Academic Council _____

Item No. _____

UNIVERSITY OF MUMBAI

Syllabus
For
Program:
B. Sc.
Nautical Science (NS)
Syllabus for Sem III & IV

CHOICE BASED CREDIT AND GRADING SYSTEM (CBCS)

With effect from the academic year 2017-18

AC_____

Item No._____

UNIVERSITY OF MUMBAI

Syllabus for Approval

Sr. No.	Heading	Particulars
1.	Title of the Program	**B.Sc. (Nauical Science)**
2.	Eligibility for Admission	• Indian National • HSC or equivalent Certificate • Mark Sheet showing minimum 60% marks in PCM subjects in HSC (10+2).(Original with 2 photocopies) • Original School/College Leaving Certificate with 2 photocopies. • Minimum 50% Marks in English language in SSC or HSC • Age not more than 25 yrs for HSC students on the date of commencement of course. • Medical Fitness Certificate from a Doctor approved by Director General, Shipping (original with 1 photocopy) • Eye Sight Test Certificate -6x6 both eyes and no colour blindness from any DG approved doctor (original with 1 photocopy)
3.	Passing Marks	12th standard passed.
4.	Ordinances / Regulations (if any)	Time to time issued by university.
5.	No. of Years / Semesters	3 Years / 6 Semesters.
6.	Level	U.G.
7.	Pattern	Semester
8.	Status	Revised
9.	To be implemented from Academic Year	From Academic Year 2017-18 (w.e.f. Academic Year 2017-18 onwards.)

Date: **Signature:**

Name BOS Chairperson / Dean: **Capt.(Dr.) Ashutosh V. Apandkar**

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UNIVERSITY OF MUMBAI

Syllabus for Approval

1. **Title of the Program:-** Syllabus Three Years B.Sc. Course In Nautical Science **Program Code: –** B.Sc. (Nautical Science)
2. **Preamble / Scope:-**

P R E A M B L E

This course is an integral part of the overall planned and shipboard structured training programme for the prospective navigating officer. The course is residential in nature and of Three-year duration comprising of six semesters of six months each.
The prospective navigating officer will be trained for one year onboard ship in practical application of the theory learnt. Thereafter at the end of this structured programme, a "contact programme" for four months may be conducted at the Institute to prepare the Cadets for an oral examination conducted by the Director General of Shipping, Ministry of Surface Transport, Government of India.
On successful conclusion of the Programme a Cadet will be awarded a degree of BSc (Nautical Science) by University of Mumbai and a Certificate of Competency by Govt. of India, which will enable him to become an officer on a merchant ship.
A Pre-Sea Navigating Officer Cadet successfully completing the three year programme would acquire basic knowledge and understanding of the types of merchant ships, ship operations, types of goods carried by ships, shipping trade, and a foundation in the basic principles of navigation and environmental science.
The course is designed to impart:
~ Theory and practice of seamanship and ship knowledge.

~ Good foundation in principles of navigation and introduction to Astronomical Navigation.

~ Practical knowledge of chart work and cargo work.

~ Detailed study of atmosphere and use of meteorological instruments in connection with weather reporting.

~ Knowledge of ship construction and ship stability.

~ Regular practice in Morse code signalling, in addition to International Code of Signals and use of VHF and R/T.

~ Practical training in handling a lifeboat and motorboat.

~ One Project related to shipping industry to be under taken.

~ Study of environmental protection with reference to MARPOL 73/78.

~ Study of various IMO courses.

~ Study of basic Marine Engineering and drawing.

Practical Training in carpentry shop, plumbing shop, machine shop, electrical shop and maintenance workshop including Electric Arc welding and Gas welding, Hydraulics, Pneumatics and Diesel Engine maintenance .

Objective

This course is designed to assist a prospective navigating officer in achieving the minimum standards of competence for officers in charge of navigational watch on ships of 500 gross tonnes or more as specified in Regulation II/1, Table A-1 of STCW Code 2010.

