

University of Mumbai



No. UG/ 11 of 2020-21

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges and Directors of the recognized Institutions in Science & Technology Faculty is invited to this office circular No.UG/75 of 2015-16, dated 15th September, 2015 relating to the revised syllabus as per the (CBSGS) for the First Year (Sem. I & II) of B. Sc Programme in Nautical Science.

They are hereby informed that the recommendations made by the Ad-hoc Board of Studies in Nautical Science at its online meeting held on 15th April, 2020 vide item No.1 and subsequently made by the Board of Deans at its meeting held, on 26th June, 2020 vide item No. 13 (4) have been accepted by the Academic Council at its meeting held on 23rd July, 2020 vide item No. 4.69 and that in accordance therewith, the revised syllabus as per the (CBCS) of F.Y. B.Sc. Nautical Science (Sem - I&II) has been brought into force with effect from the academic year 2020 -21 accordingly. (The same is available on the University's website www.mu.ac.in).

MUMBAI - 400 032
11th November, 2020


(Dr. Vinod Patil)
I/c REGISTRAR

To

The Principals of the affiliated Colleges and Directors of the recognized Institutions in Science & Technology Faculty. (Circular No. UG/334 of 2017-18 dated 9th January, 2018.)

A.C/4.69/23/07/2020

No. UG/ 11 -A of 2020-21

MUMBAI-400 032

11th November, 2020

Copy forwarded with Compliments for information to:-

- 1) The Dean, Faculty of Science & Technology,
- 2) The Chairman, Ad-hoc Board of Studies in Nautical Science,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Co-ordinator, University Computerization Centre,


(Dr. Vinod Patil)
I/c REGISTRAR

Copy to :-

1. The Director of Board of Student Development.,
2. The Deputy Registrar (Eligibility and Migration Section)
3. The Director of Students Welfare,
4. The Executive Secretary to the to the Vice-Chancellor,
5. The Pro-Vice-Chancellor
6. The Registrar and
- 7 The Assistant Registrar, Administrative sub-centers, Ratnagiri, Thane & Kalyan, for information.

1. The Director of Board of Examinations and Evaluation
2. The Finance and Accounts Officers
3. Record Section
4. Publications Section
5. The Deputy Registrar, Enrolment, Eligibility and Migration Section
6. The Deputy Registrar (Accounts Section), Vidyanagari
7. The Deputy Registrar, Affiliation Section
8. The Professor-cum- Director, Institute of Distance and Open Learning Education,
9. The Director University Computer Center (IDE Building), Vidyanagari,
10. The Deputy Registrar (Special Cell),
11. The Deputy Registrar, (PRO)
12. The Deputy Registrar, Academic Authorities Unit (1 copies) and
13. The Assistant Registrar, Executive Authorities Unit

They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.

1. The Assistant Registrar Constituent Colleges Unit
2. BUCTU
3. The Deputy Accountant, Unit V
4. The In-charge Director, Centralize Computing Facility
5. The Receptionist
6. The Telephone Operator
7. The Secretary MUASA
8. The Superintendent, Post-Graduate Section
9. The Superintendent, Thesis Section

for information.

Academic Council _____

Item No. _____

UNIVERSITY OF MUMBAI



Syllabus For Program: B. Sc.

Nautical Science (NS)

Syllabus for Semester I & II

**CHOICE BASED CREDIT AND GRADING
SYSTEM (CBCGS)**

With effect from the academic year 2020-2021

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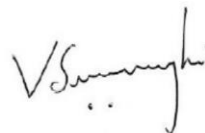
Item No. _____

UNIVERSITY OF MUMBAI

Sr. No.	Heading	Particulars
1.	Title of the Program	B.Sc. (Nautical Science)
2.	Eligibility for Admission	• Indian National • HSC or equivalent Certificate • Mark Sheet showing minimum 60% marks in PCM subjects in HSC (10+2). • Minimum 50% Marks in English language in SSC or HSC • Age not more than 25 yrs on the date of commencement of course. Age relaxation as per govt. Rules. • Medical Fitness Certificate from a Doctor approved by Director General of Shipping • Eye Sight Test Certificate -6x6 both eyes and no colour blindness from any DG approved doctor
3.	Entrance Examination	Should have passed CET conducted by IMU
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 2020-21 (w.e.f. Academic Year 2020-21 onwards.)

Date:

Signature:



Name BOS Chairperson / Dean:

Capt. Vinod Suryavanshi

Cover Page

UNIVERSITY OF MUMBAI

Syllabus for Approval

1. Title of the Program:- B.Sc. (Nautical Science)

Program Code: – 42300006

2. Preamble / Scope:-

P R E A M B L E

This course is an integral part of the overall shipboard structured training programme for the prospective navigating officer and guidelines set by DG Shipping of India. 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 12 months onboard ship in practical application of the theory learnt. Thereafter at the end of this structured programme, a “contact programme” for four months (optional) may be conducted at any of the DG approved Institute to prepare the Cadets for a written & oral examination conducted by the Director General of Shipping, Ministry of Surface Transport, Government of India.

