3	1	45	15	3	2	5
	VOYAGE PLANNING & COLLISION PREVENTION - III	3	2	45	30			
USNSC503	SHIP OPERATION TECHNOLOGY-III	3	1	45	15	3	2	5
	SHIP OPERATION TECHNOLOGY-IV	3	1	45	15			
	NAVAL ARCHITECTURE-III	4		60				
USNSC504	ENVIRONMENTAL SCIENCE-III	3	1	45	15	2	2	4
	MARINE ENGINEERING & CONTROL SYSTEMS-III	3	1	45	15			
		33	08	495	120	12	8	20

Theory / Practical :

Semester –VI

Course Code	Title of the Course	Per Week		Per Semester		Credits		TOTAL
		L	P	L	P	L	P	
USNSC601	NAVIGATION –IV	3	1	45	15	4	2	6
	SHIPPING MANAGEMENT	4		60				
	MARITIME LAW	4		60				
USNSC602	NAVIGATION –III	3	1	45	15	3	2	5
	VOYAGE PLANNING & COLLISION PREVENTION - III	3	2	45	30			
USNSC603	SHIP OPERATION TECHNOLOGY-III	3	1	45	15	3	2	5
	SHIP OPERATION TECHNOLOGY-IV	3	1	45	15			
	NAVAL ARCHITECTURE-III	4		60				
USNSC604	ENVIRONMENTAL SCIENCE-III	3	1	45	15	2	2	4
	MARINE ENGINEERING & CONTROL SYSTEMS-III	3	1	45	15			
		33	08	495	120	12	8	20

NAVIGATION -IV / SHIPPING MANAGEMENT / MARITIME LAW **Contact Hours 180**

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc in Nautical Science	Six Semesters	V	NAVIGATION -IV / SHIPPING MANAGEMENT / MARITIME LAW [USNSc 501]
Course Code	Title	Credits	
USNSc 501	NAVIGATION -IV / SHIPPING MANAGEMENT / MARITIME LAW	4+2	

For Course per week 1 lecture/period is 60 minutes duration				**For subject** per week 1 lecture/period is 60 minutes duration			
	Theory	Practical	Tutorial	NAVIGATION	SHIPPING MANAGEMENT	MARITIME LAW	
Actual contacts	11	1	--	3	4	4	
Credits	4	2	--	1			

NAVIGATION –III
VOYAGE PLANNING & COLLISION PREVENTION - III **Contact Hours 135**

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc in Nautical Science	Six Semesters	V	Navigation-III Voyage Planning & Collision Prevention –III [USNSc 502]
Course Code	Title	Credits	
USNSc 502	Navigation-III Voyage Planning & Collision Prevention-III	3+2	

For Course per week 1 lecture/period is 60 minutes duration				**For subject** per week 1 lecture/period is 60 minutes duration	
	Theory	Practical	Tutorial	Navigation-III	Voyage Planning & Collision Prevention-II
Actual contacts	6	3	--	3	3
Credits	3	2	--	1	2

SHIP OPERATION TECHNOLOGY PAPER- III
SHIP OPERATION TECHNOLOGY PAPER- IV
NAVAL ARCHITECTURE-III **Contact Hours 180**

Name of the Programme	**Duration**	**Semester**	**Course/ Course Code**
B.Sc in Nautical Science	Six Semesters	V	Ship Operation Technology-III Ship Operation Technology-IV Naval Architecture-III [USNSc 503]
Course Code	Title	Credits	
USNSc 503	Ship Operation Technology-III Ship Operation Technology-IV Naval Architecture-III	3+2	

For Course per week 1 lecture/period is 60 minutes duration				**For subject** per week 1 lecture/period is 60 minutes duration			
	Theory	Practical	Tutorial	Ship Operation Technology- Paper- III	Ship Operation Technology -IV	Naval Architecture Paper- III	
Actual contacts	10	2	--	3	3	4	
Credits	3	2	--	1	1	-	

ENVIRONMENTAL SCIENCE-III
MARINE ENGINEERING & CONTROL SYSTEMS-III **Contact Hours 120**

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc in Nautical Science	Six Semesters	V	Environment Science – III Marine Engineering & Control System- III [USNSc 504]
Course Code	Title	Credits	
USNSc 504	Environment Science – III Marine Engineering & Control System- III	2+2	

For Course per week 1 lecture/period is 60 minutes duration				**For subject** per week 1 lecture/period is 60 minutes duration		
	Theory	Practical	Tutorial	Environment Science – III	Marine Engineering & Control System- III	
Actual contacts	06	02	--	3	3	
Credits	02	02	--	1	1	

Objective: .

This subject exposes the students to Navigation, Shipping Management & Maritime Law

Contents of syllabus for USNSC 501

Navigation - IV

		Theory	Practical
UNIT 1	**SEMESTER - V** **Note:** With respect to Navigational Aids, Operating Procedures include characteristics, limitations, care and maintenance. **Magnetic Compass:** The construction of the magnetic compass and binnacle. The method of determination and compensation by means of components of the effects of a ship's magnetic field on the magnetic compass. The approximate coefficients A,B,C,D, and E. conditions which might produce coefficient A and E. Analysis of a table of deviation to obtain appropriate coefficients. Methods of obtaining a table of deviation. Calculations on the above.	**15 Hours**	-
Unit 2	General principles of compass corrections and the method of correction for coefficient B,C, and D. Heeling error and its cause, effect and method of correction. Siting of compasses with reference to the proximity of magnetic material and electrical appliances. Care and maintenance of liquid compasses. Calculation on the above. **Course Recorder:** working principles and operating procedure. **Long Range Identification and Tracking (LRIT)**: working principles and operating procedure	**22 Hours**	
UNIT 3	**Gyro Compass:** The properties of the free gyroscope. The relationship between applied force and precession. The effect of earth's rotation on a free gyroscope. Drift, tilt and damping. Errors associated with gyro compasses including latitude, course and speed error, ballistic deflection and its relation to change of speed error. Latitude, course and speed correction, rolling error and how it is minimized. The principal parts of gyro compass and repeater systems. **PRACTICAL** **Magnetic compass:** Familiarisation with various types of magnetic compasses used on Merchant Navy ships. Routine maintenance of the compass. **Gyro-compass:** Familiarisation with various types of Gyro-compasses used on Merchant Navy ships. Explain procedure starting and stopping and routine maintenance.	**8 Hours**	**15 Hours**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 60% as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India .

Reference Books:-

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.	Radar Observer's Handbook	W.Burger
10.	Marine Electronic Navigation	S.F. Appleyard
11.	Electronic Aids to Navigation; Position Fixing	L. Tetley & D. Calcutt

SHIPPING MANAGEMENT

		Theory	Practical
UNIT 1	**SEMESTER – V** **SECTION-A** Managing & Managers: Organisation and the need for management; the management process; types of managers; management level and skills; managerial roles; the challenge of management. The evolution of management theory: Why study management theory? The classical Management theories; the behavioural school; the quantitative school – operations research and Management science; the evolution of management theory The external environment of organisations: the external environment and its importance; Elements of the direct-action environment; elements of the indirect-action environment; theories of total organisation environments, managing the total environment.	**20 Hours**	-
UNIT 2	Planning and strategic management: Planning – an overview; the formal planning process; the evolution of the concept of strategy. Social responsibility and ethics: the changing concept of social responsibilities; the shift to ethics; the tools of ethics; the challenge of relativism. Strategy implementation: Matching strategy implementation to strategy; matching structure and strategy; institutionalizing strategy. the nature of managerial decision making; the rational model of decision making and problem solving. Planning and decision – making tools & techniques: the management science approach; the management science process; planning for the future – forecasting; planning for the future – scheduling; planning to meet goals with certainty; planning to meet goals with uncertainty.	**20 Hours**	