The course is residential in nature and its duration is 36 weeks.This course is aimed at preparing the Cadet to develop a right attitude towards tasks and duties assigned to him during the on-board training programme in learning the job of being a ship's officer and in achieving the overall standard of competence required.

Salient features

- As under the preview of D.G Shipping, it's a fully residential course
- Students' daily routine starts from 6:00 o'clock in the morning till 8:30 in the evening, as per the requirement on board ships
- Morning exercise, parade, evening sports and 2 hours of self study classes 6 days a week is the part of daily routine.
- Trekking, dock visits, ship visits is a part of curriculum apart from other extracurricular and sports activities

Note:

The conduct of STCW 2010 courses is strictly conducted as per the guidelines of D.G Shipping; who in turn being directed by International Maritime Organization, these guidelines may be modified/ changed time to time and instructed by D.G Shipping through its training circulars or as the case may be.

Syllabus Committee Members

1)	Capt. (Dr.) Ashutosh Apandkar	Convener
2)	Capt. Vinod Suryavanshi	Co - convener
3)	Capt. Mahadeo Makane	Member (Teacher)
4)	Capt. Laxman Dubey	Member (Teacher)
5)	Capt. Sandeep G. Bhatnagar	Member (Teacher)
6)	Capt. A.P. Singh	Member (Teacher)

Objective

This course is designed to assist a prospective navigating officer in achieving the minimum standards of competence for officers in charge of navigational watch on ships of 500 gross tonnes or more as specified in Regulation II/1, Table A-1 of STCW Code 2010. The course is residential in nature and its duration is 36 weeks.

This course is aimed at preparing the Cadet to develop a right attitude towards tasks and duties assigned to him during the on-board training programme in learning the job of being a ship's officer and in achieving the overall standard of competence required.

3. Eligibility:-

- Indian National
- HSC or equivalent Certificate
- Mark Sheet showing minimum 60% marks in PCM subjects in HSC (10+2).(Original with 2 photocopies)
- Original School/College Leaving Certificate with 2 photocopies.
- Minimum 50% Marks in English language in SSC or HSC
- Age not more than 25 yrs for HSC students on the date of commencement of course.
- Medical Fitness Certificate from a Doctor approved by Director General, Shipping (original with 1 photocopy)
- Eye Sight Test Certificate -6x6 both eyes and no colour blindness from any DG approved doctor (original with 1 photocopy)

B.Sc. in Nautical Science

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

Semester –III

B.Sc in Nautical Science Theory / Practical :

Course Code	Title of the Course	Per Week		Per Semester		Marks		Credits		Total
		L	P	L	P	TH	PR	L	P	
Core Course										
USNSc302	Navigation –II	3	1	45	15	100	50	3	2	5
	Voyage Planning & Collision Prevention– II	2	2	30	30	100	50			
USNSc303	Ship Operation Technology-II	3	1	45	15	100	50	3	2	5
	Bridge Procedure & Legal Knowledge	3	1	45	15					
	Naval Architecture-II	4		60		100				
AECC – Ability Enhancement Compulsory Course										
USNSc301	Applied Mathematics-III	6		90		100		3	1	4
	Nautical Physics & Electronics-III	4	2	60	30	100	50			
SEC - Skill Enhancement Course										
USNSc301	Computer Science	3	1	45	15	100	50	1	1	2
DSE – Elective: Discipline Specific										
USNSc304	Environmental Science-II	3	1	45	15	100	50	2	2	4
USNSc304	Marine Engineering & Control System II	3	1	45	15	100	50			
Total		33	10	495	150	1000	400	12	8	20

Semester IV

Course Code	Title of the Course	Per Week		Per Semester		Marks		Credits		Total
		L	P	L	P	TH	PR	L	P	
Core Course										
USNSc402	Navigation –II	3	1	45	15	100	50	3	2	5
	Voyage Planning & Collision Prevention– II	2	2	30	30	100	50			
USNSc403	Ship Operation Technology-II	3	1	45	15	100	50	3	2	5
	Bridge Procedure & Legal Knowledge	3	1	45	15	100	50			
	Naval Architecture-II	3		45		100				
AECC – Ability Enhancement Compulsory Course										
USNSc401	Applied Mathematics-III	6		90		100		3	1	4
	Nautical Physics & Electronics-III	4	2	60	30	100	50			
SEC - Skill Enhancement Course										
USNSc401	Computer Science	3	1	45	15	100	50	1	1	2
DSE – Elective: Discipline Specific										
USNSc404	Environmental Science-II	3	1	45	15	100	50	2	2	4
USNSc404	Marine Engineering & Control System II	3	1	45	15	100	50			
Total		33	10	495	150	1000	400	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-I I **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

