

AC 19/3/2012

Item No. 4.84

UNIVERSITY OF MUMBAI



**Syllabus for the S.Y.B.Sc.
Program: B.Sc.
Course : Nautical Science**

(Credit Based Semester and Grading
System with effect from the academic year
2012-2013)

B.Sc. Nautical Science Semester -III

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

Theory / Practical :

Course Code	Title of the Course	Per Week		Per Semester		Credits		TOTAL
		L	P	L	P	L	P	
USNSC301	COMPUTER SCIENCE	3	1	45	15	4	2	6
	APPLIED MATHAMETICS-III	7		105				
	NAUTICAL PHYSICS & ELECTRONICS-III	5	2	75	26			
USNSC302	NAVIGATION -II	3	1	45	15	3	2	5
	VOYAGE PLANNING & COLLISION PREVENTION - II	2	2	30	30			
USNSC303	SHIP OPERATION TECHNOLOGY-II	3	1	45	15	3	2	5
	BRIDGE PROCEDURES & LEGAL KNOWLEDGE	3	1	45	15			
	NAVAL ARCHITECTURE-II	4		60				
USNSC304	ENVIRONMENTAL SCIENCE-II	3	1	45	15	2	2	4
	MARINE ENGINEERING & CONTROL SYSTEMS-II	3	1	45	15			
		36	10	540	146	12	8	20

Semester -IV

Theory / Practical :

Course Code	Title of the Course	Per Week		Per Semester		Credits		TOTAL
		L	P	L	P	L	P	
USNSC401	COMPUTER SCIENCE	3	1	45	15	4	2	6
	APPLIED MATHAMETICS-IV	7		105				
	NAUTICAL PHYSICS & ELECTRONICS-IV	5	2	75	26			
USNSC402	NAVIGATION -II	3	1	45	15	3	2	5
	VOYAGE PLANNING & COLLISION PREVENTION - II	2	2	30	30			
USNSC403	SHIP OPERATION TECHNOLOGY-II	3	1	45	15	3	2	5
	BRIDGE PROCEDURES & LEGAL KNOWLEDGE	3	1	45	15			
	NAVAL ARCHITECTURE-II	4		60				
USNSC404	ENVIRONMENTAL SCIENCE-II	3	1	45	15	2	2	4

MARINE ENGINEERING & CONTROL SYSTEMS-II	3	1	45	15				
	36	10	540	146	12	8	20	

COMPUTER SCIENCE /PHYSICS /MATHS

Contact Hours 225

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc. in Nautical Science	Six Semesters	III	Computer / Physics/Maths [USNSC 301]
Course Code	Title	Credits	
USNSC 301	Computer/Physics/Maths	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	Computer	Maths	physics	
Actual contacts	15	3	--	3	7	5	
Credits	4	2	--	1		2	

NAVIGATION -II

VOYAGE PLANNING & COLLISION PREVENTION - II

Contact Hours 75

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc. in Nautical Science	Six Semesters	III	Navigation-II Voyage Planning & Collision Prevention -II [USNSC 302]
Course Code	Title	Credits	
USNSC 302	Navigation-II Voyage Planning & Collision Prevention- II	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-II	Voyage Planning & Collision Prevention-II
Actual contacts	5	3	--	3	2
Credits	3	2	--	1	2

**SHIP OPERATION TECHNOLOGY PAPER- II
BRIDGE PROCEDURES & LEGAL KNOWLEDGE
NAVAL ARCHITECTURE-II**

Contact Hours 150

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc. in Nautical Science	Six Semesters	III	Ship Operation Technology Paper- I Bridge procedures & legal knowledge Naval Architecture [USNSC 303]
Course Code	Title	Credits	
USNSC 303	Ship Operation Technology Paper- I Bridge procedures & legal knowledge Naval Architecture	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	SOT Paper- II	Bridge procedures & legal knowledge	Naval Architecture Paper- II	
Actual contacts	10	2	--	3	3	4	
Credits	3	2	--	1	1	-	

**ENVIRONMENTAL SCIENCE-II
MARINE ENGINEERING & CONTROL SYSTEMS-II**

Contact Hours 90

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc. in Nautical Science	Six Semesters	III	Environment Science – II Marine Engineering & Control System- II [USNSC 304]
Course Code	Title	Credits	
USNSC 304	Environment Science – II Marine Engineering & Control System- II	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 – II	Marine Engineering & Control System- II	

Actual contacts	06	02	--	3	3	
Credits	02	02	--	1	1	

Objective:-

This subject exposes the students to Computer Science, Applied Mathematics & Nautical Physics

Contents of syllabus for USNSC 301

Computer Science

		Theory	Practical
UNIT I	SEMESTER - III Historical development of computers: an evolution. Classification of Computers on different norms such as generations, technology, etc. Different functional parts of a computer and their functions. Computer peripherals: Monitor, Printer, Key board, Floppy disk drive, Floppy, Hard disk, Mouse.	15 Hours	-
UNIT II	Computer arithmetic: Binary, Octal, Decimal & Hexadecimal number systems and mutual conversion: Addition, 1's & 2's complementation in binary only. Units of memory measurement: Bits, Bytes, KB, MB, GB, TB. Units of run-time measurement: sec, ms, μ s, ns, ps, fs, as. Different computer environments: Batch processing, Time sharing, Interactive & Network, their functional details and differences. Computer connectivity: LAN, MAN, WAN, Internet. Internet activity in India and various facilities available on internet, Satellite based Communication	22 Hours	
UNIT III	C Language: Computer languages, their classification and compilation. C- character set. Data Types. Constants and variables. Operators: Arithmetic, Increment & Decrement, Modulo division, Relational, Logical, Conditional and Comma PRACTICAL Programs are to be written, tested and filed for certification by teacher/head of Institution: [1] Finding n! [2] Finding GCD of two numbers [3] Solution of a quadratic equation	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 : 40 % / E as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India .

Reference Books:-

1. Turbo C reference manual
2. Programming in C: Kris A. Jamsa : Galgotia Publications Pvt. Ltd.
3. Mastering turbo C: Kelly/Bootle : EPB
4. Turbo C programming techniques : Stevens A. : BPB
5. Computer Virus – prevention, detection & removal : Kapur R : BPB
6. Introduction to computer science vol. I & II : Jain S. : BPB
7. Introducing computers I, II & III : Mehta S. : BPB

APPLIED MATHS-III

		Theory	Practical
UNIT I	<p style="text-align: center;">SEMESTER - III</p> <p>Bessel Functions and Legendre Polynomials & Partial Differential Equations:</p> <p>Relations between Laplace equation and Bessel's differential equation, Its solution by series methods, Bessel functions of first and second kind, Recurrence relations for J (x), Generating function of J(x), Orthogonality of J(x), Bessel-Fourier series of a function, Relation between Laplace equation and Legendre differential equation, Its solution by series methods, Recurrence relations for Pn(x), Rodriguez's formula for P(x), Generating function of P(x), Orthogonality of Pn(x), Legendre-Fourier series for a function.</p> <p>Partial differential equation governing Transverse Vibrations of an elastic string, its solution using Fourier Series, Vibrations of a rectangular and circular membrane. Heat equation, steady – state configuration for heat flow and Laplace equation in two and three dimensions, Variable heat flow in one dimension.</p>	30 Hours	-
UNIT II	<p>Laplace Transforms:</p> <p>Function of bounded variation (Statement only), Laplace transforms of 1, t^n, e^{at}, $\sin(at)$, $\cos(at)$, $\sinh(at)$, $\cosh(at)$, $\operatorname{erf}(t)$, Shifting properties. Expressions (with Proofs) for :</p> <p>(i) $L\{t^n f(t)\}$ ii) $\frac{L\{f(t)\}}{t}$ iii) $L\left\{\int_0^t f(u)du\right\}$</p> <p>IV) $\frac{L\{d^n f(t)\}}{dt^n}$</p> <p>Unit step functions, Heaviside, Dirac functions and their Laplace transform. Laplace transform of periodic functions.</p> <p>Evaluation of inverse Laplace Transforms, partial fraction methods, Heaviside development convolution theorem.</p> <p>Application to solve initial and boundary value problems involving ordinary differential equations with one dependent variable.</p>	25 Hours	