UNIT 3	**SECTION-B** International Trade and Shipping: Seaborne trade of the world composition and direction of cargoes – different types of ships which carry them – Technological development – Role of Shipping on national economic development. Basic Structure of Shipping Industry: Types of Shipping services – Liner and Tramp – Role of Intermediaries in shipping business: Freight brokers, clearing and Forwarding Agents Stevedores – Shipbrokers, Bunker and Stores suppliers etc. Shipping Agencies. Liner Trades – characteristics – Liner Conferences – How Freight rates are fixed Components of Liner Freight – Non – Conference lines – competition. Procedures of Shipping cargoes and related documentation; Mate's Receipt, Bill of Lading. Unit load systems – containerisation and multimodal transport. Tramp Trades – Chartering – different types of chartering ships – their relevance to trades – Procedures and documentation relating chartering – Charter markets of the world – How freight / charterhire is fixed. Organisation of shipping company – Manpower planning – Business and cargo management – Statutory regulations to be complied with like Foreign Exchange Regulation. Role of ports: Port locations – Functions and range of services – Financial aspects of utilisation and cargo handling. India's ports, their organisation and administration Modernisation and development of ports	**20 Hours**	

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

NOTE : A candidate has to secure minimum percentage /grade : 40 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

1. Management — Stoner & Freeman
2. Basic Marine Management — Dr. A.V. Athalye
3. The Practice of Management — Drucker P.
4. People in Organisation, an introduction to organisation behaviour — Mitchell, Terence P.
5. Consumer Behaviour. Basic Findings & Manegerial implegations — Zaltman G. & Wallendrof A.

6. Mathematics of Investment	Hart W.L.
7. Theory and Practice of Management Information System	Burch, Strater & Grudneski
8. A Concept of Corporate planning	Russel L. & Ackoff
9. IACOCCA: An autobiography	Lee lacocca
10. An introduction to Financial Management	Solomon & Pringle
11. Manpower Management	Dwivedi R.S.
12. Industrial Relations in India's Developing Economy	N.N. Chaterjee
13. An introduction Database System	Dale C.J.
14. Monetary Planning for India	Gupta Suraj B.
15. Economics of Shipping & other papers	Dr. S.N. Sanklecha
16. International Maritime Fraud	Ellen & Campbell
17. Elements of Shipping	Alan Branch
18. Containerisation era in India	Dr. K.V. Hariharan

MARITIME LAW

		Theory	Practical
UNIT 1	**SEMESTER – V** Concept of Law-Civil, Criminal Law, Public Law, Private Law, Public and Private International Law.	**15 Hours**	-
UNIT 2	Indian contract Act with reference to following: Agreement, Offer and Acceptance, consideration, consent, capacity to contract, valid void and voidable contracts, quasi contract, breach of contract, remedies for breach, discharge of contract, agency bailment.	**25 Hours**	
UNIT 3	Scope of Maritime Law – Sources, Subjects and objects. Continental Shelf, Exclusive Economic Zone, Sea Bed, Admiralty Jurisdiction International aspects of Registration Ship building contracts and mortgage. Nationality of ships, flags of convenience & flag discrimination. International Maritime Organisation – its Structure, Objects & Functions.	**20 Hours**	

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 40 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India.

Books for references

1. Merchant Shipping Act, 1958 — Govt. of India
2. The Indian Multimodal Transport of Goods Act,1993 — Govt. of India
3. Carriage of Goods by Sea Act, 1925 — Govt. of India
4. Marine Insurance Act, 1963 — Govt. of India
5. The Arbitration and Conciliation Act, 1996 — Govt. of India
6. S.T.C.W Convention, 1978 — I.M.O
7. The Indian Contract Act, 1879 — I.M.O
8. Relevant Shipping Manual, Conventions & Rules
9. Hague/Visby Rules. Hamburg Rules
10. Charter Parties — Scrutton
11. Indian Contract Act — Actar Singh
12. Maritime Law of India — Gopalan Nair, Editor
13. Shipping Law — Charley & Giles
14. Legal Regime of Merchant Shipping — Dr. Nagendra Singh
15. Limitation of Liability of Shipowners — Khodie Narmada
16. Maritime Liens — Dr. Thomas
17. Carriage of Goods by Sea — Mitra
18. Business & law for the Shipmaster — F.N. Hopkins
19. Shipping law — Grime R.
20. Law of Carriage of Goods — Avatar Singh
21. Law of Arbitration — Avatar Singh

(Note: Reference to the Acts include all amendments made from time to time)

Objectives:-

The subject will develop basics of Principles of Navigation / Practical Navigation and Voyage Planning & Collision Prevention .

Contents of syllabus for USNSC 502

NAVIGATION-III

		Theory	Practical
UNIT 1	**SEMESTER – V** **SECTION-A PRINCIPLES OF NAVIGATION** Birth of universe, stars, planets and their satellites. Signs of the Zodiac. Recognition of principal stars with reference to their constellations. Stellar magnitudes. **SECTION-B PRACTICAL NAVIGATION** Solution of Spherical triangle by Haversine formula, Sine formula, Cosine formula, four part formula & Napier's Analogies.Application of right angled & quadrantal spherical triangles.	**15 Hours**	**-**
UNIT 2	**SECTION-A PRINCIPLES OF NAVIGATION** Kepler's Law. Distance of planets from the sun. Bodes law. Inferior and superior planets. Axial revolution of planets. Relative motion of planets in their orbits. Elongation; Morning and evening star; Reasons for change of SHA/RA of Sun, Moon and planets. Solar prominences, solar spot cycle and its effect on terrestrial magnetism. **SECTION-B PRACTICAL NAVIGATION** 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.	**15 Hours**	
UNIT 3	**SECTION-B PRACTICAL NAVIGATION** Earth-moon system, moon's orbital and axial rotation, phases of the moon, liberation. Lunar month. Eclipses – solar & lunar; Conditions necessary for occurrence of a planet or star. Precession of equinoxes. Familiarity with all the contents of nautical almanac and its usage. **SECTION-B PRACTICAL NAVIGATION** Calculations based on sem I, II, III & IV portion of practical navigation, **PRACTICALS** **SEXTANT:** To use Sextant for the accurate measurement of vertical & horizontal sextant angles. To identify adjustable errors of the sextant and to	**15 Hours**	**15 Hours**

	correct such errors. To measure altitudes of heavenly bodies when possible and do sight calculation. **GYRO COMPASS:** To know procedure of starting & stopping of Gyro Compass. Routine maintenance. Use of Azimuth ring to take bearing of both celestial and terrestrial objects.		

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 70 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India.

Reference Books:-

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

VOYAGE PLANNING & COLLISION PREVENTION-III

	SEMESTER – V	Theory	Practical
UNIT 1	**VOYAGE PLANNING** To find the time and height of HW and LW at standard ports and at secondary ports by Tidal differences. To find the time at which the tide reaches a specified height or the heights of the tide at a given time and hence the correction to be applies to soundings or charted heights of shore objects.	**15 Hours**	**05 Hours**
UNIT 2	**VOYAGE PLANNING** A systematic knowledge and use of the contents of the following documents in relation to Safety of Navigation Sailing Directions List of Light & Fog Signals List of Radio Signals	**10 Hours**	**05 Hours**
UNIT 3	**COLLISION PREVENTION** Thorough Knowledge of all the Rules, Annexes of International Regulations for prevention of collision and IALA buoyage systems.	**20 Hours**	**05 Hours**
	PRACTICALS **VOYAGE PLANNING** Practicals of first year and second year pertaining to Position fixing by various methods, current & leeway, running fix and three point bearing and the use of hyperbolic charts, to a higher degree. **COLLISION PREVENTION** The students will be required to identify various collision situations by day and by night. Practicals to be held using a Magnetic Board, Wooden models, or any other aid to simulate such conditions. Candidates will be required to deal with each collision situations broadly under the heading 'recognition', 'responsibility', 'action', 'appropriate sound signal' and 'any ordinary practice of seaman'.		**15 HOURS**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 70 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