	Semester III	Theory	Practicals
Unit I	**Basic Hardware Familiarization:** Different functional parts of a computer and their functions. Computer peripherals: Monitor, Printer, Key board, Hard disk and Mouse. **Operating System:** Explain the Windows Operating System. Explain different types of files and their extension. Finding, sorting and hyper linking a file. **Basics of C:** History of C. C character set, C operators. Formatted input and output. Data Types. Constants and variables. Operators: Arithmetic, Increment & Decrement, Modulo division, Relational, Logical, Conditional and Comma and decision making.	**8 Hours**	
Unit II	**Networks:** Identify network cable CAT 5 and CAT 6. Explain crippling and punching of the network cable. Explain E-mail, Virus protection and firewall. Computer connectivity: LAN, MAN and WAN. Internet and various facilities available on internet, Satellite based Communication. **Computer arithmetic:** Binary, Octal, Decimal & Hexadecimal number systems and mutual conversion. 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, **C Programming:** While, do and do-While loops.	**15 Hours**	

Unit III	**MS-Word:** Explain how to create and save a word file using various short cuts. Explain how to manage files into folders and sub-folders. Demonstrate the use of a print command and its various options. Explain the various options of paragraphs and bulleting **MS- Excel:** Explain how to create and save an excel file using various short cuts. Explain how to work with rows, columns, and various cell formatting options. Create formula and employ the function wizard. **C Programming:** For loop. Switch-Case, continue and break statements. **Practical's** **MS-Word:** Introducing tables and columns. Mail merging address for envelopes. • **MS-Excel:** Creating and opening workbook and entering data. Use of formulas, functions and named ranges to process data. • **C Programming:** • To understand various types of control statements. • To understand various loops and the switch- case statement.	**22 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 % as per Training Circular No 4 of 2005 by DG Shipping , Govt Of India .

Recommended Books For Reference:

1. Practical Microsoft Office 2007: June Jamrich Parsons
2. Computer Networking from LAN's to WAN's, Hardware, Software & Security
3. Turbo C reference manual
4. Programming in C: Kris A. Jamsa : Galgotia Publications Pvt. Ltd.
5. Mastering turbo C: Kelly/Bootle : EPB
6. Turbo C programming techniques : Stevens A. : BPB
7. Computer Virus – prevention, detection & removal : Kapur R : BPB
8. Introduction to computer science vol. I & II : Jain S. : BPB
9. Introducing computers I, II & III : Mehta S. : BPB
10. Computer Fundamentals Architecture and Organization: B Ram
11. Let us 'C': Kanitkar, 3rd BPB

APPLIED MATHS-III

		Theory	Practical
UNIT I	**SEMESTER - III** Bessel Functions and Legendre Polynominals & Partial Differential Equations: 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. 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.	**25 Hours**	-
UNIT II	Laplace Transforms: Function of bounded variation (Statement only), Laplace transforms of 1, t^n , e^{at} , sin (at), cos (at), Sin h (at), Cos h (at), erf (t), Shifting properties. Expressions (with Proofs) for : (i) $L^{t}\{{}^{n}f(t)\}$ ii) $L\{f(t)\}$ iii) $L\int f(u)du$ $IV)\ L\dfrac{d^{n}}{dt^{n}}f(t)$ Unit step functions, Heaviside, Dirac functions and their Laplace transform. Laplace transform of periodic functions. Evaluation of inverse Laplace Transforms, partial fraction methods, Heaviside development convolution theorem. Application to solve initial and boundary value problems involving ordinary differential equations with one dependent variable.	**25 Hours**	