UNIT III	<p>Complex Variable:</p> <p>Functions of complex variable. Continuity (only statement) derivability of a function analytic. Regular function. Necessary conditions for $f(z)$ to be analytic. (Statement of sufficient conditions). Cauchy Riemann equation in polar co-ordinates. Harmonic functions, Orthogonal trajectories. Analytical and Milne – Thomson method to find $f(z)$ from its real or imaginary parts. Integration of complex functions, Cauchy’s integral theorem for simply connected regions, Cauchy’s integral formula, Taylor’s and Laurent’s expansion, Zeros, Singularities, poles, residue at isolated singularity and its evaluation. Residue theorem, its application to evaluate real integrals.</p>	50 Hours	
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Reference Books:-

- | | |
|----------------------------|---|
| 1. Wartikar, P. N. & J. N. | A text books for applied mathematics (Vol. 2) |
| 2. Sastry S. S. | Engineering mathematics (Vol.2) |
| 3. Santi Narayan | Theory of Function of a complex variable |
| 4. Wilfred Kaplan | Advanced Calculus |
| 5. Schaum’s outline series | Laplace Transforms |
| 6. Dr. Grewal B. S. | Higher Engineering Mathematics |

NAUTICAL PHYSICS-III

		Theory	Practical
UNIT I	<p style="text-align: center;">SEMESTER - III</p> <p>Review of a. c. circuits:</p> <p>Self inductance, inductive reactance, purely inductive circuit, a. c. through resistance and inductance, choke, numerical problems. Capacitance, capacitive reactance, purely capacitive circuit, a. c. through capacitance. and resistance, numerical problems. Impedance, admittance, a. c. through L-C-R circuit, series and parallel resonant circuits, power and power factor in a. c. circuits, numerical problems.</p> <p>Modulation concepts:</p> <p>Amplitude modulation, modulation index, power distribution in A. M. wave, linear modulation, square law modulation; diode modulator, transistor modulator, balance modulator, single side band generation, suppression of carrier. Frequency and phase modulation, F. M. wave, modulation index, side band in F. M. reactance modulator, comparison of A.M., F.M. and P.M., phase Lock Loop and its advantages.</p> <p>Demodulation Techniques:</p> <p>Demodulation of A.M. waves, diode detector, transistor modulator, detection efficiency, amplitude distortion. Demodulation of FM waves, frequency demodulator, slope detector, balanced slop detector, ratio detector, frequency distortion.</p>	20 Hours	-
UNIT II	<p>Transmission systems:</p> <p>Classification of amplifiers – A, B and C, AF, RF and power amplifier, AM transmitter, SSB (single side band) transmitter, sideband filters.</p> <p>Digital Communications:</p> <p>Types of pulse modulation, generation and demodulation of Pulse Amplitude Modulation (PAM) waves, distortion in PAM, Pulse Duration (width) Modulation (PWD of PDM), Pulse Position Modulation (PPM), generation and demodulation of PPM, Pulse Code Modulation (PC M), generations and demodulation of PCM, direct FM transmitter, Armstrong FM system, mobile communication systems.</p> <p>Wave propagation:</p>	35 Hours	

	Basic electromagnetic spectrum, mechanism of wave propagation, field strength, propagation through troposphere, propagation models, radio horizon, troposphere monitoring techniques, sky – wave propagation, ionosphere, microwave links and other communication links, noise in communication systems.		
UNIT III	<p>Radio receivers: Straight and regenerative receivers, tuned RF receivers, super heterodyne receivers, AM receivers, communication receivers, stereo FM multiplexed reception, single side band receiver, noise consideration, FM receiver performances.</p> <p>Antennas: Resonant antenna, antenna gain, radiation resistance, impedance matching, feeders, resonant line feed, grounded antennas, higher frequency antennas, dipole arrays, Yagi – Uda antenna, Rhombic antenna, microwave antenna, active antenna, horn antenna, dielectric antenna.</p> <p>Transmission lines: Motion of electrical wave along a lone line, characteristic impedance, infinite line, reflection of a wave on a line, resonant and non resonant lines, standing wave ratio (SWR), input impedance of a transmission line for use at VHF.</p> <p>Radar Communication: Elements of radar system, radar range, limitations of radar, radar altimeters and beacons, interrogating radars, Instrument Landing System (ILS), Visual VHF Omni Range (VOR), Tactical Air Navigation (TACAN), Radio Direction Finding (RDF).</p> <p>Satellite Communication: Satellite links, eclipses, orbits and inclination, satellite construction, communication frequencies, domestic satellites, telemetry.</p> <p style="text-align: center;">EXPERIMENTS</p> <ol style="list-style-type: none"> 1. Use of a C.R.O. – measurement of voltage, frequency, time & phase shift. 2. Low pass, High pass filters (R-C) 3. Band pass & Band stop filters (R-C) 4. Series & Parallel resonance (R-C-L) – Q factor 5. Class A Power Amplifier 6. Amplitude Modulation 7. Frequency Modulation 8. Pulse Code Modulation – Generator & Demodulator 9. Study of PLL 10. Diode as a peak detector for A.M. & F.M. <p>NOTE: A minimum of 8 experiments are expected to be performed</p>	20 Hours	26 Hours

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

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.

BOOKS RECOMMENDED FOR REFERENCE:-

1. Communication Electronics – N. D. Deshpande, D. A. Deshpande, P. K. Rangole
2. Operational Amplifiers & Linear Integrated Circuits – Coughlin & Driscoll.
3. Electronic Devices & Circuit Theory – Bolystead & Nashelesky.
4. Electronics – A Text Lab Manual – Zbar.

Objectives:-

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

Contents of syllabus for USNSC 302

NAVIGATION-II

		Theory	Practical
UNIT I	<p style="text-align: center;">SEMESTER - III</p> <p>The celestial sphere, celestial poles equinoctial, declination, celestial meridians, vertical circles, prime vertical, Ecliptic, First point of Aries, RA, SHA, GHA, LHA. v and 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.</p>	15 Hours	-
UNIT II	<p>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 dist. Total correction tables. Artificial horizon & correction of altitudes there from; back angle altitudes.</p>	22 Hours	
UNIT III	<p>True and apparent motion of bodies. Solar time, Solar day; apparent sun, mean sun, and dynamical mean sun; equation of time. Time and hour angle, Hour circles, Greenwich time, local time, zone time & standard time. Keeping time at sea, advancing & retarding of clocks with change of longitude; 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.</p> <p>PRACTICAL NAVIGATION</p> <ol style="list-style-type: none"> 1. 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). 2. To find the compass error and deviation from amplitude of Sun and Moon. 3. To find the latitude by meridian altitude of a heavenly body. To calculate meridian passage time and approx meridian altitude for setting on the sextant (computed altitude). <p>Latitude and position line by observation of Polaris.</p>	8 Hours	15 Hours