1. Chart work — Capt. S.K.Puri
2. Rule of the road — Bhandarkar publications
3. BA Chart 5011 — HMSO
4. Shipborne Radar, Chapters on plotting — Capt. H.Subramanian
5. Voyage Planning & Chartwork — Capt. M.V. Naik & Capt. Varty
6. International Light, Shape & Sound signals — Moore D.A
7. A Guide to Collision Avoidance — A.N. Cockroft
8. Chartwork — Capt. S.S. Chaudhari
9. Modern Chartwork — Capt. W.H. Squair

Objective:-

This subject exposes the students to Ship Operation Technology Paper-III , Ship Operation Technology Paper-IV & Naval Architecture

Contents of syllabus for USNSC 503

SHIP OPERATION TECHNOLOGY PAPER- III

		Theory	Practical
UNIT 1	**SEMESTER – V** **Section - A** Study of IMO codes and guidelines for the carriage of dangerous goods, chemicals in bulks, liquefied gases in bulk. **Dangerous goods in packaged form (SOLAS, Ch. VII, IMDG Code and MARPOL Annex III)** Classification of IMDG cargo with distinctive labels and examples. Use of IMDG Code, UN No., General Index, MFAG, EmS. Compatibility and segregation table, precautions during stowage handling and loading of explosives. **Chemical Tankers (SOLAS Ch. VII, MARPOL Annex II, IBC Code)** Type 1, Type2 and Type 3 chemical tankers. Various categories (X,Y,Z, OS) of cargoes. Hazards associated with chemical cargoes and control measures. Purpose and use of IBC Code. **Gas Tankers: (Ch. VII of SOLAS, SIGTTO and IGC Code) LNG, LPG, LEG and chemical gases in bulk** Type A, Type B and Type C tanks; each tank is fitted with high level alarm and auto-shut off. Purpose and objectives of the IGC Code. Hazards of gas cargoes and control measures adopted.	**15 Hours**	-
UNIT 2	**Section – A** Detailed study of stowage and securing of various types of cargoes taking into account safety of ships and cargoes. Cargo handling gear, designs and strength parameter, special requirements for handling of bulk cargoes and containers.	**18 Hours**	
UNIT 3	**Section -B** Basic knowledge of the various components of a shipboard GMDSS station. **PRACTICALS** **MARINE COMMUNICATION** 1. To send and receive Morse code by flash lamp up to six words per minute. 2. Knowledge of operation of GMDSS Radio Station equipment.	**12 Hours**	**15 Hours**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 60 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

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. Marpol 73/78 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. Tankers Handbook for Officers	Capt. C. Baptist
14. Tankers Practice	G.A.B. King
15. Tankers Practice	Rutherford
16. International Safety Guide for Oil Tankers & Terminals (ISGOTT)	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

SHIP OPERATION TECHNOLOGY -IV

		Theory	Practical
UNIT 1	**SEMESTER - V** **SECTION A – SEAMANSHIP & WATCHKEEPING** 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 maneuvers, Man overboard. Anchor work – different types of anchors, their advantages/disadvantages, cables & there care, anchoring to single anchor. Use of 2nd anchor – when, why, & how. Mooring – Standing Moor – Running Moor.	**15 Hours**	**-**
UNIT 2	**SEMESTER - V** **SECTION A – SEAMANSHIP & WATCHKEEPING** Thorough knowledge of ropes and wires. Their SWL, Proof Load & Breaking strengths. Knots, bends, hitch and splice in common use. Purchase & tackle – power gained. Muster lists and all duties connected with the same. Use & care of Life Saving and Fire Fighting Appliances. Life Boat/Life raft – Statutory requirements, handling them in an emergency. Precautions in manoeuvring for launching of boats or life rafts in bad weather. Methods of taking on board survivors from lifeboats & liferafts. Prevention of fire at sea & in port. Oxidation, flashpoint auto ignition temperature, and spontaneous combustion. Methods used to prevent the spread of fire. Action to be taken.	**15 Hours**	

UNIT 3	**SECTION B – MAINTENANCE** Inspection and maintenance of ship and equipment, items to be covered include Hull, Bulkheads, DBs, Deep and Peek tanks, bilges, pipe lines, rudders, anchor and cables. Davits, safety equipment, derricks and other cargo gear, navigation lights. a practical knowledge of siting and screenary of ships navigational flights. Surveys and classification of ships with reference to safety equipment and safety construction certificates with particular attention to maintenance aspect. **PRACTICALS** **SEAMANSHIP AND WATCHKEEING** Use of various types of fire extinguishers in the event of fire. To recharge various types of fire extinguisher. Use of smoke helmet, and breathing apparatus. Identification and familiarisation with the documents and certificates carried on board – Brief contents and their validity.	**15 Hours**	**15 Hours**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 60 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

1. Theory and Practice of Seamanship — G. Danton
2. Seamanship Notes — Kemp and Young
3. Seamanship and Cargo work — Capt. J. Dinger
4. Nicholls's Seamanship and Nautical Knowledge — A.N. Cockcroft
5. Shipboard Operations — H.I. Laurey

NAVAL ARCHITECTURE-III

		Theory	Practical
UNIT 1	**SEMESTER – V** **SHIP STABILITY** Use of Simpson's rules for the computation of areas, second moment of areas, volumes, moments of volumes and centroids. Centre of pressure for regular shapes and parabolic shapes, when given horizontal or vertical ordinates. Derivation of the formulae for TPC, FWA, BM (Transverse), MCTC, Angle of Loll, Virtual loss of GM due to free surface, Virtual loss of GM on dry docking, List with Zero GM, Wall sided formula and Attwood formula.	**20 Hours**	**-**
UNIT 2	**SHIP STABILITY** Stability at moderate and large angles of heel. Use of the wall – sided formula. Effect of beam and freeboard on stability. Dynamical Stability – calculation of same by the GZ curve. Stability and trim when dry – docking or grounding. Theory of rolling. Synchronism. The danger to a ship at the angle of loll. Ballasting sequence to rectify same. Dangers to a ship with a heavy list. Dangers associated with deck cargoes including timber. Preventive and corrective actions to take.	**20 Hours**	
UNIT 3	**SHIP CONSTRUCTION** Properties of steel, aluminium and other construction materials used for shipbuilding. Effect of fire, heat, shock etc. on these materials. Types of ships. General ideas on strength and construction. Midship section of specialized carriers – Passenger ship, RoLASH, Refrigerated cargo, LNG, LPG, Chemicals etc. An out-line knowledge of shipyard practice and procedure including drawing office methods, place and section marking; process control and prefabrication. Methods used in welding of steel ships. Welding of ferrous and non-ferrous metals as practiced in Shipyards. Testing and inspection of welds. Types of joint and edge preparations. Stresses set up due to welding. Stress relieving.	**20 Hours**	

***There will be continuous assessment of skills being acquired through class work, periodic assignments / project works / tests/ orals etc.**

NOTE : A candidate has to secure minimum percentage /grade : 60 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

1. Merchant Ship Construction	T.A. Taylor (1985 edition)
2. Ship Construction	D.J. Eyres (1988 edition)
3. Ship Construction	Kemp & Young
4. i) Load Line, ii) Tonnage, iii)Cargo Ship Construction, iv) Passengers Ship Construction (Selected parts referring to Sub-division & Fire Protection)	Statutory Regulations
5. Ship Stability (volumes I, II & III)	Capt. H. Subramaniam
6. Problems on M.V. Hindship	Capt. Joseph & Capt. Rewari
7. Notes of Stability	Kemp & Young
8. Ship Stability for Masters and Mates	D.R. Derret
9. Reed's Ship Construction for Marine Students	E.A. Stokoe