UNIT III	Complex Variable: 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.	**40 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	**SEMESTER – II** **Review of a. c. circuits:** 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. **Modulation concepts:** 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. **Demodulation Techniques:** Demodulation of A.M. waves, diode detector, transistor modulator, detection efficiency, amplitude distortion. Demodulation of FM waves, frequency demodulator.	**17 Hours**	
UNIT II	**Transmission systems:** Classification of amplifiers – A, B and C, AF, RF and power amplifier, AM transmitter. **Digital Communications:** Types of pulse modulation, generation and demodulation of Pulse Amplitude Modulation (PAM) waves, distortion in PAM, Pulse Duration (width). Pulse Code Modulation (PC M), generations and demodulation of PCM, direct FM transmitter, Armstrong FM system, mobile communication systems. **Wave propagation:** Basic electromagnetic spectrum, mechanism of water 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.	**25 Hours**	
UNIT III	Radio receivers: Straight and regenerative receivers, turned RF receivers, super heterodyne receivers, AM receivers, stereo FM multiplexed reception, noise consideration, 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. 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), Radar	**18 Hours**	

	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). Satellite Communication: Satellite links, eclipses, orbits and inclination, satellite construction, communication frequencies, domestic satellites, telemetry. **EXPERIMENTS** 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. ***NOTE:*** A minimum of 8 experiments are expected to be performed		**30 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 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	**SEMESTER - III** 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.	**15 Hours**	
UNIT II	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.	**22 Hours**	
UNIT III	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. **PRACTICAL NAVIGATION** 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). Latitude and position line by observation of Polaris.	**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:-

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	**SEMESTER - III** Elementary Knowledge of Passage Planning and its execution. Landfall in thick and clear weather. The selection of a suitable anchorage. **COLLISION PREVENTION** More detailed knowledge of 'International Regulations for Preventing Collision at Sea' than that at the year level.	**10 Hours**	**10 Hours**
UNIT II	Development of electronic Chart display system. **COLLISION PREVENTION** The IALA system of Buoyage – lateral and cardinal systems.	**10 Hours**	**10 Hours**
UNIT III	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. **COLLISION PREVENTION**	**10 Hours**	
	PRACTICALS 1) To determine ship's position by the 'running Fix' method with and without current. 2) To find the ship's position by 'Doubling the angle on the 3) Bow' method. 4) The use of a station pointer to plot ships position - given two horizontal angles. 5) Collision situations in restricted visibility with or without Radar. Statutory obligations under both circumstances. Recognition of various buoys and marks under IALA system and appropriate actions required under the rules.		**10 Hours**

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

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Reference Books:-

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 – III** **Section - A** Introduction to codes and guidelines for carriage of bulk cargoes, bulk chemicals, bulk gas. **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** Planning stowage of general cargo taking into account stowage factor, port rotation, hazardous nature, special stowage requirements relating not covered by special codes. **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	**Section – A** Principles of stowage/securing of all types cargoes into account ship's motion at sea. Calculations relating to above topics where applicable. **Section -B** FIRE PREVENTION AND FIRE FIGHTING: Causes of fire. The fire triangle. Principles of fire fighting. Types of fire and methods of extinguishing each type. Variou 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. **PRACTICALS** 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**

***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.	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	**SEMESTER - III** **BRIDGE EQUIPMENT** Guidelines for watch keeping at sea and in port. **MARINE COMMUNICATION** Introduction and use of Radio Communication Equipment on board ship for distress and safety – Selection of suitable frequencies. **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.	**15 Hours**	
UNIT II	**BRIDGE EQUIPMENT** Basic principles and use of radar. **MARINE COMMUNICATION** Radio Regulations relating to Maritime Services including maritime frequency allocation. **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.	**15 Hours**	
UNIT III	**BRIDGE EQUIPMENT** Familiarization on : Automatic Identification System (AIS) Voyage Data Recorder (VDR) Bridge Navigation Watch Alarm System (BNWAS) Ship Security Alert System (SSAS) Long Range identification and Tracking (LRIT) **MARINE COMMUNICATION** Satellite Communication and Altering system – Equipment on board and ashore. Methods adopted. **LEGAL KNOWLEDGE** The official Log Book and the law relating to entries Offences relating to misconduct to endangering ship against persons on board. Discipline and treatment to disciplinary offences. Crew accommodation. Hygiene of the ship and welfare of the crew. Inspection and reports. Fresh water and	**15 Hours**	