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

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

Reference Books:-

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|---|-------------------------------|
| 1. Principal of Navigation:- | Capt. P. M. Sarma |
| 2. Principal of Navigation | Capt. Joseph and Capt. Rewari |
| 3. Practical Navigation | Capt. H. Subramaniam |
| 4. Admiralty Manual of Navigation Vol. I & II | |
| 5. Navigation | Frost A. |
| 6. Nicholl's Concise Guide Vol. I & II | |
| 7. Nutshell Booklet on Sextant | Capt. H. Subramaniam |

VOYAGE PLANNING & COLLISION PREVENTION-II

		Theory	Practical
UNIT I	<p style="text-align: center;">SEMESTER - III</p> <p>Elementary Knowledge of Passage Planning and its execution. Landfall in thick and clear weather. The selection of a suitable anchorage.</p> <p>COLLISION PREVENTION</p> <p>More detailed knowledge of 'International Regulations for Preventing Collision at Sea' than that at the year level.</p>	10 Hours	05 Hours
UNIT II	<p>Development of electronic Chart display system.</p> <p>COLLISION PREVENTION</p> <p>The IALA system of Buoyage – lateral and cardinal systems.</p>	10 Hours	05 Hours
UNIT III	<p>To find the time and height of high and low water at Standard Ports. The use of Admiralty Tide tables and tidal curves to find the time at which the tide reaches a specified height or heights of the tide at a given and thence the correction to be applied to soundings or charted heights of shore objects.</p> <p style="text-align: center;">COLLISION PREVENTION</p> <p>PRACTICALS</p> <ol style="list-style-type: none"> To determine ship's position by the 'running Fix' method with and without current. To find the ship's position by 'Doubling the angle on the Bow' method. The use of a station pointer to plot ships position – given two horizontal angles. Collision situations in restricted visibility with or without Radar. Statutory obligations under both circumstances. <p>Recognition of various buoys and marks under IALA system and appropriate actions required under the rules.</p>	10 Hours	15 HOURS

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

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

Reference Books:-

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|-------------------------------------|--|
| 1. Bhandarkar publications | Rule of the road |
| 2. Moore | International light, shape & sound signals |
| 3. Cockroft | Guide to collision avoidance |
| 4. I.A.L.A. | Maritime buoyage system. |
| 5. Capt. S. K. Puri | Chartwork |
| 6. Square | Modern Chartwork |
| 7. Fifield | Navigation for Watchkeepers |
| 8. Capt. H. Subramaniam | Shipborne Radar |
| 9. Capt. M. V. Naik & Capt. Varty | Voyage Planning & Chatwork |
| 10. Nicholls Concise Guide Volume I | |
| 11. Moore, D. A. | Marine Chartwork |
| 12. Capt. S. K. Puri | Manual of the Rule of the Road. |

Objective:-

This subject exposes the students to Ship Operation Technology Paper-II, Bridge Procedure & Legal Knowledge & Naval Architecture

Contents of syllabus for USNSC 303

SHIP OPERATION TECHNOLOGY PAPER- II

		Theory	Practical
UNIT I	SEMESTER – IV Section - A Factory act. Requirements for annealing and periodical testing of cargo gear, chain register, other requirements of the Factory Act. Section –B ANCHOR WORK: Different types of anchors. Cables and their care. Anchoring procedure. Duties on anchor watch. Use of second anchor. Foul anchor or hawse. Hanging off an anchor, breaking and slipping cables. Mooring – Standing Moor, Running Moor.	15 Hours	-
UNIT II	Section – A Safety of personnel in handling any type of goods using EMS, MFAG, and code of safety practices for merchant seaman, General outline 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. Section –B SURVIVAL AT SEA: Boat drills and musters. Action prior to, and after abandoning ship. Managing the craft and personnel in the craft. Handling of the craft. Landing signals. An outline knowledge of SOLAS requirements of LIFE SAVING APPLIANCES.	18 Hours	

UNIT III	<p>Section – A</p> <p>Infrastructure built in ports for loading and discharging, such as cranes, gantries, conveyor belt system etc.</p> <p>Calculations relating to above topics where applicable.</p> <p>Section -B</p> <p>FIRE PREVENTION AND FIRE FIGHTING: Causes of fire. The fire triangle. Principles of fire fighting. Types of fire and methods of extinguishing each type. Various methods of detection and fighting of fire. Causes of fires in tankers during various operations carried out by tankers and its prevention methods. Outline knowledge of SOLAS requirements on FFA.</p> <p>PRACTICALS</p> <ol style="list-style-type: none"> 4. Coiling of ropes – Opening a new coil of rope. Cutting wire ropes. 5. Rigging a pilot ladder – Precautions for safety of men boarding by such ladders. 6. To renew manropes on boat davit span. 	12 Hours	15 Hours
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*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 % / A as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

- | | |
|--------------------------|-----------------------------------|
| 1. Kemp & Young | Cargo Work |
| 2. O. O. Thomas | Stowage of Cargo |
| 3. Danton | Theory and Practice of Seamanship |
| 4. Kemp & Young | Seamanship Notes |
| 5. Nicholls | Seamanship and Nautical Knowledge |
| 6. Capt. J. M. N. Dinger | Seamanship and Cargo Work |
| 7. Capt. S. K. Puri | Life Boat and Life Raft |
| 8. C. H. Wright | Survival at Sea. |

BRIDGE PROCEDURES AND LEGAL KNOWLEDGE

		Theory	Practical
UNIT I	<p style="text-align: center;">SEMESTER - III</p> <p>BRIDGE EQUIPMENT Guidelines for watch keeping at sea and in port.</p> <p>MARINE COMMUNICATION Introduction and use of Radio Communication Equipment on board ship for distress and safety – Selection of suitable frequencies.</p> <p>LEGAL KNOWLEDGE Merchant Shipping Act 1958 with special reference to General Administration, Procedure and Certificate of Registry, Passenger Ships, Certificates and other documents required to be carried on a ship – How obtained and their validity, Wreck and salvage.</p>	15 Hours	-
UNIT II	<p>BRIDGE EQUIPMENT Basic principles and use of radar.</p> <p>MARINE COMMUNICATION Radio Regulations relating to Maritime Services including maritime frequency allocation.</p> <p>LEGAL KNOWLEDGE Certificate of Officers, Seaman and Apprentices, Engagement, Management and discharge of crew, Manning scales and. Contracts of employment, Wages and other remuneration, advances, allotments, Money orders, Payments into bank accounts. Desertion, deceased seaman, engagement of substitutes, repatriation.</p>	15 Hours	
UNIT III	<p>BRIDGE EQUIPMENT Principle of position fixing by hyperbolic lattice. Use of radio waves to obtain difference of distances by measurement of time difference or phase difference. Elementary knowledge of instruments using the above principle.</p> <p>MARINE COMMUNICATION Satellite Communication and Altering system – Equipment on board and ashore. Methods adopted.</p>	15 Hours	