Objective:-

This subject exposes the students to Environment Science – III, Marine Engineering & Control System- III

Contents of syllabus for USNSC 504

Environmental Science-III

		Theory	Practical
UNIT 1	**SEMESTER V** Air Masses and Fronts: Air masses: Basic concepts; Factors governing Development & properties; Classification; Convergence & Divergence. Fronts: Types; Associated weather; Frontal Depressions – Origin, life and movement; Forecasting Techniques. Non – Frontal Depressions 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 manoeuvring in the vicinity of a T.R.S.	**20 Hours**	-
UNIT 2	Meteorological Analysis & Weather Forecasting: Sources of Meteorological data; principles of weather analysis; Weather forecasting; Principles & Practices: Macro, Meso & Micro level forecasting.	**10 Hours**	
UNIT 3	Environment Pollution; Basic causes; Common pollutants. International convention on prevention of pollution by Marine Environment 1973 / 78 (MARPOL); Pollution by oil, chemicals, hazardous substances. **PRACTICALS** 1. Application of rules of Navigation when near or facing tropical storms – few exercises. 2. Principles of working and use of meteorological instruments.	**15 Hours**	**15 Hours**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 50 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

Sr. No.	TITLE	AUTHOR	PUBLISHER
1.	Weather analysis & forecasting vol. I	S. Petterson	M/c Graw Hill
2.	Weather analysis & forecasting vol. II	S. Peterson	M/c Graw Hill
3.	Tropical Meteorology	H. Reehi	M/c Graw Hill
4.	Principles of meteorological analysis	W.J. Saucier	University of Chicago Press
5.	Marine Meteorology	Capt. H. Subramanian	Vijaya Publications
6.	Meteorology for Mariners	HMSO	HMSO
7.	Marine Observer's Hand book	HMSO	HMSO
8.	Atmosphere, weather & climate	R.g. Barry, R.J. Chorley	Metheun, London
9.	Ship's code	I.M.D. 1982	
10.	Dynamic and physical meteorology	Haltiner & Martin	M/c Graw Hill
11.	General Meteorology	H.R. Byers	M/c Graw Hill
12.	Numerical Weather Analysis & predication	P.D. Thompson	Mc. Millan Co.
13.	Atlantic Hurricanes	Gord E Dunn	Louisiana state University
14.	An introduction to Dynamic Meteorology	J.R. Holten	M/c Graw Hill
15.	Atmosphere science an Introduction survey	P.E. Hobbs J.M. Wallace &	M/c Graw Hill
16.	Forecasting Manuals	I.M.D.	
17.	Numerical Predication	Haltiner J.H. & Williams R.T	John Wiley & Sons New York
18.	Marpol 73/78 with all amendments	I.M.O	I.M.O
19.	Regulations for the prevention of Pollution by oil	I.M.O	I.M.O
20.	Regulations for control of pollution by Noxious substances in bulk	I.M.O	I.M.O
21.	Shipboard oil pollution emergency plan	I.M.O	I.M.O

MARINE ENGINEERING & CONTROL SYSTEM- III

		Theory	Practical
UNIT 1	**SEMESTER - V** **SECTION – A** Introduction, growth in shipboard automation, understanding terminology. Sensors measuring elements for temperature, pressure, level, flow, etc. Transmitter and actuators. Automatic control systems, open loop, closed loop control system, general principles. Controllers and proportional controller. Pneumatic, hydraulic, electric, electronic control systems. Applications in various shipboard operations. Bridge control on main propulsion. Manoeuvring aids – CP. Propeller, bow thrusters. Care and precautions. Trim indicator, heel indicator, draft gauge, load and stress indicators.	**18 Hours**	-
UNIT 2	**SECTION -B** Liquid cargo loading, storage and discharge operations. Monitoring. Remote level gauges. Types of remote control valves used on board ships. Remote control operation of hatch covers. Remote operation for loading, discharging and ballasting operations. Information display, data logging, alarm systems. Testing and maintenance. Role of classification society in quality of construction, machinery and operations. Surveys and importance of same. Lifeboat engine, emergency fire pump engine, lifeboat winch, operation and care.	**14 Hours**	
UNIT 3	**SECTION -C** Fire detectors, smoke, heat, flame etc. Fire alarm circuits. Fire fighting systems: Fixed fire fighting installations for engine room, accommodation and cargo holds. CO_2 flooding, high pressure water system, water sprinkler system, bulk dry powder and foam systems. Inert gas for cargo. Inert gas production, generation from boiler fuel gas etc. inert gas system plant. Use of O2 analyzer, explosive meter, dragger pump and other portable measuring instruments. Smoke helmets, breathing apparatus, fire suits and other safety equipments.	**13 Hours**	

	PRACTICALS 1. Starting and running operations of motor boat engines, emergency fire pump engine. 2. Starting, running and care of centrifugal pumps and air compressors. 3. Simple turning operations on lathe machine. 4. Use of instruments like portable O_2 analyser, explosimeter, dragger pump.		**15 Hours**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 50 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

Books for reference

Sr. No.	**TITLE**	**AUTHOR**	**PUBLISHER**
1.	Basic Marine Engineering	J.K. Dhar	G. Maritime Publications
2.	General Engineering knowledge for Marine Engineers	L.Jackson & T. Morton	Thomas Reed Publications Ltd
3.	Reeds Engineering knowledge for Deck officers	W. Embleton and T. Morton	Thomas Reed Publications Ltd
4.	Basic Electro Technology for Engineers		Thomas Reed Publications Ltd
5.	Marine Engineering series – Marine Professional Boilers	GTH Flanogan	Heinemann Publications Ltd
6.	Marine Engineering series – Diesel Professional Engines	Wharton A.S	Heinemann Publications Ltd
1.	Marine Auxiliary Machinery	D.W. Smith	Thomas Reed Publications Ltd
2.	Marine Electrical Practice	G.O. Watson	Thomas Reed Publications Ltd
3.	Instrumentation & control for engineers		Thomas Reed Publications Ltd
4.	Fire fighting equipment and its uses on ship Marine engineering volume – I		Thomas Reed Publications Ltd
5.	Principles and practice of marine	D.K. Sanyal	Thomas Ree
6.	Diesel engines		Publications Ltd

B.Sc. in Nautical Science

Theory/Practical : 16 Weeks (15 weeks for lectures/practical & one week for semester end examination)

Semester –V

Course Code	Title of the Course	Per Week		Per Semester		Credits		TOTAL
		L	P	L	P	L	P	
USNSC501	NAVIGATION –IV	3	1	45	15	4	2	6
	SHIPPING MANAGEMENT	4		60				
	MARITIME LAW	4		60				
USNSC502	NAVIGATION –III	3	1	45	15	3	2	5
	VOYAGE PLANNING & COLLISION PREVENTION - III	3	2	45	30			
USNSC503	SHIP OPERATION TECHNOLOGY-III	3	1	45	15	3	2	5
	SHIP OPERATION TECHNOLOGY-IV	3	1	45	15			
	NAVAL ARCHITECTURE-III	4		60				
USNSC504	ENVIRONMENTAL SCIENCE-III	3	1	45	15	2	2	4
	MARINE ENGINEERING & CONTROL SYSTEMS-III	3	1	45	15			
		33	08	49	12	12	8	20

Theory / Practical :

Semester –VI

Course Code	Title of the Course	Per Week		Per Semester		Credits		TOTAL
		L	P	L	P	L	P	
USNSC601	NAVIGATION -IV	3	1	45	15	4	2	6
	SHIPPING MANAGEMENT	4		60				
	MARITIME LAW	4		60				
USNSC602	NAVIGATION -III	3	1	45	15	3	2	5
	VOYAGE PLANNING & COLLISION PREVENTION - III	3	2	45	30			
USNSC603	SHIP OPERATION TECHNOLOGY-III	3	1	45	15	3	2	5
	SHIP OPERATION TECHNOLOGY-IV	3	1	45	15			
	NAVAL ARCHITECTURE-III	4		60				
USNSC604	ENVIRONMENTAL SCIENCE-III	3	1	45	15	2	2	4
	MARINE ENGINEERING & CONTROL SYSTEMS-III	3	1	45	15			