	provisions. Procedure in cases of infectious diseases, illness or accident Maritime declaration of health. Port Health requirements. **STCW 2010 REQUIREMENTS.** **PRACTICALS** **RADAR:** Practical adjustment of operational controls to their optimum setting. To carry out performance check, using performance monitor. To take ranges and bearings of fixed and moving objects. To identify land objects using radar observations. Evaluation of risk of collision. Use of reflection plotter.	**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. Sonnenberg — Electronic navigation aids
2. Capt. H. Subramanium — Shipborne radar
3. HMSO — International code of signals
4. Telcom handbook for Radio operators
5. Hopkins — Business and Law for Ship Master
6. Bhandarkar Publication — Indian Merchant Shipping Act
7. Bonwick and Steer — Ship's Business
8. I.M.O. Publication — SOLAS
9. I.M.O. Publication — MARPOL
10. I.M.O. Publication — International Convention on Load Lines
11. I.M.O. Publication — Medical First Aid Guide
12. I.M.O. Publication — Search and Rescue Manual
13. Hydrographic Department — Annual Notices to Mariners
14. Hydrographic Department — Weekly Notices to Mariners
15. Bhandarkar Publications — Merchant Shipping Notices

NAVAL ARCHITECTURE-II

		Theory	Practical
UNIT I	**SEMESTER – III** **SHIP STABILITY** Use of Simpson's Rules in the computation of areas; volumes and centroids. **SHIP CONSTRUCTION** Longitudinal and transverse framing, Beams and Beam knees. Functions, constructions and stiffening of water tight bulkheads including collision bulkhead. Shell and deck plating. Bilge keels. Double bottom and peak tanks. Side and wing tanks. Bilges. Construction, stiffening and closing arrangements of opening on deck and superstructures. Sounding pipes, air pipes, ventilators. Hawse-pipes spurling pipes and their securing arrangement.	**15 Hours**	-
UNIT II	**SHIP STABILITY** 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. Longitudinal centre of buoyancy, Longitudinal metacentre and centre of flotation and factors affecting their positions. **SHIP CONSTRUCTION** An outline knowledge of the functions of Classification Societies. Surveys for assignment and retention of class.	**15 Hours**	
UNIT III	**SHIP STABILITY** Theory of Trim. Changes of trim and draft due to loading, discharging and shifting weights. Change of trim due to change of density. Use of stability, hydrostatic and stress data supplied to ships. Calculations based on the foregoing including those based on "Trim and Stability Particulars" of a given ship. **SHIP CONSTRUCTION** 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.	**15 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. 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 - III** 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**

***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:-

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	**SEMESTER - III** **SECTION – A** Engineering Materials – Common Engineering Materials. Various metals & alloys, Properties & uses. Ceramics and their use. 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. Heat treatment – Heat treatment of steels-obtaining desired properties from steel for use in different areas.	**18 Hours**	-
UNIT II	SECTION -B 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.	**14 Hours**	
UNIT III	SECTION -C Transformers: High and Low voltage transformers, step up/step down Transformers, Transformer efficiency and maintenance & care. Power distribution: Maniswitch boards, power distribution boards, Circuit breakers, measuring instruments, overload trip short circuit trip, fuses other protections. Procedures of maintenance of batteries. Purpose & operation of purifier drive. Navigation light circuit with indicators/alarms & alternative power supply. Services to be supplied from emergency generator. Procedure for starting emergency generator manually. **PRACTICALS** **BASIC MARINE WORKSHOP** 1.Electrical wiring diagrams and fittings of simple circuits. 2. Fuses, earthings, tube &other light fittings, etc- practice training. 3. Cutting, filling, 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 % 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	Hannah & Hiller
	Marine Auxiliary Machinery	ouchette & Smith