NAVAL ARCHITECTURE-II

		Theory	Practical
UNIT I	<p style="text-align: center;">SEMESTER – III</p> <p>SHIP STABILITY</p> <p>Use of Simpson’s Rules in the computation of areas; volumes and centroids.</p> <p>SHIP CONSTRUCTION</p> <p>Longitudinal and transverse framing, Beams and Beam knees. Functions, constructions and stiffening of water tight bulkheads including collision bulkhead. Shell and deck plating.</p> <p>Bilge keels. Double bottom and peak tanks. Side and wing tanks. Bilges.</p> <p>Construction, stiffening and closing arrangements of opening on deck and superstructures.</p> <p>Sounding pipes, air pipes, ventilators. Hawse-pipes, spurling pipes and their securing arrangement.</p>	20 Hours	-
UNIT II	<p>SHIP STABILITY</p> <p>Determination of position of the longitudinal centre of gravity of a ship for different conditions of load and ballast. The effect on the position of centre of gravity of a ship by adding, removing and/or shifting weights.</p> <p>Longitudinal centre of buoyancy, Longitudinal metacentre and centre of flotation and factors affecting their positions.</p> <p>SHIP CONSTRUCTION</p> <p>An outline knowledge of the functions of Classification Societies. Surveys for assignment and retention of class.</p>	20 Hours	
UNIT III	<p>SHIP STABILITY</p> <p>Theory of Trim. Changes of trim and draft due to loading, discharging and shifting weights.</p> <p>Change of trim due to change of density.</p> <p>Use of stability, hydrostatic and stress data supplied to ships.</p> <p>Calculations based on the foregoing including those based on “Trim and Stability Particulars” of a given ship.</p> <p>SHIP CONSTRUCTION</p> <p>General Pumping arrangements – Bilge and Ballast line systems. Pumping arrangement on tankers. Methods adopted to maintain integrity of divisions and opening in the hull including stern, side and bow doors.</p>	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 % / A as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

- | | |
|--------------------------------|--|
| 1. Capt. H. Subraminiam | Ship Stability I, II, III |
| 2. Derrett | Merchant Ship Stability for Master and Mates |
| 3. Kemp & Young | Notes on Stability |
| 4. Capt. Lester | Stability for Merchant ships |
| 5. La Dage & Gemert | Stability |
| 6. Capt. Joseph & Capt. Rewari | Problems on Hindship |
| 7. Reeds | Ship Construction for Marine Students |
| 8. Kemp & Young | Ship Construction |
| 9. Eyres | Ship Construction |
| 10. Pursey | Ship Construction |
| 11. Taylor | Ship Construction |
| 12. IMO | Grain Code |

Objective:-

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

Contents of syllabus for USNSC 304

Environmental Science-II

		Theory	Practical
UNIT I	SEMESTER - I Formation of the earth and its - Evolution of continents and ocean basins – Continental drift hypothesis – concept of isotasy and its application to surface phenomena – Recent ideas on drift: plate tectonics – practical significance of recent information.	18 Hours	-
UNIT II	Materials of the earth's crust: minerals and rocks – Rock types and their formation – Lithological characteristics and their impact on landform development – Tectonic landforms: folds, faults and associated features – Volcanic and seismic activities: associated landforms.	14 Hours	
UNIT III	Exogenic forces: denudation – Weathering, mass-wasting and erosion – Marine landforms – Sea level changes – Classification of coasts. PRACTICALS 1. Identification of common rocks and minerals. 2. Reading and interpretation of topographical maps for coastal areas. 3. Reading and interpretation of hydrographic charts. 4. Preparation and interpretation of tidal charts	13 Hours	15 Hours

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

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

Reference Books:-

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' , Oxform University Press, New York.
4. Monkhouse, F. J. (1971), 'Principles of Physical Geography' , University of London Press.
5. Thornbury, W. D. (1960), 'Principles of Geolorphology' , 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 geographirs' , 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 Satllites' , 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.

MARINE ENGINEERING & CONTROL SYSTEM- II

		Theory	Practical
UNIT I	<p align="center">SEMESTER - III</p> <p>SECTION - A</p> <p>Engineering Materials – Common Engineering Materials. Various metals & alloys, Properties & uses. Ceramics and their use.</p> <p>Steels – Elementary metallurgy of steels, steel production – smelting & refining, Iron – carbon diagram to show role of carbon in steels and effect on properties. Types of steel & use.</p> <p>Heat treatment – Heat treatment of steels-obtaining desired properties from steel for use in different areas.</p>	18 Hours	-
UNIT II	<p>SECTION -B</p> <p>AC & DC Machines: DC generators. AC generators. Meaning of frequency, phase & power factor. Parallel running & load shearing. Prime mover-Diesel engine, steam turbines. AC & DC Motors.</p>	14 Hours	
UNIT III	<p>SECTION -C</p> <p>Transformers: High and Low voltage transformers, step up/step down Transformers, Transformer efficiency and maintenance & care.</p> <p>Power distribution: Maniswitch boards, power distribution boards, Circuit breakers, measuring instruments, overload trip short circuit trip, fuses other protections.</p> <p>PRACTICALS</p> <p>BASIC MARINE WORKSHOP</p> <ol style="list-style-type: none"> 1. Electrical wiring diagrams and fittings of simple circuits. 2. Fuses, earthings, tube & other light fittings, etc- practice training. 3. Cutting, filing, preparation of level surfaces on metals. 4. Drilling, tapping, reamer operations 5. Shaping, drilling, grinding operations 	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 % / C as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

- | | |
|---|-------------------------------------|
| 1. Basic Marine Engineering | J.K. Dhar |
| 2. Engineering Drawing | Bhat |
| 3. Engineering knowledge for Deck Officers | Reed |
| 4. General Engineering knowledge Vol. 8 | Reed |
| 5. Mechanical Engineering Science
Marine Auxiliary Machinery | Hannah & Hiller
ouchette & Smith |

Scheme of Examination (Theory)**(a) Internal assessment- 40 marks**

Sr. No.	Evaluation type	Marks
1	Two assignments/ case study/ projects	20
2	One class test (multiple choice questions objective)	10
3	Active participation in routine class instructional deliveries (case studies/ seminars/ presentation)	05
4	Overall conduct as a responsible student, manners, skill, in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05
	Total	40

(b) Semester end examination (Pattern of Question Paper):-**Theory**

First Semester (Duration 2 hrs.)		
Questions in Examination Paper	Units	Maximum Marks
Q - 1	1, 2,3	15
Q - 2	1	15
Q - 3	2	15
Q - 4	3	15
	Total	60

- Question no. 1 should be of short answer type questions having six sub questions (2 from each unit) of 3 marks each. Total 5 questions are to be attempted.
- Question 2, 3 & 4 should be from topics mentioned in the table total 3 sub questions to be attempted of 5 marks each out of the choice of 4 sub questions.