On successful completion of the Programme a Cadet will be awarded a degree of B.Sc. (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 years 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 celestial 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 signaling, 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, as amended
- ~ Study of various SCTW 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 GT or more as specified in Regulation II/1, Table A-1 of STCW 1978, as amended.

This course is aimed at preparing the trainee 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 as 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 9:00 in the evening, as per the requirement on board ships

- Morning exercise, parade, evening sports and 1 hour 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 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 as instructed by D.G Shipping through its training circulars or as the case may be.

Syllabus Committee Members

1)	Capt. Vinod Suryavanshi	Convener/BOS Chairperson
2)	Capt. (Dr.) Ashutosh Apandkar	Invitee/Ex BOS Chairperson
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)

3. Eligibility:-

- Indian National
- HSC or equivalent Certificate
- Mark Sheet showing minimum 60% marks in PCM subjects in HSC (10+2).
- Minimum 50% Marks in English language either in SSC or HSC
- Age not more than 25 yrs for HSC students on the date of commencement of course. Age relaxation as per govt. Rules.
- Medical Fitness Certificate from a Doctor approved by Director General of Shipping
- Eye Sight Test Certificate -6x6 both eyes and no colour blindness from a DG approved doctor

B.Sc. in Nautical Science: Theory/Practical: 16 Weeks (15 weeks for lectures/practical & one week for semester end examination)

Semester –I

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										
USNSc102	Navigation –I	3	1	45	15	100	50	3	2	5
	Voyage Planning & Collision Prevention– I	2	2	30	30	100	50			
USNSc103	Ship Operation Technology-I	3	1	45	15	100	50	3	2	5
	Cargo Work & Marine Communication	3	1	45	15	100	50			
	Naval Architecture-I	3		45		100				
AECC – Ability Enhancement Compulsory Course										
USNSc101	Applied Mathematics-I	4		60		100		3	1	4
	Nautical Physics & Electronics-I	4	2	60	30	100	50			
SEC - Skill Enhancement Course										
USNSc101	English & Communication Skills	3	1	45	15	100	50	1	1	2
DSE – Elective: Discipline Specific										
USNSc104	Environmental Science-I	3	1	45	15	100	50	2	2	4
USNSc104	Marine Engineering & Control System - I	3	1	45	15	100	50			
Total		31	10	465	150	1000	400	12	8	20

Semester II

Course Code	Title of the Course	Per Week		Per Semester		Marks		Credits		Total
		L	P	L	P	TH	PR	L	P	
Core Course										
USNSc202	Navigation –I	3	1	45	15	100	50	3	2	5
	Voyage Planning & Collision Prevention– I	2	2	30	30	100	50			
USNSc203	Ship Operation Technology-I	3	1	45	15	100	50	3	2	5
	Cargo Work & Marine Communication	3	1	45	15	100	50			
	Naval Architecture-I	3		45		100				
AECC – Ability Enhancement Compulsory Course										
USNSc201	Applied Mathematics-I	4		60		100		3	1	4
	Nautical Physics & Electronics-I	4	2	60	30	100	50			
SEC - Skill Enhancement Course										
USNSc201	English & Communication Skills	3	1	45	15	100	50	1	1	2
DSE – Elective: Discipline Specific										
USNSc204	Environmental Science-I	3	1	45	15	100	50	2	2	4
	Marine Engineering & Control System - I	3	1	45	15	100	50			
Total		31	10	465	150	1000	400	12	8	20

Objective: - This subject exposes the students to English & Communication skills, Applied Mathematics & Nautical Physics

Contents of syllabus for USNSC 101 - ENGLISH & COMMUNICATION SKILLS

Semester I

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	1.1 Comprehension passages – Prose and short stories out of below mentioned: 1.1.1 The Refugee – K.A. Abbas 1.1.2 Happiness 101 – Geeta Padmanabhan 1.1.3. The Google guys 1.1.4. The Postmaster – Rabindranath Tagore 1.1.5. A Garden So rich – Christie Craig 1.1.6. The Umbrella Man – Roald Dahl 1.2 Reading Process, Sub-Skills of Reading, Reading Techniques, Note Making Techniques, Summarizing and Paraphrasing. 1.3 Integrated Grammar 1.4 Importance of effective communication on board- Difference between General and Technical Communication - Key Aspects and Barriers of Communication	15 Hrs.	
Unit II	Written Communication 2.1: Writing Process (identify, organize and list the points/ideas related to a given topic in a proper logical sequence and write a rough draft and final draft), Sentence Structure, Sentence Coherence, Paragraph Writing. 2.2: Letter Writing: Types, Parts, Style and Tone, 2.2.1: FORMAL LETTERS- Official and Semi-Official Letters: application of appointment, leave application, formal invitations, requisition letter, grievance letter, commercial letters and letter to influence public opinion 2.2.2: INFORMAL LETTERS: letters to friends and relatives.	28 Hrs.	