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-I I **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

	Semester IV	Theory	Practical
Unit I	**MS- Power point:** Explain how to create and save a Power point file. Explain various layout options of a new slides and how to create them. **PDF:** Explain why use a PDF file. Create a PDF document. **C Programming:** Arrays: Declaration and initialization of one dimensional, two dimensional and character arrays. String handling functions from standard library (strlen( ), strcpy( ), strcat ( ), strcmp ( )).	**15 Hours**	
Unit II	**E-Commerce:** The information technologies and its related business. E- Commerce concepts. Cryptography and Digital Signature Protocols for Transactions. **C Programming:** Functions: Need of functions, defining functions, function call with return values.	**8 Hours**	
Unit III	**MS- Access:** Explain what is a database? Explain Tables, Field, Record, Column, Primary Key and a Null value in a database. Introduction to databases using Access 2007. Explain how to create a Table, Query and Form in MS Access 2007. **C Programming:** Pointers: Understanding pointers. Declaring pointer variable, accessing address of a variable and pointer expressions. Structures: Defining structure, declaring and accessing structure members. **Practical's** • MS-Power point: Creating a simple text slides. • PDF: Create a PDF documents. Use converter (Word to PDF) • MS-Access: Create a Table as: College Database with the following:	**22 Hours**	15 Hours

Field Name	Data Type	Field Size or Format
ID	Number	10
Primary Key	Text	
Name	Text	15
Surname	Text	15
Telephone	Number	Number Long Integer
Date of Birth	Date/Time	Medium Date
Stipend	Currency	
Foreigner	Yes/No	Yes/No
Save the table as "Students Table"		

Create a query showing only Student First Name and respective Stipend.
Create a report showing the Fields Name and Telephone Number.

E-Commerce: Simple exercise using HTML. Create a web site with minimum details.

C Programming

- To understand arrays in 'C'.
- To understand functions in 'C'.
- To understand pointers. Write a program to print values and their addresses and call by reference

Problem based on nautical sciences. Like solving a spherical triangle when its three sides are input, etc.

***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

Recommended Books For Reference:

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) Introduction to computer science vol. I & II : Jain S. : BPB
6) Introducing computers I, II & III : Mehta S. : BPB
7) Computer Fundamentals Architecture and Organization: B Ram
8) Let us 'C': Kanitkar, 3rd BPB

APPLIED MATHS - IV

		Theory	Practical
UNIT I	**SEMESTER - IV** **Numerical Methods:** 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, Langrangian interpolation, Sterling and Bessel's interpolation formulas, Numerical integration: rectangular and trapezoidal rule, Simpson's rules. Solutions to systems of linear algebraic equations: Gause elimination, Gauss-Jordan method, Gauss-Seidel integration Jacobi integration.	**25 Hours**	-
UNIT II	**Matrices:** 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 quadratic form.	**25 Hours**	
UNIT III	**Statistics:** 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.	**40 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 % 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 Spiegal — 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	**SEMESTER - IV** **ANALOG CIRCUITS** 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: **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: **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	**15 Hours**	-
UNIT II	**DIGITAL CIRCUITS** 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 andde multiplexer), De Morgan's theorems; Boolean algebra, NAND and NOR as a basic building blocks, Logic levels for TTLIC's Ref: ML **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. **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	**25 Hours**	
UNIT III	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	20 Hours	

	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 Cathode Ray Oscilloscope: Construction, working and basic measurements. **26 Hours** Ref: BN. **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: **EXPERIMENTS** 1) CE Amplifier – voltage gain, frequency response, plotting A.C. & D.C. load lines. 2) Emitter Follower – voltage gain & output resistance. 3) Op-Amp – inverting & non-inverting amplifier, voltage follower, summer & difference amplifiers. 4) Op-amp – square wave generator, slew rate. 5) Timer – astable & monostable multivibrators. 6) Wien Bridge Oscillator – transistor & op-amp versions. 7) Study of Basic Logic Gates – NOT, AND, OR, NAND, NOR. 8) DeMorgan's Laws & use of NAND & Nor as basic building blocks. 9) J-K Flip Flop – truth table, Ripple & Decade counters. 10) Microprocessors: 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. Simple Input & Output programs		30 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