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**(a) Internal assessment- 20 marks**

Sr. No.	Evaluation type	Marks
1	Two best practical	10
2	Journal	05
3	Viva	05
		20

(b) Semester end assessment - 30 marks

- * Practical exams of 20 marks each to be conducted for –
 - a) Computer Science
 - b) Nautical Physics
- * A candidate shall be judged on the basis of his performance practicals and viva-voce.
- * Journal (continuous assessment of practical throughout the year) – 05 marks.
- * Viva-voce – 05 marks

Semester IV B.Sc. in Nautical Science

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

COMPUTER SCIENCE /PHYSICS /MATHS

Contact Hours 225

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc. in Nautical Science	Six Semesters	IV	Computer / Physics/Maths [USNSC 401]
Course Code	Title	Credits	
USNSC 401	Computer/Physics/Maths	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	Computer	Maths	physics	
Actual contacts	15	3	--	3	7	5	
Credits	4	2	--	1		2	

NAVIGATION –II

VOYAGE PLANNING & COLLISION PREVENTION - II

Contact Hours 75

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc. in Nautical Science	Six Semesters	IV	Navigation-II Voyage Planning & Collision Prevention –II [USNSC 402]
Course Code	Title	Credits	
USNSC 402	Navigation-II Voyage Planning & Collision Prevention- II	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-II	Voyage Planning & Collision Prevention-II
Actual contacts	5	3	--	3	2
Credits	3	2	--	1	2

**SHIP OPERATION TECHNOLOGY PAPER- II
BRIDGE PROCEDURES & LEGAL KNOWLEDGE
NAVAL ARCHITECTURE-II**

Contact Hours 150

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc. in Nautical Science	Six Semesters	IV	Ship Operation Technology Paper- I Bridge procedures & legal knowledge Naval Architecture [USNSC 403]
Course Code	Title	Credits	
USNSC 403	Ship Operation Technology Paper- I Bridge procedures & legal knowledge Naval Architecture	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	SOT Paper- II	Bridge procedures & legal knowledge	Naval Architecture Paper- II	
Actual contacts	10	2	--	3	3	4	
Credits	3	2	--	1	1	-	

**ENVIRONMENTAL SCIENCE-II
MARINE ENGINEERING & CONTROL SYSTEMS-II**

Contact Hours 90

Name of the Programme	Duration	Semester	Course/ Course Code
B.Sc. in Nautical Science	Six Semesters	IV	Environment Science – II Marine Engineering & Control System- II [USNSC 404]
Course Code	Title	Credits	
USNSC 404	Environment Science – II Marine Engineering & Control System- II	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 – II	Marine Engineering & Control System- II	
Actual contacts	06	02	--	3	3	
Credits	02	02	--	1	1	

Objective:-

This subject exposes the students to Computer Science, Applied Mathematics & Nautical Physics

Contents of syllabus for USNSC 401**Computer Science**

		Theory	Practical
UNIT I	SEMESTER - IV Expressions and Assignment statements. Control statements: if, nested if, switch, while loop, for loop, do while loop. Arrays: single and two dimensional only. Functions:	15 Hours	-
UNIT II	User-defined, Standard library functions of various types. Pointers: & * operators. Pointer expression: pointer assignment, pointer arithmetic, pointer comparison, Structures.	22 Hours	
UNIT III	File handling in C: opening a file, write into a file, reading from a file, closing a file. PRACTICAL [4] Simple and compound interest [5] Mean and standard deviation [6] Sorting of numbers [7] Finding real distinct roots of an algebraic equation: Newton-Raphson method [8] Creating a database of students using file operations [9] Creating and manipulating a singly linked-list. [10] Problems based on nautical sciences. Note: For practicals, Turbo C compiler or interpreter may be used.	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 : 40 % / E as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

8. Turbo C reference manual
9. Programming in C: Kris A. Jamsa : Galgotia Publications Pvt. Ltd.
10. Mastering turbo C: Kelly/Bootle : EPB
11. Turbo C programming techniques : Stevens A. : BPB
12. Computer Virus – prevention, detection & removal : Kapur R : BPB
13. Introduction to computer science vol. I & II : Jain S. : BPB
14. Introducing computers I, II & III : Mehta S. : BPB

APPLIED MATHS - IV

		Theory	Practical
UNIT I	<p style="text-align: center;">SEMESTER - IV</p> <p>Numerical Methods:</p> <p>Solutions of transcendental & algebraic equations: Newton – Raphson method, bisection method. Finite differences of first and higher order, forward, backward, central and divided differences, difference tables, Taylor’s operator – D, shift operator – E, averaging operator, differences of polynomials. Interpolation: linear and quadratic interpolation, Newton’s forward and backward difference interpolation formulas, Lagrangian interpolation, Sterling and Bessel’s interpolation formulas, Numerical integration: rectangular and trapezoidal rule, Simpson’s rules. Solutions to systems of linear algebraic equations: Gauss elimination, Gauss-Jordan method, Gauss-Seidel integration, Jacobi integration.</p>	30 Hours	-
UNIT II	<p>Matrices:</p> <p>Types of matrices. Adjoint of a matrix. Inverse of a matrix. Elementary transformations, rank of a matrix. Linear dependent and independent of rows and columns of a matrix over a real field. Reduction to a normal form. Partitioning of matrices. System of Homogeneous and non homo-generous linear equations, their consistency and solution. Linear programming-problems and applications. Characteristic values and vectors, and their properties for Hermitian and real symmetric matrices. Characteristic polynomial. Cayley Hamilton theorem. Functions of a square matrix, Minimal Polynomial, Diagonable matrix. Quadratic forms, Orthogonal, congruent and Lagrange’s reduction of quadratic form. Rank, Index, Signature of a quadratic form.</p>	25 Hours	
UNIT III	<p>Statistics:</p> <p>Frequency distribution, Measures of central tendency; Mean, Median and Mode, Measures of variability, Range, Percentiles, Variance Standard Deviation, Skewness, Moments, Discrete random variables and their probability distributions, Binomial and Poisson’s distributions, Continuous random variables, Normal distribution, Properties of Normal distribution, coefficient of Correlation, Lines of Regression – Rank Correlation. Elements of operation Research-Inventory Control and Elements of Queuing Theory. Decision Trees.</p>	50 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:-

- | | |
|------------------------------|---|
| 1. Wartikar, P. N. & J. N. | A text books for applied mathematics (Vol. I) |
| 2. Santi Narayan | A text book of Matrices |
| 3. Kapur, J. N. Sexena H. C. | Mathematical Statistics |
| 4. Murray Spiegel | Statistics in Schaum's series |
| 5. Myers | Statistics & Probability for engineers |
| 6. Dr. Grewal B. S. | Higher Engineering mathematics |
| 7. S. K. Gupta | Numerical methods for engineers |
| 8. Taha H. A. | Operations Research an introduction |
| 9. Srieni, Yaspan, Friedman | Operation Research Methods and Problems |
| 10. Hadley G. | Linear Programming. |

NAUTICAL PHYSICS-IV

		Theory	Practical
UNIT I	<p align="center">SEMESTER - IV</p> <p>ANALOG CIRCUITS</p> <p>Transistor Biasing: Operating point, Base bias (Fixed bias), Emitter bias, Voltage divider bias, D.C. load lines, Transistor saturation, Transistor as a switch, Bias Stabilization. Ref.: M:</p> <p>Transistor Amplifier : C.E. amplifier, DC and AC equivalent circuits, small signal operation, voltage gain, current gain, Input and output impedance, Frequency response, DC and AC load lines, Class A operation, Power gain, Decibel Voltage gain, A typical emitter follower circuit Ref.: M:</p> <p>Operational Amplifier: The basis differential and Common Mode Operation, Basic Opamp Specifications, Practical Opamp circuits – Schmitt Trigger and square wave generator, Inverting and Non-inverting amplifiers, voltage follower, Summing Amplifier, Difference Amplifier, Integrator and Differentiator. Ref.: BN, M</p>	20 Hours	-
UNIT II	<p>DIGITAL CIRCUITS</p> <p>Number System and Logic Gates: Binary numbers, binary to decimal conversion, Decimal to binary conversion, (Octal and hexadecimal numbers, Binary to Octal and binary – Hexadecimal inter conversion), NOT, OR, AND, NAND, NOR Logic gates, EXOR Gate, arithmetic and data processing circuits (half adder, full adder, multiplexer and de multiplexer), De Morgan’s theorems; Boolean algebra, NAND and NOR as a basic building blocks, Logic levels for TTLIC’s Ref: ML</p> <p>Clocks and Timers: 555 times, basic timing concept, 555 block diagram, monostable and astable multivibrators, Voltage Controlled Oscillator (VCO), ramp generator. Ref: M NAND gate as a clock. Ref: ML.</p> <p>Flip flops and contents: RS flip flop, Clocked RS flip flop, D flip flop, JK flip-flop, Master Slave concept Schmitt trigger, Flip-Flops used as binary ripple counters, decade counter. Ref: ML</p>	35 Hours	