NAVIGATION -IV / SHIPPING MANAGEMENT / MARITIME LAW

Contact Hours 180

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc in Nautical Science	Six Semesters	V	NAVIGATION -IV / SHIPPING MANAGEMENT / MARITIME LAW [USNSc 601]
Course Code	Title	Credits	
USNSc 601	NAVIGATION -IV / SHIPPING MANAGEMENT / MARITIME LAW	4+2	

For Course per week 1 lecture/period is 60 minutes duration				**For subject** per week 1 lecture/period is 60 minutes duration			
	Theory	Practical	Tutorial	NAVIGATION	SHIPPING MANAGEMENT	MARITIME LAW	
Actual contacts	11	1	--	3	4	4	
Credits	4	2	--	1			

NAVIGATION –III

VOYAGE PLANNING & COLLISION PREVENTION - III **Contact Hours 135**

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc in Nautical Science	Six Semesters	V	Navigation-III Voyage Planning & Collision Prevention – II [USNSc 602]
Course Code	Title	Credits	
USNSc 602	Navigation-III Voyage Planning & Collision Prevention-III	3+2	

For Course per week 1 lecture/period is 60 minutes duration				**For subject** per week 1 lecture/period is 60 minutes duration	
	Theory	Practical	Tutorial	Navigation-III	Voyage Planning & Collision Prevention-III
Actual contacts	6	3	--	3	3
Credits	3	2	--	1	2

SHIP OPERATION TECHNOLOGY PAPER- III
SHIP OPERATION TECHNOLOGY PAPER- IV
NAVAL ARCHITECTURE-III **Contact Hours 180**

Name of the Programme	**Duration**	**Semester**	**Course/ Course Code**
B.Sc in Nautical Science	Six Semesters	V	Ship Operation Technology-III Ship Operation Technology-IV Naval Architecture-III [USNSc 603]
Course Code	Title	Credits	
USNSc 603	Ship Operation Technology-III Ship Operation Technology-IV Naval Architecture-III	3+2	

For Course per week 1 lecture/period is 60 minutes duration				**For subject** per week 1 lecture/period is 60 minutes duration			
	Theory	Practical	Tutorial	Ship Operation Technology -Paper- III	Ship Operation Technology-IV	Naval Architecture Paper- III	
Actual contacts	10	2	--	3	3	4	
Credits	3	2	--	1	1	-	

ENVIRONMENTAL SCIENCE-III
MARINE ENGINEERING & CONTROL SYSTEMS-III **Contact Hours 120**

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc in Nautical Science	Six Semesters	V	Environment Science – III Marine Engineering & Control System- III [USNSc 604]
Course Code	Title	Credits	
USNSc 604	Environment Science – III Marine Engineering & Control System- III	2+2	

For Course per week 1 lecture/period is 60 minutes duration				**For subject** per week 1 lecture/period is 60 minutes duration		
	Theory	Practical	Tutorial	Environment Science – III	Marine Engineering & Control System- III	
Actual contacts	06	02	--	3	3	
Credits	02	02	--	1	1	

Objective:-

This subject exposes the students to Navigation, Shipping Management & Maritime Law

Contents of syllabus for USNSc 601

Navigation- IV

		Theory	Practical
UNIT 1	**SEMESTER – VI** **Note:** With respect to Navigational Aids, Operating Procedures include characteristics, limitations, care and maintenance. ***Satellite navigation****:* general features of Navigational satellite. Orbits of Satellites. Full description of the Global Positioning System, (GPS and DGPS) **Automatic Identification System** (***AIS)***: Operation as per Manual, precautions and limitations, care and maintenance ***Voyage Data Recorder (VDR):*** Operation as per Manual, precautions and limitations, care and maintenance ***Bridge Navigation Watch Alarm System:*** Operation as per Manual, precautions and limitations, care and maintenance ***Ship Security Alert System (SSAS):*** Operation as per Manual, precautions and limitations, care and maintenance **ECDIS:** The working of and ECDIS, Raster and Vector charts, ENC's**,** sensors, advantages and limitations of the equipment. **Dynamic Positioning Systems:** A brief introduction to the principles.	**22 Hours**	**-**
UNIT 2	**Sonar Aids:** ***Echo Sounder:*** Principle and working. Operational controls. Choice of site for echo sounder transducers. Errors causing display of faulty or unreliable soundings. ***Doppler Log:*** Description of the system. Errors and their remedies. ***Berthing aids:*** Brief description of systems using sound propagation and systems using radio waves propagation.	**15 Hours**	
UNIT 3	***Radar:*** Characteristics of a Radar set and its limitations, errors and accuracy, radiation hazards, anomalous propagation, block diagram, safe distance with respect to Radar Spares and magnetic compass, factors (internal and external) that affect Radar detection and interpretation, influence of weather, various types of displays, Radar logbook, use of radar for navigation and collision avoidance, knowledge of ARPA Radar. Racon, Ramark Beacons and SART.	**8 Hours**	

	PRACTICAL ***Echo Sounder:*** To take sounding using both visual and graphic types. (Actual instrument or simulator). ***Radar:*** Practical adjustment of operational controls. To carry out performance check. Use of performance monitor. To take range and bearing of targets. To identify land objects on the Navigation Chart using radar observations. Evaluation of risk of collision using relative & true plotting techniques and ARPA Radar. **ECDIS:** familiarity with controls, basics of planning a route and monitoring it. **GPS, AIS, BNWAS, SSAS, VDR***:* Familiarity with usage		**15 Hours**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 60 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

12.	Ships Magnetism & Magnetic Compass	F.G. Merrifield
13.	Compass Work	Kemp & Young
14.	Radar at Sea	G.I. Sonnenberg
15.	Shipborne Radar	Capt. H. Subramaniam
16.	Radar and ARPA Manual	A.G. Bole & W.O. Dineley
17.	Ships Compass	Klinkert & Grant
18.	Magnetic Compass Deviation & Correction	W. Denne
19.	Gyro Compass for Ships Officers	A. Frost
20.	Radar Observer's Handbook	W.Burger
21.	Marine Electronic Navigation	S.F. Appleyard
22.	Electronic Aids to Navigation; Position Fixing	L. Tetley & D. Calcutt

SHIPPING MANAGEMENT

		Theory	Practical
UNIT 1	**SEMESTER - VI** Organisational structure, co-ordination, and design: organisational structure; types of organizational structures; co-ordination; organisational design. Authority, delegation, and decentralisation: Authority, power, and influence; line and staff authority; delegation; job design; decentralisation.	**15 Hours**	-
UNIT 2	Human resource management: the HRM process – a traditional view; human resource planning; recruitment; selection, orientation or socialisation, training and development; performance appraisal; promotions, transfer, demotions, and separations; HRM and strategy. Managing organisational change and innovation. Why planned change is needed? A model of the change process; type of planned change; organisational development; managing creativity and innovation. Motivation, performance and job satisfaction. Theories of motivation – an overview; content theories of motivation; process theories of motivation; reinforcement theory, a system view of motivation in organisations. Leadership: Defining leadership; the trait approach of leadership; the behavioural approach to leadership; contingency approaches to leadership; the future of leadership theory. Groups and committees: types of groups; characteristics of groups; problem solving in groups; making formal group effective. Communication and negotiation: the importance of communication; interpersonal communication; barriers to effective interpersonal communication; communication in organisations, using communication skills – negotiating to manage conflicts. Effective control: the meaning of control; types of control methods; designing control systems; financial controls; budgetary control methods. operational management: the nature of operations; the importance of operational management; designing operations systems; operational planning and control decisions; quality control. information systems: information and control; management information systems; designing a computer – based MIS; implementing a computer – based MIS; end-user computing; the impact of computers and MIS on managers and organisations.	**25 Hours**	