	2.3 Resume writing. 2.4 Email Writing. 2.5 Factual Reports (Informative): Types of Reports (Routine/Special), Incident Report, Accident Report, Visit Report, Feedback. 2.6 Log book writing & Diary writing. 2.7 Essay writing on contemporary topics. 2.8 Safety circulars and notices 2.9 Agenda and minutes of a meeting		
Unit III	3: Skills of oral communication 3.1: Presentation skills – Group activities 3.2 Asking for and giving personal data 3.3 Expressing personal likes and dislikes, preferences 3.4 Describe crew roles and routines 3.5 Sea speak- SMCP phrases and maritime English- Procedure, Spelling, Message Markers, Responses, Distress/ Urgency, Safety Signals, Corrections, Readiness, Repetition, Numbers, Positions, Bearings, Courses, Distance, Speed, Time, Geographical names, ambiguous words	2 Hrs	
Practical	All items under skills of oral communication, i.e. item 3 under course content.		15 Hrs.

Contents of syllabus for USNSC 201 - ENGLISH & COMMUNICATION SKILLS
Semester II

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	1.1 Comprehension passages - Seen and unseen comprehension- Prose and short stories out of below mentioned: 1.1.1 The Cellphonic Epidemic 1.1.2 The Lion and the Lamb	18 Hrs.	

	1.1.3. The Lady or the Tiger? 1.1.4. The Sky is the Limit 1.1.5. The Model Millionaire 1.1.6. The Adventure of the Dying Detective 1.2 Development of logical reasoning and analytical ability to enhance situational thinking and strategizing. 1.3 Technical writing definition and characteristics giving		
Unit II	2. Writing Skills. a) Maritime correspondence. b) Report writing c) Welcome address d) Vote of thanks e) Essay writing	18 Hrs.	
Unit III	3.1 Importance of SMCP and English language among multilingual crew- Procedure, Spelling, Message Markers, Responses, Distress/ Urgency, Safety Signals, Corrections, Readiness, Repetition, Numbers, Positions, Bearings, Courses, Distance, Speed, Time, Geographical names, ambiguous words, omission of 'may', 'might', 'should' and 'could'. 3.2 Phonology: Pronunciation, Work Stress, Intonation, Sentence Stress. 3.3 Presentation Skills: Content Structuring, Preparation & Planning, Welcome Note, Vote of thanks. 3.4 Facing Interview: Attitude, Etiquette, Body Language and Diction. 3.5 "Sea-Speak" Training Manual: External Communication & Internal Communication on Board Ship. 3.6 Group Discussion & Extempore Speeches.	9 Hrs.	
Practical	All topics covered in unit III		15 Hrs.

***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. Spring Text book- Board of Editors
2. Panorama- English for Communication- Board of Editors
3. IMO Standard Marine Communication Phrases (SMCP) London- IMO

**Contents of syllabus for USNSC 101 – APPLIED MATHEMATICS - I
Semester I**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	Complex Variables & Vector Algebra and Calculus Definition, Cartesian, Polar & exponential form. De- Moivre's Theorem. Power & Roots of Exponential and Trigonometric Functions. Hyperbolic & Logarithmic Functions. Inverse Hyperbolic & Inverse Trigonometric Functions. Separation into real and imaginary parts of all types of functions. Vector Algebra and Calculus Scalar and Vector Triple Products. Differentiation of a vector functions of a single scalar variable. Derivative of a unit vector.	20 Hrs.	
Unit II	Vector analysis Gradient, divergence and curl, Divergence theorem, Stoke's theorem, expressions for gradient, divergence and curl in orthogonal curvilinear co-ordinates, Gauss theorem, Equation of heat flow, equations of hydrodynamics. Differential Calculus Successive differentiation. Standard form to find the nth derivative. Rolle's theorem (with proof), Lagrange's and Cauchy's mean value theorem (with proof).	20 Hrs.	