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	**SEMESTER – IV** **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. **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.	**15 Hours**	-
UNIT II	**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 **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).	**22 Hours**	
UNIT III	**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). **PRACTICAL NAVIGATION** To find the intercept, Intercept termination point and direction of position line from an observation of any heavenly body. (Intercept Method). **PRACTICAL** 1. Use of Azimuth Mirror and pelorus.	**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:-

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	**SEMESTER – IV** **VOYAGE PLANNING** The interpretation of a chart or plan, particularly the information given about Lights, Buoys, Radio Beacons and other Navigational Aids. **COLLISION PREVENTION** Precautions while using floating navigational aids, such as buoys, light vessels etc.	**10 Hours**	**05 Hours**
UNIT II	**VOYAGE PLANNING** Depths and height counters. Tidal Streams Traffic lanes and separation zones. Recognition of the coast and radar responsive targets. Chart correction. **COLLISION PREVENTION** Radar Plotting exercises.	**10 Hours**	**05 Hours**
UNIT III	**VOYAGE PLANNING** Geographical Range, Luminous Range, Nominal range; and their significance. **COLLISION PREVENTION** Relative plot. Action by own ship, Action by Target ship. Set and Drift. **PRACTICALS** **VOYAGE PLANNING** Use of single position line obtained from a celestial observation when near a coast to keep safe distance off the coast. To find course made good using the three point bearing method. **COLLISION PREVENTION** 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. 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'. NOTE: The second year examination will include the entire 'practical's portion of the first year.	**10 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:-

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** **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.	**15 Hours**	-
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. **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.	**18 Hours**	
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. **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 by 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.	**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:-

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 LNOWLEDGE-II

		Theory	Practical
UNIT I	**SEMESTER - IV** **BRIDGE EQUIPMENT** **MARINE COMMUNICATION** Global Maritime Distress and Safety System – principles and actual applications. **LEGAL KNOWLEDGE** Custom House procedure, entering and clearing ship. Load Line Marks, Entries and reports in respect of freeboard. Draft and allowance. Calculations on Lay day and Load Line (zone problems). Safety of the ship, crew and passengers. Assistance to vessels in distress and salvage. Duties of Master in the case of an accident.	**15 Hours**	-
UNIT II	**BRIDGE EQUIPMENT** **MARINE COMMUNICATION** World Wide Navigational Warning System – India's role as a Co-coordinator for area 8. **LEGAL KNOWLEDGE** The law relating to the reporting of derelicts, tropical revolving storms and other dangers to navigation. Compulsory and non-compulsory pilotage	**15 Hours**	
UNIT III	**BRIDGE EQUIPMENT** **MARINE COMMUNICATION** Meteorological Broadcast – Routine weather messages and storm warnings. Search and Rescue Communications. **LEGAL KNOWLEDGE**: 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. A knowledge of the contents of "Merchant Shipping Notices" and Notices to Mariners. The use of Notices to Mariners. **PRACTICALS** ECHO SOUNDER: Use and care of both visual and graphic types. To take soundings using Echo Sounder or Echo sounder simulator. **MARINE COMMUNICATION** Practical usage of 'International Code of Signals'. To prepare portable radio equipment for operation. Ship to ship and ship to shore communication exercises by portable VHF sets.	**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:-

16. Sonnenberg — Electronic navigation aids
17. Capt. H. Subramanium — 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** **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. **SECTION B - SHIP CONSTRUCTION** Rudders, construction and support. Stern frame, Propellers and Propeller shaft; stern tube and adjacent structure.	**15 Hours**	-
UNIT II	**SECTION A – SHIP STABILITY** Carriage of deck cargoes and their effect on stability. **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.	**15 Hours**	
UNIT III	**SECTION A – SHIP STABILITY** 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. **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.	**15 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:-