<p>UNIT III</p>	<p>Feedback types: Voltage and current feedback, Effects of negative feedback on amplifier parameters, derivation only for gain with feedback (No other derivations), typical single transistor circuits for voltage series and current series feedback. Oscillator operation Barkhausen criteria, RC oscillators – phase shift and Wein Bridge (op-amp and transistor), LC oscillators – Colpitts and Hartley (transistor and op-amp), crystal oscillator. Ref:BN:Ch. 18.1 – 18.8 except 18.4</p> <p>Cathode Ray Oscilloscope: Construction, working and basic measurements. Ref: BN.</p> <p>Microprocessors: Digital Computers, Computer Languages, Single Chip Microprocessor architecture and its operations, Memory, Input and Output (I/O) devices, Interfacing devices, Example of a microcomputer system. The 8085 microprocessor, example of 8085 – based microcomputer, memory interfacing, how does an 8085-based single-board microcomputer work? Basic interfacing concepts, interfacing output displays and input devices, memory-mapped I/O, 8085 programming model, instruction classification, instruction format, how to write, assemble and execute a simple program, overview of 8085 instruction set. Ref: G: Ch. 1, 2, 4 (except 3.4), 4 (except 4.5, 4.6), 5:</p> <p style="text-align: center;">EXPERIMENTS</p> <ol style="list-style-type: none"> 5. CE Amplifier – voltage gain, frequency response, plotting A.C. & D.C. load lines. 6. Emitter Follower – voltage gain & output resistance. 7. Op-Amp – inverting & non-inverting amplifier, voltage follower, summer & difference amplifiers. 8. Op-amp – square wave generator, slew rate. 9. Timer – astable & monostable multivibrators. 10. Wien Bridge Oscillator – transistor & op-amp versions. 11. Study of Basic Logic Gates – NOT, AND, OR, NAND, NOR. 12. DeMorgan’s Laws & use of NAND & Nor as basic building blocks. 13. J-K Flip Flop – truth table, Ripple & Decade counters. 14. Microprocessors: <ol style="list-style-type: none"> 11. Learning (get to know) the Hardware of a microprocessor. 12. Operating procedure, precautions & use of key-board of a microprocessor 13. Use of commands & keys of a microprocessor to solve simple problems. 14. Writing & Running simple programs. 15. Simple Input & Output programs 	<p>20 Hours</p>	<p>26 Hours</p>
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*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 % / E as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

1. Digital Principles & Applications – Malvino & Leach.
2. Operational Amplifiers & Linear Integrated Circuits – Coughlin & Driscoll.
3. Electronics – A Text Lab Manual – Zbar & Malvino.
4. Microprocessor Architecture, Programming & Application – R. S. Gaonkar.

Objectives:-

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

Contents of syllabus for USNSC 402

NAVIGATION-II

		Theory	Practical
UNIT I	<p align="center">SEMESTER – IV</p> <p>PRINCIPLES OF NAVIGATION 4Azimuths and amplitudes; Derivation of formula: Sin amp =Sin decl. sec lat. Apparent altitude of Sun, Moon at time of theoretical rising or setting.</p> <p>PRACTICAL NAVIGATION 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.</p>	15 Hours	-
UNIT II	<p>PRINCIPLES OF NAVIGATION 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</p> <p>PRACTICAL NAVIGATION To find the longitude corresponding to the DR latitude through which the position line passes and the direction of position line from an observation of any heavenly body. (Long by chron).</p>	22 Hours	
UNIT III	<p>PRINCIPLES OF NAVIGATION 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 for P/L and practical applications. Simple calculations on (1) to (7).</p> <p>PRACTICAL NAVIGATION To find the intercept, Intercept termination point and direction of position line from an observation of any heavenly body. (Intercept Method).</p> <p>PRACTICAL 1. Use of Azimuth Mirror and pelorus.</p>	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 % / O as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

- | | |
|--|-------------------------------|
| 8. Principal of Navigation:- | Capt. P. M. Sarma |
| 9. Principal of Navigation | Capt. Joseph and Capt. Rewari |
| 10. Practical Navigation | Capt. H. Subramaniam |
| 11. Admiralty Manual of Navigation Vol. I & II | |
| 12. Navigation | Frost A. |
| 13. Nicholl's Concise Guide Vol. I & II | |
| 14. Nutshell Booklet on Sextant | Capt. H. Subramaniam |

VOYAGE PLANNING & COLLISION PREVENTION-II

		Theory	Practical
UNIT I	<p align="center">SEMESTER – IV</p> <p>VOYAGE PLANNING The interpretation of a chart or plan, particularly the information given about Lights, Buoys, Radio Beacons and other Navigational Aids.</p> <p>COLLISION PREVENTION Precautions while using floating navigational aids, such as buoys, light vessels etc.</p>	10 Hours	05 Hours
UNIT II	<p>VOYAGE PLANNING Depths and height counters. Tidal Streams Traffic lanes and separation zones. Recognition of the coast and radar responsive targets. Chart correction.</p> <p>COLLISION PREVENTION Radar Plotting exercises.</p>	10 Hours	05 Hours
UNIT III	<p>VOYAGE PLANNING Geographical Range, Luminous Range, Nominal range; and their significance.</p> <p>COLLISION PREVENTION Relative plot. Action by own ship, Action by Target ship. Set and Drift.</p> <p>PRACTICALS</p> <p>VOYAGE PLANNING Use of single position line obtained from a celestial observation when near a coast to keep safe distance off the coast.</p> <p>Fixing the position of a ship using bearings obtained from a D.F. set. Conversion of DF bearing to Mercator bearing.</p> <p>To find course made good using the three point bearing method.</p> <p>COLLISION PREVENTION</p>	10 Hours	15 Hours

	<p>The students will be required to identify various collision situations by day and by night. Practical's to be held using a magnetic board, wooden models, overboard projector, video tapes or any other aid to simulate such conditions.</p> <p>Candidates will be required to deal with each collision situation broadly under the headings - 'recognition', 'responsibility' , 'action', 'appropriate sound signals' and ordinary practice of seaman'.</p> <p>NOTE: The second year examination will include the entire 'practical's portion of the first year.</p>		
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***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 % / O as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

- | | |
|-------------------------------------|--|
| 13. Bhandarkar publications | Rule of the road |
| 14. Moore | International light, shape & sound signals |
| 15. Cockroft | Guide to collision avoidance |
| 16. I.A.L.A. | Maritime buoyage system. |
| 17. Capt. S. K. Puri | Chartwork |
| 18. Square | Modern Chartwork |
| 19. Fifield | Navigation for Watchkeepers |
| 20. Capt. H. Subramaniam | Shipborne Radar |
| 21. Capt. M. V. Naik & Capt. Varty | Voyage Planning & Chatwork |
| 22. Nicholls Concise Guide Volume I | |
| 23. Moore, D. A. | Marine Chartwork |
| 24. Capt. S. K. Puri | Manual of the Rule of the Road. |

Objective:-

This subject exposes the students to Ship Operation Technology Paper- I , Cargo Work & Communication & Naval Architecture