Unit III	Spherical trigonometry & Simpson's Rules Properties of a spherical triangle and oblique spherical triangle. Cosine formula, Haversine formula, Sine formula and four part formula and their application to Navigational problems. Polar triangle and application of their properties. Right angle and quadrantal triangles. Napier's Rules and their application to Navigational problems. Area of spherical triangles. Inequalities, Derivation of formula by supplemental theorem, 'Half angle' formula, 'Half side' formula, Identities. Delambre's Analogies, Napier's Analogies, Legendre's theorem. Derivation of Simpson's first, second and five-eighth rules and their use in the computation of areas, volumes and centroids.	20 Hrs	
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Contents of syllabus for USNSC 201 – APPLIED MATHEMATICS - II
Semester II

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	Integral Calculus and Beta & Gama Functions Rectification of plane curves. Double & Triple integrals, their geometrical interpretation and evaluation. Evaluation of double integrals by change of order and change to polar form. Applications of double & triple integrals to areas and volumes Centre of mass, Moment of Inertia. Beta & Gama functions & their properties, relations between Beta & Gama functions. Error functions	20 Hrs.	
Unit II	Infinite Series and Fourier Series Convergence of infinite series, uniform convergence, properties of uniformly convergent series, Exponential and logarithmic series, definition of Trigonometric and Fourier series, Fourier coefficients, expansion of functions in Fourier series, Even and Odd functions, half range Fourier series, Differentiation and Integration of Fourier Series, Fourier series with respect to a set of	20 Hrs.	

	orthogonal functions over (a,b). [Fourier series over $(-\pi, \pi)$, $(0, 2\pi)$ and for arbitrary range (a, a+2L) must be treated.		
Unit III	Differential Calculus Indeterminate forms. L'Hospital's rule, Expansion of function in power series (all types), Partial derivatives of first and higher orders. Total differential. Euler's theorem on homogeneous functions. Deduction from Euler theorems. Errors & approximations. Maxima & Minima the functions of two variables. Differential equations a) Exact differential equations and those which can be made exact by use integrating factors by inspection. (i) Linear Equations and reducible to linear (Bernoulli) equations, (ii) Method of substitution to reduce the equations to one of the above forms. b) Linear Differential Equations of the nth order with constant coefficients. Complimentary function and Particular integral when the function of the independent variable R.H.S. is e^{ax} , x^n , $e^{ax}V(x)$, $\sin(ax+b)$, $\cos(ax+b)$. Cauchy's Linear equation (homogeneous). Legendre's Linear equation. Variation of parameters and method of indeterminate coefficients. c) Elementary applications of above differential equations in solving engineering problems such as Electrical Engg., Mech. Engg.	20 Hrs.	

***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. An introduction to Spherical Trigonometry | Clough-Smith J.H |
| 2. Spherical Trigonometry | Capt. H. Subramaniam |
| 3. Higher engineering Mathematics | Dr. B.S. Grewal |
| 4. A Text book of applied mathematics | Wartikar P.N. & Wartikar J.N. |
| 5. Integral Calculus | Shanti Narayan |

Contents of syllabus for USNSC 101 – NAUTICAL PHYSICS & ELECTRONICS - I

Semester I

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	MECHANICS Review of Newton's Law of motion. Circular motion, Centripetal and Centrifugal forces. Law of Gravitation. Work, Power and Energy, Potential and Kinetic Energy. Conservation of Energy, Conservation of linear momentum, Impulse, collision – direct and oblique impact. Explain and apply triangle and parallelogram law of forces. Centre of Mass and Centre of Gravity, Rotational Motion, Torque, Angular Momentum, conservation of angular momentum. Hydrostatics: - Archimedes Principle, upthrust, Buoyancy, Pressure at a depth. Atmospheric Pressure, Barometer. Hydrodynamics: - Streamlines, Turbulence, Pascal Law. Equation of continuity. Bernoulli's equation: - Stability and Spin, Aerofoil, lift, Rotating cylinder ship. Surface Tension: - Capillarity, Angle of contact, Excess Pressure inside a bubble, Air bubbles in an oil tank. Oscillation: - S.H.M and its features, Typical examples – A helical spring, a pendulum. Damped & undamped oscillations, Forced oscillations (vibrations), Resonance.	20 Hrs.	
Unit II	SOUND & LIGHTS Velocity of sound, Effect of pressure, temperature and humidity on velocity of sound, Pitch, Quality & Loudness, The Decibel. Doppler Effect. Principle of Radar, echo sounder. Refraction of sound waves, Effect of wind & Temperature. Propagation of light, Shadows, Eclipses, Reflection of light at plane and curved surfaces, Rotation of a plane mirror, Refraction. Total internal reflection. Mirages. Optical fibre, the	25 Hrs.	