Capt. H. Subraminiam	Ship Stability I, II, III
Derrett	Merchant Ship Stability for Master and Mates
Kemp & Young	Notes on Stability
Capt. Lester	Stability for Merchant ships
La Dage & Gemert	Stability
Capt. Joseph & Capt. Rewari	Problems on Hindship

Reeds	Ship Construction for Marine Students
Kemp & Young	Ship Construction
Eyres	Ship Construction
Pursey	Ship Construction
Taylor	Ship Construction
IMO	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	**SEMESTER - IV** **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. 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. 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. 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.	**18 Hours**	-
UNIT II	**Atmosphere:** Factors affecting atmospheric motion and the resulting winds – Newton's laws and equation of motion – Basic patterns of air movement. 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	**14 Hours**	
UNIT III	Seasonal weather and climatic characteristics over India – Cyclones in Indian seas and their impact on coastal life. Weather forecasting: methods and techniques – Constraints in accurate forecasts. **PRACTICALS** 2. Plotting of weather details at surface stations 3. Plotting of tephigrams and their interpretation. 4. Tracking of cyclones.5. 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.	**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:-

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.

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MARINE ENGINEERING & CONTROL SYSTEM- II

		Theory	Practical
UNIT I	**SEMESTER - IV** **SECTION - A** a) 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. b) Steam – types of marine steam boilers. Construction and operation of water tube and smoke tube boiler. Boiler mountings, accessories, safety features. Waste heat recovery boiler. Boiler maintenance. Importance of boiler feed water chemical treatment. c) Compressed air - air compressor, uses of compressed air. Storage and distribution of compressed air	**18 Hours**	-
UNIT II	**SECTION-B** a) Refrigeration & Air conditioning: Principle of refrigeration, compression refrigeration cycle, components & operation. Arrangement of cold storage holds. b) Pumps – working principle, construction of different types of pumps. Selection of pumps for different duties onboard the ship. c) Steering – common types of steering gear, electro-hydraulic steering gears, two and four ram systems, telemotors and control systems. Safety features. Emergency arrangements. Legislation national and international operation and maintenance. Hydraulic systems – rotary vane actuators. Electric steering. Variable delivery pump. Steering gear circuits. Safe-matic system.	**14 Hours**	
UNIT III	**SECTION-C** a) Working principles: Classification of various types of engines, various types of modern diesel engines. Basic principles of cycles, P-V diagrams, work done etc. four stroke and two stroke engines b) Components – construction, main components and working **PRACTICALS** **BASIC MARINE WORKSHOP** 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.	**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:-

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:

The performance of the learners shall be evaluated into two parts. The learner's performance shall be assessed by Internal Assessment with 25% marks in the first part & by conducting the Semester End Examinations with 75% marks in the second part.

The Course having Practical training will have Practical Examination for 50 marks at the end of Semester, out of which 30 marks for the Practical task assigned at the time of examination. The 20 marks are allotted as Internal Assessment.

The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below:-

Internal Assessment : It is defined as the assessment of the learners on the basis of continuous evaluation as envisaged in the Credit based system by way of participation of learners in various academic and correlated activities in the given semester of the progamme.

Semester End Assessment : It is defined as the assessment of the learners on the basis of Performance in the semester end Theory/ written/ Practical examination.

Modality of Assessment :

Internal Assessment - 25% **25 marks.**

a) Theory **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

B) External examination - 75 %

Semester End Theory Assessment - 75% **75 marks**

i. Duration - These examinations shall be of 2.5 hours duration.

ii. Theory question paper pattern :-

1. There shall be four questions.
2. On each unit there will be one question & fourth one will be based on entire syllabus.
3. Question number 1, 2 & 3 will be 20 marks(40 marks with internal option) each and question number 4 will be 15 marks (30 marks with internal option).
4. All questions shall be compulsory with internal choice within the questions.
5. Questions may be sub divided into sub questions a, b, c, d & e only & the allocation of marks depends on the weight age of the topic.

Practical External Assessment **50 marks**