Contents of syllabus for USNSC 403

Ship Operation Technology Paper- II

		Theory	Practical
UNIT I	SEMESTER – IV	15 Hours	-
	Section - A Factory act. Requirements for annealing and periodical testing of cargo gear, chain register, other requirements of the Factory Act.		
	Section –B SHIP MANOEUVRING: Effect of various factors on maneuvering. Berthing and unberthing at quays and oil terminals. Management of ship in heavy weather.		
UNIT II	Section - A practices for merchant seaman, General outline 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.	18 Hours	
	Section –B Precaution in maneuvering for launching of boats or life rafts in bad weather. Methods of taking on board survivors from life boats and life rafts.		
UNIT III	Section - A Infrastructure built in ports for loading and discharging, such as cranes, gantries, conveyor belt system etc. Calculations relating to above topics where applicable.	12 Hours	
	Section –B GENERAL: Properties and uses of paint resins and other protective coverings. Preparations for dry docking and undocking. Use of side shores, bilge blocks and bilge shores. Measures to be taken to prevent spillage of oil during cargo work, bunkering or oil transfer. Keeping oil record book.		
	PRACTICALS 25. Coiling of ropes – Opening a new coil of rope. Cutting		

	wire ropes. 26. Rigging a pilot ladder – Precautions for safety of men boarding by such ladders. 27. To renew manropes on boat davit span.		15 Hours
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*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 % / A as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

- | | |
|---------------------------|-----------------------------------|
| 9. Kemp & Young | Cargo Work |
| 10. O. O. Thomas | Stowage of Cargo |
| 11. Danton | Theory and Practice of Seamanship |
| 12. Kemp & Young | Seamanship Notes |
| 13. Nicholls | Seamanship and Nautical Knowledge |
| 14. Capt. J. M. N. Dinger | Seamanship and Cargo Work |
| 15. Capt. S. K. Puri | Life Boat and Life Raft |
| 16. C. H. Wright | Survival at Sea. |

BRIDGE PROCEDURE LEGAL KNOWLEDGE-II

		Theory	Practical
UNIT I	<p style="text-align: center;">SEMESTER - IV</p> <p>BRIDGE EQUIPMENT</p> <p>MARINE COMMUNICATION Global Maritime Distress and Safety System – principles and actual applications.</p> <p>LEGAL KNOWLEDGE Custom House procedure, entering and clearing ship.</p> <p>Load Line Marks, Entries and reports in respect of freeboard. Draft and allowance. Calculations on Lay day and Load Line (zone problems).</p> <p>Safety of the ship, crew and passengers. Assistance to vessels in distress and salvage. Duties of Master in the case of an accident.</p>	15 Hours	-
UNIT II	<p>BRIDGE EQUIPMENT</p> <p>MARINE COMMUNICATION World Wide Navigational Warning System – India’s role as a Co-coordinator for area 8.</p> <p>LEGAL KNOWLEDGE The law relating to the reporting of derelicts, tropical revolving storms and other dangers to navigation.</p> <p>Compulsory and non-compulsory pilotage</p>	15 Hours	
UNIT III	<p>BRIDGE EQUIPMENT</p> <p>MARINE COMMUNICATION Meteorological Broadcast – Routine weather messages and storm warnings.</p> <p>Search and Rescue Communications.</p> <p>LEGAL KNOWLEDGE</p>	15 Hours	

	<p>A general knowledge of shipping practice and documents with particular reference to charter parties, bills of lading and Mates receipts. The law relating to carriage of cargo and the ship owners liabilities and responsibilities. Protests, certificate of sea worthiness.</p> <p>A knowledge of the contents of "Merchant Shipping Notices" and Notices to Mariners. The use of Notices to Mariners.</p> <p>PRACTICALS</p> <p>ECHO SOUNDER: Use and care of both visual and graphic types. To take soundings using Echo Sounder or Echo sounder simulator.</p> <p>MARINE COMMUNICATION</p> <p>Practical usage of 'International Code of Signals'.</p> <p>To prepare portable radio equipment for operation.</p> <p>Ship to ship and ship to shore communication exercises by portable VHF sets.</p>		<p>15 Hours</p>
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*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 % / A as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

- | | |
|---|--|
| 16. Sonnenberg | Electronic navigation aids |
| 17. Capt. H. Subramaniam | Shipborne radar |
| 18. HMSO | International code of signals |
| 19. Telcom handbook for Radio operators | |
| 20. Hopkins | Business and Law for Ship Master |
| 21. Bhandarkar Publication | Indian Merchant Shipping Act |
| 22. Bonwick and Steer | Ship's Business |
| 23. I.M.O. Publication | SOLAS |
| 24. I.M.O. Publication | MARPOL |
| 25. I.M.O. Publication | International Convention on Load Lines |
| 26. I.M.O. Publication | Medical First Aid Guide |
| 27. I.M.O. Publication | Search and Rescue Manual |
| 28. Hydrographic Department | Annual Notices to Mariners |
| 29. Hydrographic Department | Weekly Notices to Mariners |
| 30. Bhandarkar Publications | Merchant Shipping Notices |

Naval Architecture-III

		Theory	Practical
UNIT I	SEMESTER – IV	20 Hours	-
	<p>SECTION A – SHIP STABILITY Cross curves of stability, K. N. values, determination of Righting moment using K.N. Values, Curve of statical stability and its practical usage.</p> <p>SECTION B - SHIP CONSTRUCTION Rudders, construction and support. Stern frame, Propellers and Propeller shaft; stern tube and adjacent structure.</p>		
UNIT II	<p>SECTION A – SHIP STABILITY</p> <p>Carriage of deck cargoes and their effect on stability.</p> <p>SECTION B - SHIP CONSTRUCTION General ideas on various plans supplied by shipyard. Midship sections of General cargo ship, tanker, bulk carrier, container, OBO. Causes and methods of corrosion control in steel work and also between dissimilar metals including cathodic protection. Impressed current system.</p>	20 Hours	
UNIT III	<p>SECTION A – SHIP STABILITY</p> <p>Stowage of grain and stability aspects in respect thereof with particular reference to calculations involved and the manner of presentation of the information relating to grain heeling Moments and the resulting angle of heel as presented in the National Statutory Regulations.</p> <p>SECTION B - SHIP CONSTRUCTION Stresses and strains in ships in still water and in a seaway. Parts of ship specially strengthened and stiffened to resist such stresses including panting and pounding.</p>	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 % / A as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

Capt. H. Subraminiam
Derrett
Kemp & Young
Capt. Lester
La Dage & Gemert
Capt. Joseph & Capt. Rewari
Reeds
Kemp & Young
Eyres
Pursey
Taylor
IMO

Ship Stability I, II, III
Merchant Ship Stability for Master and Mates
Notes on Stability
Stability for Merchant ships
Stability
Problems on Hindship
Ship Construction for Marine Students
Ship Construction
Ship Construction
Ship Construction
Ship Construction
Grain Code