	azimuth mirror, Periscope. Lenses, Image formation, Telescope, Prism Binocular. Explain why wheelhouse windows are required to be inclined.		
Unit III	HEAT AND THERMODYNAMICS Transfer of Heat: Conduction, Convection and Radiation. Expansion of solids, liquids and gases and their effect on liquid cargoes. Equation of state for gases, isothermal and adiabatic processes. First law of Thermodynamics, Second law of Thermodynamics – Carnot cycle. The Heat engine and refrigerator, Concept of Entropy.	15 Hrs	
Practical	EXPERIMENTS 1) Demonstration of block and tackle arrangements. 2) Demonstration of a Weston Differential pulley. 3) A single cantilever (loaded at one end). Determinations of Y. 4) Surface tension of liquid by capillary rise method. 5) Moment of Inertia of Flywheel and Frictional Torque. 6) Velocity of sound in air (Using a CRO). 7) Use of CRO to study the characteristics of an audio oscillator (Frequency, Period, Amplitude). 8) Study of Laser: Interference and diffraction due to a single and double slit. 9) Stefan's Law of radiation using a filament lamp. 10) Thermistor as a Thermometer. 11) Determination of angle of repose of grains 12) Determine focal length of combination of lenses. NOTE: A minimum of 8 experiments are expected to be performed		30 Hrs.

Contents of syllabus for USNSC 201 – NAUTICAL PHYSICS & ELECTRONICS - II

Semester II

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	ELECTRICITY AC and DC voltages, dangerous levels, precautions. Static electricity and its hazards. Work, energy, power in a circuit. Magnetic Effect: Magnetic field due to a stationary coil, Electromagnet, Circular lifting magnet. Review of electro – magnetic induction. Faraday – Lenz’s Law, transformer. The AC generator, The DC generator.	17 Hrs.	
Unit II	ELECTRONICS Semiconductors of p and n type, p-n junction diodes-their characteristics, half-wave, full wave & bridge rectifiers, voltage regulation. Ripple, Capacitor filter, Zener Diode, its uses as a voltage regulator. Thermistors: - Use in temperature control. Transistors: - pnp, npn, 3 modes of operation, current gains α and β . Photoelectric effect, opto-electronic devices – LDR, LED. 7 – Segment displays, photo diode, photo transistor.	18 Hrs.	
Unit III	MAGNETISM & MODERN PHYSICS Earth as a magnet, magnetic elements and their variation. Magnetism of the ship and its components. Effect of motion of the ship and latitude on the compass. Radioactivity, emissions from natural radioactive nuclei, radioactive series. Detection of radiation, GM counter, radiation units. Radiation damage, Nuclear fission and fusion, Nuclear Reactors. Nuclear hazards & precautions.	25 Hrs.	
Practical	EXPERIMENTS 1. Series L-R and C-R AC circuits,		30 Hrs.

	Determination of impedance, L & C. 2. Magnetic elements of the earth, use of a Dip circle. 3. Use of multimeter (analog and digital) to determine resistance. Comparison with color code value. 4. Use of multimeter (analog and digital) for testing of diodes and transistors. 5. Forward and Reverse characteristics of Rectifier Diode and a Zener Diode. 6. CE characteristics of an npn transistor, Determination of α and β. 7. Half wave Rectifier – Voltage regulation and ripple. Effect of a capacitor filter. 8. Full wave rectifier – Voltage regulation and ripple. Effect of a capacitor filter. 9. Study of an IC voltage Regulation, Voltage regulation and ripple. 10. LED and LDR characteristics. 11. Use of Digital multimeter and DPMs is preferred for measurement of voltage and current. 12. Ripple to be obtained on CRO. NOTE: A minimum of 8 experiments are expected to be performed.		
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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 % as per Training Circular No 4 of 2005 by DG Shipping, Govt of India.

Reference Books:

- | | |
|------------------------------------|-------------------------|
| 1. Electronic Principles | Malvino, TMH |
| 2. Electronic Devices and Circuits | Boylestead & Nashelsky |
| 3. Physics – Classical & Modern | Gettys, Keller, Skove |
| 4. University Physics | Young, Sears & Zemansky |
| 5. Electricity & Magnetism | Brijlal & Subramaniam |

6. Physics Part II
7. Modern Physics
8. Basic Electronics

Halliday & Resnick
B.L. Thareja
B.L. Thareja

Books for Practical for Paper I & II

1. Advanced level Practical Physics
2. Electronics – A Test Lab Manual

M. Nelkon & J.M. Ogborn
Zabar

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

Contents of syllabus for USNSC 102 – NAVIGATION I

Semester I

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	Introduction to Sea Navigation, Navigable waters on the Earth – Oceans and major ocean routes, seas, canals, straits, navigable rivers. Continents, major ports of the world. The shape of the earth, Poles, Equator, Great circles, Small circles, Parallels of latitude, Latitude, D'Lat, Meridians, Prime meridian, Longitude, D'long, Position by latitude & longitude. Measurement of distance: Nautical, Geographical and Statute mile. Knot. Effect of polar compression on nautical mile.	10 Hrs.	
Unit II	Section A Compass Points: True and Magnetic north. Magnetic variation and changes in its annual value. Isogonals. Deviation of magnetic compass, compass error. Course & Bearing. Conversion of compass course to true course and vice versa. Departure. Relationship between Departure and D'long. Parallel sailing. Section B Practical problems on parallel sailing using formulae	15 Hrs.	
Unit III	Section A Rhumb Line: Mean latitude. Plane sailing. Relationship between departure, d'lat, course & distance. Middle Latitude. Section B – Practical problems on plane sailing using formulae.	20 Hrs.	