UNIT 3	**SECTION-B** Role of Customs: Customs Act and documents relating to customs relating to ship operators and trade. Indian Shipping Development: India's Merchant Fleet – Role of Government – Maritime Administration in India – India's Shipping Policy. Maritime Frauds: Safeguards to be taken to prevent frauds with special reference to shipping industry, operators and seafaring personnel. Role of International Organisation: IMF, World Bank, IMO, UNCTAD, WTO.	**20 Hours**	

***There will be continuous assessment of skills being acquired through class work, periodic assignments / project works / tests.**

NOTE : A candidate has to secure minimum percentage /grade : 40 % / E as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

19.	Management	Stoner & Freeman
20.	Basic Marine Management	Dr. A.V. Athalye
21.	The Practice of Management	Drucker P.
22.	People in Organisation, an introduction to organisation behaviour	Mitchell, Terence P.
23.	Consumer Behaviour. Basic Findings & Manegerial implegations	Zaltman G. & Wallendrof A.
24.	Mathematics of Investment	Hart W.L.
25.	Theory and Practice of Management Information System	Burch, Strater & Grudneski
26.	A Concept of Corporate planning	Russel L. & Ackoff
27.	IACOCCA: An autobiography	Lee lacocca
28.	An introduction to Financial Management	Solomon & Pringle
29.	Manpower Management	Dwivedi R.S.
30.	Industrial Relations in India's Developing Economy	N.N. Chaterjee
31.	An introduction Database System	Dale C.J.
32.	Monetary Planning for India	Gupta Suraj B.
33.	Economics of Shipping & other papers	Dr. S.N. Sanklecha
34.	International Maritime Fraud	Ellen & Campbell
35.	Elements of Shipping	Alan Branch
36.	Containerisation era in India	Dr. K.V. Hariharan

MARITIME LAW

		Theory	Practical
UNIT 1	**SEMESTER – VI** Indian Merchant Shipping Act, 1958 in general with special reference to; a) Definitions. Section 3. b) Registration of Indian Ships Sections 20 to 74. c) Seamen and Apprentices. Sections 88 to 218. d) Limitation and Liability. Sections 352 to 352 F. e) Investigation and Inquiries. Sections 357 to 389.	**30 Hours**	-
UNIT 2	Contract of affreightment: a) General aspects of Carriage of Goods by Sea Act, 1925. b) The Indian Multimodal Transport of Goods Act, 1993. c) Hague Visby Rules; Hamburg Rules. d) Charter Party – Various Clauses and their Interpretations.	**15 Hours**	
UNIT 3	Marine Insurance Act – Insurable interest in a policy, difference between marine insurance policies and other policies, different types of marine insurance policies, perils of sea, claim. Settlement of claims. Legal remedies maritime liens, at common law, general legal remedies as given in specific relief act. Writs injunction Indian Arbitration and Conciliation Act. 1996.	**15 Hours**	

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 40 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Books for references

22.	Merchant Shipping Act, 1958	Govt. of India
23.	The Indian Multimodal Transport of Goods Act,1993	Govt. of India
24.	Carriage of Goods by Sea Act, 1925	Govt. of India
25.	Marine Insurance Act, 1963	Govt. of India
26.	The Arbitration and Conciliation Act, 1996	Govt. of India
27.	S.T.C.W Convention, 1978	I.M.O
28.	The Indian Contract Act, 1879	I.M.O
29.	Relevant Shipping Manual, Conventions & Rules	
30.	Hague/Visby Rules. Hamburg Rules	
31.	Charter Parties	Scrutton

32.	Indian Contract Act	Actar Singh
33.	Maritime Law of India	Gopalan Nair, Editor
34.	Shipping Law	Charley & Giles
35.	Legal Regime of Merchant Shipping	Dr. Nagendra Singh
36.	Limitation of Liability of Shipowners	Khodie Narmada
37.	Maritime Liens	Dr. Thomas
38.	Carriage of Goods by Sea	Mitra
39.	Business & law for the Shipmaster	F.N. Hopkins
40.	Shipping law	Grime R.
41.	Law of Carriage of Goods	Avatar Singh
42.	Law of Arbitration	Avatar Singh

(Note: Reference to the Acts include all amendments made from time to time)

Objectives:-

The subject will develop basics of Principles of Navigation / Practical Navigation and Voyage Planning & Collision Prevention .

Contents of syllabus for USNSC 602

NAVIGATION-III

		Theory	Practical
UNIT 1	**SEMESTER – VI** **SECTION-A PRINCIPLES OF NAVIGATION** 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. Circumpolar bodies; conditions necessary for a body to be circumpolar. Maximum azimuth. Problems on these topics. **SECTION-B PRACTICAL NAVIGATION** 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.	**15 Hours**	-
UNIT 2	**SECTION-A PRINCIPLES OF NAVIGATION** Great circle sailing – Initial & Final courses and distances, Pole, vertex, course on crossing the equator. Figure drawing of a GC track approximately to scale. Composite great circle sailing. **SECTION-B PRACTICAL NAVIGATION** Practical problems on composite circle.	**22 Hours**	
UNIT 3	**SECTION-A PRINCIPLES OF NAVIGATION** Relationship between tides & phases of the moon – spring and neap tides; priming & lagging. calculations based on 1st & 2nd year's portion of Principles of Navigation, together with (1) to (7) above. **SECTION-B PRACTICAL NAVIGATION** Calculations based on I,II,III,IV& Vth Semester portion of practical navigation . **PRACTICALS** **METEOROLOGICAL INSTRUMENTS:** To take observations and apply corrections to obtain accurate barometric pressure using both Mercurial & Aneroid Barometers. To take readings on Barograph and measure pressure tendency. To obtain Relative Humidity using dry & wet bulb thermometer. The use of Psychrometer. Use of anemometer and wind wane.	**8 Hours**	**15 Hours**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 70 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

7.	Principles of Navigation	Capt. P.M. Sarma
8.	Practical Navigation	Capt. H. Subramaniam
9.	Principles of Navigation	Capt. T.K. Joseph & Capt. S.S.S.Rewari
10.	Principles and Practice of Navigation	A. Frost
11.	Admiralty Manual of Navigation volume I & II	HMSO
12.	Nicholls Concise Guide Vol. I & II	Brown & Ferguson

VOYAGE PLANNING & COLLISION PREVENTION-III

		Theory	Practical
UNIT 1	**SEMESTER – VI** **VOYAGE PLANNING** A systematic knowledge and use of the contents of the following documents in relation to Ocean Passages of the world Notices to Mariners M & MS Notices Guide to Port Entry	**15 Hours**	**05 Hours**
UNIT 2	**VOYAGE PLANNING** Selection of ocean routes. Shore-based Weather Routeing. Planning & executing a coastal passage. Navigation in pilotage waters. Approaching and passing through a Traffic Separation Scheme.	**15 Hours**	**05 Hours**
UNIT 3	**COLLISION PREVENTION** Radar plotting exercises. True Plot Relative plot Determining bow pass distance Revision of radar plotting syllabus done in second year Deciding action for collision avoidance taking into consideration the 'Rules of the Road'. **PRACTICALS** **VOYAGE PLANNING** 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, navigations aids available, etc. **COLLISION PREVENTION** Recognition of various buoys & marks under IALA system and appropriate actions required under the Rules. Collision situations in restricted visibility with or without Radar Statutory obligations under both circumstances.	**15 Hours**	**05 Hours** **15 Hours**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 70 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