Objective:-

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

Contents of syllabus for USNSC 404**ENVIRONMENTAL SCIENCE-II**

		Theory	Practical
UNIT I	<p style="text-align: center;">SEMESTER - IV</p> <p>OCEANOGRAPHY Oceans: Major relief features of the ocean-floor – Bottom relief of Indian, Atlantic and Pacific oceans – Properties of ocean water: temperature, salinity and density – Their vertical and horizontal distribution – Ocean currents: currents factors and patterns – Ocean deposits: types and their work – NIO and its activities.</p> <p>Biotic resources of the oceans: fish corals, mangroves, etc – Distribution of biotic resources – Problems of their exploitation – Environmental and other stresses – Remedial measures – Mariculture: merits and limitations.</p> <p>Abiotic resources: types Oceanic mineral nodules and places – Oil and natural gas – Technological advances – Marine politics and law of the sea – Environmental oceanic problems and oceanic hot-spots – Future of scenario.</p> <p>Oceanic water as a resource: navigations, power generation, source of drinking water etc. – Spatial pattern of feasibility- Oceanic islands and their strategic significance – Indian Ocean islands.</p>	18 Hours	-
UNIT II	<p>Atmosphere: Factors affecting atmospheric motion and the resulting winds – Newton's laws and equation of motion – Basic patterns of air movement.</p> <p>Horizontal and vertical distribution of atmospheric pressure and the resulting circulation – Recent advances in the knowledge of general circulation: upper air waves and jet stream – Dynamics of the Indian monsoon</p>	14 Hours	
UNIT III	<p>Seasonal weather and climatic characteristics over India – Cyclones in Indian seas and their impact on coastal life.</p> <p>Weather forecasting: methods and techniques – Constraints in accurate forecasts.</p> <p>PRACTICALS</p> <p>2. Plotting of weather details at surface stations</p>	13 Hours	

	3. Plotting of tephigrams and their interpretation 4. Tracking of cyclones. 5. Estimation of geostrophic wind speed from geostrophic scale. 6. Reading and interpretation of I.M. D. synoptic maps. 7. Interpretation of upper air charts.		15 Hours
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*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 % / C as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

18. Wooldridge, S. W. and Morgan, R. S. (1988), 'An outline of Geomorphology' , Orient Longman, Calcutta.
19. Tarling, D. H. and Tarling, M. P. (1971), 'Continental Drift' , G. Bell and Sons Ltd., London.
20. Birkland, P. W. and Larson, E.E. (1978), 'Putnam's Geology' , Oxform University Press, New York.
21. Monkhouse, F. J. (1971), 'Principles of Physical Geography' , University of London Press.
22. Thornbury, W. D. (1960), 'Principles of Geolorphology' , John Wiley, New York.
23. Bhatt, J.J. (1978), 'Oceanography: Exploring the Ocean' , Von Norstrand, New York.
24. Sharma, R. C. and Vatal, M (1970), 'Oceanography for geographirs' , Chaitanya Allahabad
25. Sharma, R. C. (ed) (1985), 'The Oceans: Realities and Prospects' , Rajesh Publications, New Delhi.
26. Birla Economic Research Foundation (1992), ' The Oceans' , Allied Publications, New Delhi.
27. Barry, R. S. and Chorley, R. J. (1971), 'Atmosphere, Weather and Climate' , ELBS, Methuen, New York.
28. Flohn, H. (1969), 'Climate and Weather' , World University Library.
29. Petterssen, A. (1969), 'Introduction to Meteorology' , Mcgraw Hill London.
30. Ayoade, J. O. (1983), 'Introduction to Climatology for the Tropics' , John Wiley, New York.
31. Anthes, R. A. et. al. (1978), 'The Atmosphere' , Charles E. Merrill, Columbus (Ohio)
32. Barrett, E. C. (1974), 'Climatology from Satllites' , Methuen, London
33. Riley, D. and Spolton, I. (1974), 'world Weather and Climate' ,Cambridge University Press.
34. Cole, F. W. (1970), 'Introduction to Meteorology' , John Wiley, New York.

JOURNALS

'Mausam' IMD.

MARINE ENGINEERING & CONTROL SYSTEM- II

		Theory	Practical
UNIT I	<p style="text-align: center;">SEMESTER - IV</p> <p>SECTION - A</p> <p>Fresh water: Methods of generation of freshwater from seawater at sea. Principle, construction & operation of freshwater generator, steam evaporator, flash evaporator & reverse osmosis plant. Treatment of water for obtaining portable water. Storage and supply of fresh water in ships. Fresh water and sanitary water. Hydrophase systems.</p> <p>SECTION-B</p> <p>Refrigeration & Air conditioning: Principle of refrigeration, compression refrigeration cycle, components & operation. Arrangement of cold storage holds.</p> <p>SECTION-C</p> <p>Working principles: Classification of various types of engines, various types of modern diesel engines. Basic principles of cycles, P-V diagrams, work done etc.</p>	18 Hours	-
UNIT II	<p>SECTION-A</p> <p>Compressed air: Air compressor, uses of compressed air. Storage and distribution of compressed air.</p> <p>SECTION-B</p> <p>Pumps: working principle, construction of different types of pumps. Selection of pumps for different duties onboard the ship.</p> <p>SECTION-C</p> <p>Four stroke and two stroke engines.</p>	14 Hours	
UNIT III	<p>SECTION-A</p> <p>Bilge, ballast, fire, cargo & other pipelines of different type of ships.</p> <p>SECTION-B</p> <p>Steering: Common types of steering gear, electro hydraulic steering gears, 2 & 4 Ram systems, Telemotor and control systems. Safety features. Emergency arrangements. Legislation national and international, Operations and</p>	13 Hours	

	<p>maintenance.</p> <p>SECTION-C</p> <p>Components: Construction, main components and working of two and four stroke engines.</p> <p>PRACTICALS</p> <p>BASIC MARINE WORKSHOP</p> <p>13. Edge preparation on steel objects for welding 14. Welding of simple joints. 15. Removal & fittings of ball bearing 16. Overhaul of valves practice on fittings on pipelines 17. Competency – Cutting & planning Dove tail joints.</p>		<p>15 Hours</p>
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*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 % / C as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India

Reference Books:-

- | | |
|--|-------------------|
| 6. Basic Marine Engineering | J.K. Dhar |
| 7. Engineering Drawing | Bhat |
| 8. Engineering knowledge for Deck Officers | Reed |
| 9. General Engineering knowledge Vol. 8 | Reed |
| 10. Mechanical Engineering Science | Hannah & Hiller |
| Marine Auxiliary Machinery | Souchette & Smith |

Scheme of Examination (Theory)

(b) Internal assessment- 40 marks

Sr. No.	Evaluation type	Marks
1	Two assignments/ case study/ projects	20
2	One class test (multiple choice questions objective)	10
3	Active participation in routine class instructional deliveries (case studies/ seminars/ presentation)	05
4	Overall conduct as a responsible student, manners, skill, in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05
	Total	40

(b) Semester end examination (Pattern of Question Paper):-

Theory

First Semester (Duration 2 hrs.)		
Questions in Examination Paper	Units	Maximum Marks
Q - 1	1, 2,3	15
Q - 2	1	15
Q - 3	2	15
Q - 4	3	15
	Total	60

- Question no. 1 should be of short answer type questions having six sub questions (2 from each unit) of 3 marks each. Total 5 questions are to be attempted.
- Question 2, 3 & 4 should be from topics mentioned in the table total 3 sub questions to be attempted of 5 marks each out of the choice of 4 sub questions.

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

(a) Internal assessment- 20 marks

Sr. No.	Evaluation type	Marks
1	Two best practical	10
2	Journal	05
3	Viva	05
		20

(b) Semester end assessment - 30 marks

- * Practical exams of 20 marks each to be conducted for –
 - c) Computer Science
 - d) Nautical Physics

* A candidate shall be judged on the basis of his performance practicals and viva-voce.

* Journal (continuous assessment of practical throughout the year) – 05 marks.

* Viva-voce – 05 marks