Practical	Lay out of Bridge and Integrated Bridge: Sketch the layout of the Bridge with its Navigational Equipment, Use of various Navigational Equipments. Introduction to Integrated Bridge. The chronometer. Checking chronometer error by radio signals. Finding U.T and correct date. The micrometer Sextant. Arc of excess. Error of perpendicularity. Side error. Index error on the arc and off the arc. Collimation error. Taking vertical and horizontal angles.		15 Hrs.
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**Contents of syllabus for USNSC 202 – NAVIGATION I
Semester II**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	Section A Principles of Mercator projection: Mercator chart, Natural Scale, Meridional parts; DMP. Latitude and longitude scales and conversion of one to the other; Mercator sailing. Relationship between Course, D'long and DMP. Principle of Gnomonic projection. Gnomonic chart. Section B Practical problems on Mercator sailing using formulae.	15 Hrs.	
Unit II	Section A Dead Reckoning position (DR), Estimated position (EP) and Observed position (Fix). Set and drift of current. Leeway. Spherical triangle. Great circle sailing: initial course, final course, distance using cosine formula. Section B The Use of Traverse Tables to obtain the position of the ship at any time, given compass course, variation, deviation, and the run recorded by the log or estimated speed or engine speed allowing for the effects of wind and current, if any. Day's work.	15 Hrs.	

Unit III	Section A Solar System: Rotation and Revolution. Equinoxes and solstices. Cause of seasons and unequal length of day and night. The principle of the Sextant and the Azimuth Mirror Section B To find initial course, final course and distance between two positions on the earth's surface by Great Circle Sailing.	15 Hrs.	
Practical	Recognition of important stars with reference to stellar constellations. The use of Azimuth mirror and Pelorus. Procedure for checking accuracy of azimuth mirrors. The use and care of magnetic compasses. Precautions to be observed while taking compass bearings. Practical limitations of the magnetic compasses.		15 Hrs.

***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. Joseph and Capt. Rewari |
| 2. Principal of Navigation | Capt. P. M. Sarma |
| 3. Practical Navigation | Capt. H. Subramaniam |
| 4. Admiralty Manual of Navigation Vol. I & II | |
| 5. Nicholl's Concise Guide Vol. I & II | |
| 6. Bridge Equipment, Charts and Publications | Capt. H. Subramaniam |

Contents of syllabus for USNSC 102 – VPCP I Semester I

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	VOYAGE PLANNING The nautical chart. Natural Scale, types of projections, Title of Chart, Number of Chart, Date of Publication. Deciphering the symbols and abbreviations used on a nautical chart (Chart BA 5011 & BA 5012). Units of Soundings used.	10 Hrs.	

	How to read latitude and longitude. The use of parallel rulers to lay down or read courses and bearings. The compass Rose. The distance scale. Use of dividers to measure distances. Reason for using the nearest latitude scale for measuring distance. COLLISION PREVENTION International Regulations for preventing collisions at sea. Part A – General (Rule 1 to 3) Application. Exceptions for local rules or harbors etc. Exception for special class of ships. Responsibility for the consequence of neglect of rules. Definitions of term ‘Vessel’. ‘Power driven vessel’, ‘sailing vessel’, ‘fishing vessel’, ‘seaplanes’, ‘Underway’ etc.		
Unit II	VOYAGE PLANNING Correction from Notices to Mariners. Weekly, Cumulative & Annual summary of admiralty notices to mariners. T & P Corrections. To find the date the chart was last brought up to date. Small and large Corrections. Degree of reliability of information shown on the chart. COLLISION PREVENTION IRPCS Part B – Section I – (Rule 4 – 8). Conduct of vessel in any condition of visibility, Maintenance of proper look out. Maintenance of safe speed. Factors to be considered for determining safe speed. Determination of risk of collision with another vessel. Use of radar in determining risk of collision. Use of visual bearings. Types of actions to be taken to avoid collision or close quarter situation	10 Hrs.	
Unit III	VOYAGE PLANNING Types of chart – Ocean charts, coastal charts, harbour plans, Routeing charts. Various nautical Publications. The use of the Admiralty Catalogue to identify the charts required for the voyage. COLLISION PREVENTION IRPCS Part B – Section I – (Rule 9 – 10). Conduct of vessels in narrow channels and when approaching blind bends. Conduct of vessel in traffic separation schemes of International Maritime Organization.	10 Hrs.	