10.	Chart work	Capt. S.K.Puri
11.	Rule of the road	Bhandarkar publications
12.	BA Chart 5011	HMSO
13.	Shipborne Radar, Chapters on plotting	Capt. H.Subramanian
14.	Voyage Planning & Chartwork	Capt. M.V. Naik & Capt. Varty
15.	International Light, Shape & Sound signals	Moore D.A
16.	A Guide to Collision Avoidance	A.N. Cockroft
17.	Chartwork	Capt. S.S. Chaudhari
18.	Modern Chartwork	Capt. W.H. Squair

Objective:-
This subject exposes the students to Ship Operation Technology Paper-III , Ship Operation Technology Paper-IV & Naval Architecture

Contents of syllabus for USNSC 603

Ship Operation Technology Paper- III

		Theory	Practical
UNIT 1	**SEMESTER – VI** **Section –B** Principles involving the carriage of oil. Procedure at follow at tanker terminals. Detail study of tanker terminal codes for handling of petroleum products, bulk liquids chemicals and liquefied gases. Avoidance of accidental pollution's and precautions to be taken. Knowledge of contents of International safety guide for oil tankers and terminals. study of Tankers with respect to: Types of pumps, valves, pipeline systems, Ullageing, interface, cargo calculation. Operation of loading, discharging, ballasting, deballasting, inerting, tank washing including COW, gas freeing. Flammability diagram. Instructions for use of oxygen and hydrocarbon analysers. Man entry procedures. Rescue teams. Control of oil spill. Carriage of timber and timber code. **Ro – Ro Vehicles** Preparation of car decks for loading, procedures for opening, closing and securing of bow, stern and side doors and ramps and its water tight integrity. **Offshore Supply Vessels** Type and features of OSV, use and purpose of OSV.	**18 Hours**	-
UNIT 2	**Section –B** Study of bulk carriers with respect to: Loading, discharging, ballasting, de-ballasting operations. Precautions to be taken for high density cargoes, grain and concentrates. Calculations relating to above topics. Inspection report; Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action. Common damage/defects in WT transverse bulkheads at end of dry cargo holds of bulk carrier. Cracks found at connection of stool of transverse bulkhead and tanktops in bulk carrier. Ability to interpret given figures for BM & SF.	**15 Hours**	
UNIT 3	**Section –B** Communication procedures under GMDSS in Distress & Safety situations in accordance with regulations contained in SOLAS, ITU and other publications. **PRACTICALS** 1. Knowledge of operation of radio equipment to be carried and used in a lifeboat & life raft. (EPIRB, SART, etc). 2. Basic commercial working & logbook procedures using the simulator.	**12 Hours**	15 Hours

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 60 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

21.	Cargo Work	Kemp and Young
22.	Seamanship and Cargo Work	Capt. J. Dinger
23.	Cargo work	Capt. L.G. Taylor
24.	Stowage of Cargo	O.O. Thomas
25.	Grain Rules	I.M.O
26.	Code of Safe Practice for Bulk Cargo	I.M.O
27.	International Bulk Chemicals code 1986	I.M.O
28.	I.M.D.G. Code Consolidated edition 1988	I.M.O
29.	Marpol 73/78 Consolidated Edition	I.M.O
30.	Load Line convention 1966	I.M.O
31.	Guidelines for Tank washing with Crude Oil	Institute of Chamber of Shipping
32.	The Chemistry of Oil Tankers Fires and the Inert Gas System	Capt. G.S. Heredia
33.	Tankers Handbook for Officers	Capt. C. Baptist
34.	Tankers Practice	G.A.B. King
35.	Tankers Practice	Rutherford
36.	International Safety Guide for Oil Tankers & Terminals (ISGOTT)	International Chamber of Shipping, OCIMF, IAPH
37.	Amendments to SOLAS Convention Manual for Maritime mobile Communication and Maritime Mobile Satellite Communication	I.T.U
38.	International Volume of Radio Signals	HMSO
39.	International Code of Signals	I.M.O
40.	GMDSS for GOC	Clifford Merchant

Ship Operation Technology Paper- IV

		Theory	Practical
UNIT 1	**SEMESTER - VI** **SECTION B – MAINTENANCE** Damage control. Action to be taken following collision and grounding. Steps to be taken when disabled & in distress. Preservation of passengers and crew in an event of emergency. Abandoning ship – survival procedure. Assisting a ship or aircraft in distress use of IAMSAR manual.	**15 Hours**	-
UNIT 2	Management of ship in heavy weather – use of oil. Elementary ideas on Towing and being towed. Precautions to be observed to prevent pollution in port & on the high sea.	**15 Hours**	
UNIT 3	Treatment of steel surface – Removal of rust and scale – Primers – Modern paints. Dry Docking – general procedures – Precautions to be observed – Distribution of weights. Maintenance of Crew accommodation. Methods of post control. Fumigation of holds and living spaces. Safe guards in applying various methods. **PRACTICALS** **SEAMANSHIP AND WATCHKEEING** To find quantity of liquid in a tank using calibration tables. Handling of boat under Oars. Coming alongside and getting away. Picking up a man overboard. To take rope & chain stoppers. To reeve a 3 fold purchase and gun tackle. Overhauling of blocks. Demonstrate to cadets: taking drafts to transfer rope from mooring winch to bollards and making fast; removing of rust by chipping, preparation of surface, use of proper primers, brush painting; to make a stowage plan and cargo distribution with working out of load densities. The use of Explosimeter to determine the percentage of gas in a tank.	**15 Hours**	**15 Hours**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 60 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

6.	Theory and Practice of Seamanship	G. Danton
7.	Seamanship Notes	Kemp and Young
8.	Seamanship and Cargo work	Capt. J. Dinger
9.	Nicholls's Seamanship and Nautical Knowledge	A.N. Cockcroft
10.	Shipboard Operations	H.I. Laurey

Naval Architecture-III

		Theory	Practical
UNIT 1	**SEMESTER – VI** **SECTION A – SHIP STABILITY** Bilging of compartment. Permeability of a compartment. Calculation on bilging and flooding of a compartment, symmetrical about centre line anywhere along the ships length for a box-shaped vessel given centre MCTC.	**20 Hours**	-
UNIT 2	**SECTION A – SHIP STABILITY** The inclining experiment. Shearing Forces and Bending Moment. The ship as a box girder. The calculation, and graphical representation, of the SF and BM for box-shaped vessel, on even keel, under various conditions of load. Modern methods of determining the effect of different conditions of load and ballast on the ships structure and stability – loadicator. Calculations based on the foregoing and on the syllabi of the first and second years.	**20 Hours**	
UNIT 3	**SECTION B - SHIP CONSTRUCTION** Classification Societies and their functions. Cargo Ship Construction Rules. Outline knowledge of tonnage regulations. Load Line Regulations. Assignment of freeboard. Sub divisional load lines on passenger ships. Structural fire protection on Passenger and Cargo ships. Knowledge of application of floodable length curves. Factor of subdivision. Criterion of service numeral. Permissible length affecting hull division on passenger ships.	**20 Hours**	

***There will be continuous assessment of skills being acquired through class work, periodic assignments / project works / tests/ orals etc.**

NOTE : A candidate has to secure minimum percentage /grade : 60 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

10.	Merchant Ship Construction	T.A. Taylor (1985 edition)
11.	Ship Construction	D.J. Eyres (1988 edition)
12.	Ship Construction	Kemp & Young
13.	i) Load Line, ii) Tonnage, iii)Cargo Ship Construction, iv) Passengers Ship Construction (Selected parts referring to Sub-division & Fire Protection)	Statutory Regulations
14.	Ship Stability (volumes I, II & III)	Capt. H. Subramaniam
15.	Problems on M.V. Hindship	Capt. Joseph & Capt. Rewari
16.	Notes of Stability	Kemp & Young
17.	Ship Stability for Masters and Mates	D.R. Derret
18.	Reed's Ship Construction for Marine Students	E.A. Stokoe