Practical	VOYAGE PLANNING 1. To find the position of a point on the chart by its latitude and longitude 2. To find the position of a point on the chart by its bearing and distance from a navigational marks 3. To measure the course & distance between two points on chart. 4. To find compass error by transit bearings 5. To plot ship's position given the compass bearings of two or more shore objects. 6. To plot ship's position given the rising or dipping bearing of a light. 7. To plot ship's position using three shore objects by horizontal sextant angles (given Horizontal sextant angle less than 90, equal to 90, or greater than 90). 8. To plot ship's position, given vertical sextant angles and bearing of a light house. Note – Collision Prevention Practical Syllabus same as Theory syllabus.		30 Hrs.
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**Contents of syllabus for USNSC 202 – VPCP I
Semester II**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	VOYAGE PLANNING Meaning of Chart Datum. Reference point used for heights. Nature of bottom. Depth Contours. Information regarding lights. Height, colour and characteristics of lights. Use of leading lights for safe navigation in harbour. Horizontal sectors of lights and their use by navigators in keeping clear of submerged dangers to navigation. Use of sectors in laying courses. Use of clearing marks and horizontal and vertical danger angles. Sailing round an arc. COLLISION PREVENTION IRPCS Part B – Section – II – Rules 11 – 15. Conduct of vessel in sight of one another, Responsibilities to keep out of way when two sailing vessels are on collision course.	10 Hrs.	

	Responsibility to keep out of way when one vessel is overtaking another vessel of any type. Action to be taken by a vessel when meeting another vessel head on. Responsibility to keep out of way when two vessels are crossing each other.		
Unit II	VOYAGE PLANNING True, Magnetic and Compass North. Variation. Annual rate of change of variation. How to obtain variation from date given on the compass Rose. Deviation of the compass. The Deviation Card. True, magnetic and Compass course. Conversion of one to another. The compass error for the ship's head. True, magnetic and Compass bearings. Conversion of one to another. Gyro Error, High and Low, Conversion of Gyro courses to True course and vice versa. COLLISION PREVENTION IRPCS Part B – Section – II – Rules 16 – 18. Duty of the vessel which has the right of way (Stand on & Give way vessels). Action to be taken by such vessel required to keep out of way is not taking avoiding action. Right of way between a normal power driven vessel, a vessel not under command, a vessel restricted in her ability to manoeuvre, a vessel engaged in fishing, a sailing vessel and a vessel constrained by her draft.	10 Hrs.	
Unit III	VOYAGE PLANNING The effect of current on course steered. Set and drift. The effect of wind on course steered. Leeway. The dead Reckoning Position, Estimated Position and Observed Position (Fix). Different methods of position fixing. Reasons for “Cocked Hat”. COLLISION PREVENTION IRPCS Part B – Section – III – Rules 19. Conduct of vessel in restricted visibility, Applicability. Determination of risk of collision when another vessel is detected by radar alone.	10 Hrs.	

	Actions to be taken / avoided to prevent close quarter situation with a vessel detected on radar alone. Action to be taken when fog signal of another vessel is heard but vessel is not seen though it may have been detected by radar		
Practical	VOYAGE PLANNING 1. To plot position lines obtained by terrestrial observation. 2. To find compass course to steer between two positions on the chart so as to counteract the given set and drift of current and given leeway 3. To find the course and distance made good, given course steered, set and drift of current and leeway. 4. To find the course and speed made good and the set and drift, given the course steered, speed, duration and the initial and final observed positions. 5. To find the course from a given position so as to pass a lighthouse at given distance when abeam with & without current Note – Collision Prevention Practical Syllabus same as Theory syllabus.		30 Hrs.

***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. Chartwork | Capt. S.S. Chaudhari |
| 2. Chartwork for Mariners | Capt. S.K. Puri |
| 3. Marine Chartwork | D.A. Moore |
| 4. IMO Rule of the Road | Bhandarkar Publication |
| 5. International Regulations for Preventing Collisions at Sea | IMO |
| 6. Manual of the Rule of the Road | Capt. S.K. Puri |

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

**Contents of syllabus for USNSC 103 – SOT I
Semester I**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	GENERAL 1. Introduction to SOLAS & STCW 2. Type of Ships 3. Names of various parts of ship – • Hull • Ship's Deck • Fore Castle • Poop Deck • Poop Deck • Accommodation • Bridge: • Monkey Island • Cargo Spaces (Cargo Holds, Tanks) • Cargo Handling Gear (Derricks, Cranes, Grabs, Pumps) • Machinery Space (Engine Room/Pump room) 4. Names and timings of watches. 5. Sea terms - Common terms used onboard from Nautical Dictionary 6. Look-out – Ref. STCW Chapter 8 –Part 4-1 7. Compass points – Boxing the Compass 8. Safety wearing apparel (PPE) – Requirements for various works. 9. Preparing a surface for painting - Need for surface preparation 10. Various tools used for Surface Preparation & Painting 11. Painting defects and their prevention. 12. Cleaning of wooden decks. 13. Cleaning and polishing of brass and copper.	15 Hrs.	