Objective:-

This subject exposes the students to Environment Science – III, Marine Engineering & Control System- III

Contents of syllabus for USNSC 604

ENVIRONMENTAL SCIENCE-III

		Theory	**Practical**
UNIT 1	**SEMESTER – VI** Meteorological & Reporting Systems: Voluntary observing fleet under I.M.D; type & nature of information collected: Ship's Weather Code; weather reporting from ships and its significance in weather forecasting. International system of weather reporting.	**18 Hours**	-
UNIT 2	Voyage Planning & Weather Routing of ships: Basic considerations in Voyage Planning selection and use of data. Weather Routing; Basic parameters; least time tract and ship's performance curves.	**14 Hours**	
UNIT 3	International convention on prevention of pollution by Marine Environment 1973 / 78, garbage and sewage. Pollution by micro-organisms in ballast water; measures for prevention.Atmospheric pollution by marine transportation. Amendments against marine pollution.Liability against marine pollution. **PRACTICALS** 3. Facsimile weather charts – interpretation of information contained therein. 4. Exercises on the selection ocean rules on the basis of prognostic surface weather charts.	**13 Hours**	**15 Hours**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 50 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

Reference Books:-

Sr. No.	TITLE	AUTHOR	PUBLISHER
1.	Weather analysis & forecasting vol. I	S. Petterson	M/c Graw Hill
2.	Weather analysis & forecasting vol. II	S. Peterson	M/c Graw Hill
3.	Tropical Meteorology	H. Reehi	M/c Graw Hill
4.	Principles of meteorological analysis	W.J. Saucier	University ofChicago Press
5.	Marine Meteorology	Capt. H. Subramanian	Vijaya Publications
6.	Meteorology for Mariners	HMSO	HMSO
7.	Marine Observer's Hand book	HMSO	HMSO
8.	Atmosphere, weather & climate	R.g. Barry, R.J. Chorley	Metheun, London
9.	Ship's code	I.M.D. 1982	
10.	Dynamic and physical meteorology	Haltiner & Martin	M/c Graw Hill
11.	General Meteorology	H.R. Byers	M/c Graw Hill
12.	Numerical Weather Analysis & predication	P.D. Thompson	Mc. Millan Co.
13.	Atlantic Hurricanes	Gord E Dunn	Louisiana state University
14.	An introduction to Dynamic Meteorology	J.R. Holten	M/c Graw Hill
15.	Atmosphere science an Introduction survey	P.E. Hobbs	M/c Graw Hill
16.	Forecasting Manuals	J.M. Wallace & I.M.D.	
17.	Numerical Predication	Haltiner J.H. & Williams R.T	John Wiley & Sons New York
18.	Marpol 73/78 with all amendments	I.M.O	I.M.O
19.	Regulations for the prevention of Pollution by oil	I.M.O	I.M.O
20.	Regulations for control of pollution by Noxious substances in bulk	I.M.O	I.M.O
21.	Shipboard oil pollution emergency plan	I.M.O	I.M.O

Marine Engineering & Control System- III

		Theory	Practical
UNIT 1	**SEMESTER – VI** **SECTION-A** a) Fuels: Different types and properties. Fuel storage & supply on board the ship. Treatment of fuel b) Propellers & main shafting: types of propellers, fixed pitched & variable pitch propellers. Pitch, pitch angle, real and apparent slips, propeller efficiency, calculations. Shafting tailend shaft, thrust block, intermediate shaft, alignment. c) Deck Machinery: Cargo winch, windlass, lifeboat winch. hydraulic, Pneumatic electric drives. Safety features.	**18 Hours**	-
UNIT 2	**SECTION-B** Main propulsion units (IC engine and others) a) Process of exhausting, scavenging and supercharging. Scavenge fires. b) Lubricating oil, jacket (and other) cooling water systems. Types of lubricating oils for different duties. Simple C.W., L.O and F.O. flow circuits for large diesel engine. Reasons and methods of chemical treatment of C.W. system. Testing of jacket cooling water. c) Operations of IC engine as main propulsion engine. Warming up, starting manoeuvring, reversing and full power running of the main engine. Limitations and care required on IC engine during manoeuvring and at full power. d) Selection criterion of IC engines, power weight ratio, specific fuel consumption, indicated power, brake power, shaft power, delivered power, thrust power, effective power. Various efficiencies, calculations. Maximum continuous rating (MCR). Calculation of fuel consumption, economic speed. Heat balance, various losses and calculations .	**14 Hours**	
UNIT 3	**SECTION-C** "Other propulsion units a) ' Steam turbine Impulse and reaction turbine, gas turbines, steam turbine operations & care. Turbines as prime movers for various duties including cargo pumping operations on tankers. Steam turbine, gas turbine as main propulsion units. Advantages and disadvantages. Manoeuvring operations. b) Pollution control: sewage disposal, methods, limits, regulations. Bilge oil water separator construction, operation & regulations. Control of pollution from machinery exhausts Regulations and remedies. Incinerator construction and operations, regulations. **PRACTICALS** 1.Familiarity with parts of internal combustion engine – medium and large size. 2. Familiarity with parts of pumps, compressor heat exchangers, valves and valves fittings. 3. Assembly of certain engine components.	**13 Hours**	**15 Hours**

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

***Journal to be submitted at the end of each term for assessment**

NOTE : A candidate has to secure minimum percentage /grade : 50 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

Sr. No.	TITLE	AUTHOR	PUBLISHER
1.	Basic Marine Engineering	J.K. Dhar	G. Maritime Publications
2.	General Engineering knowledge for Marine Engineers	L.Jackson & T. Morton	Thomas Reed Publications Ltd
3.	Reeds Engineering knowledge for Deck officers	W. Embleton and T. Morton	Thomas Reed Publications Ltd
4.	Basic Electro Technology for Engineers		Thomas Reed Publications Ltd
5.	Marine Engineering series – Marine Professional Boilers	GTH Flanogan	Heinemann publications limited
6.	Marine Engineering series – Diesel Professional Engines	Wharton A.S	Heinemann Publications Ltd
1.	Marine Auxiliary Machinery	D.W. Smith	Thomas Reed Publications Ltd
2.	Marine Electrical Practice	G.O. Watson	Thomas Reed Publications Ltd
3.	Instrumentation & control for engineers		Thomas Reed Publications Ltd
4.	Fire fighting equipment and its uses on ship Marine engineering volume – I		Thomas Reed Publications Ltd
5.	Principles and practice of marine Diesel engines	D.K. Sanyal	Thomas Reed Publications Ltd

Scheme of Examination (Theory)

(a) Internal assessment- 25 marks

Sr. No.	Evaluation type	Marks
1	One class test (multiple choice questions objective)	20
2	Active participation in routine class instructional deliveries. Overall conduct as a responsible student, manners, skill, in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05
	Total	**25**

b) Semester End Theory Examination – 75%

1) **Duration – these examinations shall be of 2.5 hours duration.**
2) **Theory question paper pattern –**
   i. **There shall be five questions each of 15 marks (30 marks with internal option)**
   ii. **On each unit there will be one question fourth & fifth question will be based on entire syllabus.**
   iii. **All questions shall be compulsory with internal choice within the questions.**
   iv. **Questions may be sub divided into sub questions as a, b, c, d & e etc & the allocation of marks depends on the weightage of the topic.**

(b) Semester end examination (Pattern of Question Paper):- Exam time : 2.5 hrs

Theory

Semester end exam (Duration 2.5 hrs.)		
Questions in Examination Paper	**Units**	**Maximum Marks**
Q - 1	1	15
Q - 2	2	15
Q - 3	3	15
Q - 4	1,2,3	15
Q - 5	1, 2,3	15
	Total	**75**

NOTE : A candidate has to secure minimum percentage /grade as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India .

Conduct of Practical Examination 50 MARKS