	CODE OF SAFE WORKING PRACTICES 1. Contents of code of safe working practices for merchant seamen 2. Personal protective equipment (PPE)		
Unit II	LIFE SAVING APPLIANCES 1. Classification of ships for Life Saving Appliances – LSA Rules, Latest 2. LSA requirements for cargo ships -Life Boat: - Description of Lifeboat. Construction and parts of lifeboat. Buoyancy tanks. Means of propulsion. Different types of lifeboats used. Motor lifeboats, Totally enclosed lifeboats, partially enclosed life boats, Free fall Lifeboat 3. Determining the carrying capacity of a lifeboat. 4. Life boat Equipment, rations 5. Types of boat davits and their method of operation 6. FPD and recovery strops – their uses 7. On Load & Off Load release mechanism CODE OF SAFE WORKING PRACTICES 1. Procedures for manual lifting and carrying of weights; 2. Precautions while working aloft, over side	15 Hrs.	
Unit III	LIFE SAVING APPLIANCES – Contd. 1. Liferaft: - inflatable and rigid. Construction and parts of life raft. 2. Methods of launching Liferaft – Davit, Manual, Use of HRU 3. Life raft equipment, ration and distress signals. 4. Repairing leaks and punctures. 5. Getting into a liferaft. 6. Inflatable chute, Marine evacuation System (MES) 7. Life Buoy: - Description & Specification of a lifebuoy. Correct procedure for use of a lifebuoy. Lifebuoy with line, with SI light and Lifebuoy used with MOB Marker	15 Hrs	

	8. Life jacket: - description of a life jacket. Buoyant material used. The correct method of putting on a life jacket and jumping into water. 9. Line throwing appliances: - description and use of line throwing appliance. 10. Care and maintenance of life saving appliances CODE OF SAFE WORKING PRACTICES 1. Marking obstructions on the passage way on deck; 2. Safety precautions whilst walking/working on deck;		
Practical	1) To make and understand the use of various knots, bends and hitches. 2) Mousing hooks and shackles. Breaking flags. 3) Making fast tug/ship's lines on bitts, Racking & Parbuckling. 4) To apply rope and chain stoppers. 5) To make various types of whippings. 6) To perform various splices on natural and synthetic fibre ropes. 7) To perform various splices on wire ropes. 8) Worming, parcelling and serving of hawsers. 9) Throwing a heaving line & Passing the messenger line 10) Heaving the Hand lead line and calling out soundings. 11) Slings a stage, Precautions when using stages. 12) Rigging a Bosun's chair - Safety precautions while using. 13) Canvass sewing & Use of grommets. 14) Seizing: flat, round. 15) Changing boat falls - Demonstration. 16) Operating windlass and winches. 17) Demonstrate taking soundings and ullage to find quantity of liquid in a tank using		15 Hrs.

	Calibration Table. 18) Demonstrate taking hold temperature. 19) Removing rust by chipping hammers for preparing a surface and painting. 20) Cleaning of wooden decks – deck washing compounds		
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Contents of syllabus for USNSC 203 – SOT I
Semester II

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	Fire fighting appliances:- 1. Fire hydrants and hoses. Types of connections. 2. Types of nozzles. 3. International shore connection – Use & Standard dimensions 4. Description of portable fire extinguishers, various types and their suitability for different types of fires. 5. Principle of fire extinguishing used in each type. 6. Fireman's outfit – as per FSS Code and self-contained breathing Apparatus (SCBA). 7. Fixed smothering system: carbon dioxide smothering system, inert gas system, Flue gas system, Foam smothering system for liquid fires, 8. Safety, care and maintenance of all fire fighting appliances. CODE OF SAFE WORKING PRACTICES 1. Precautions while using hand tools; 2. Safety precautions while painting;	15 Hrs.	
Unit II	ROPES AND WIRES:- 1. Use of various types of cordage, fibre and wire ropes used on the ship. Natural fibre rope, synthetic fibre rope, wire rope – construction, care and lay. Identify between right hand lay and left hand lay ropes. Plaited ropes. 2. Characteristics of different types of fibre ropes. 3. Comparison of strength and elasticity of different ropes.	15 Hrs.	

	4. Care and maintenance of fibre ropes. 5. Damage caused by surging. 6. Meaning of marline, spun yarn, oakum, tarred hemp, 3 ply and 5 ply twines, halyards, loglines, lead lines. 7. Grades of steel used for making wire ropes. Construction of wire ropes. Advantage of a fibre heart. Factors determining flexibility. Meaning of 6/12, 6/24, 6/37, types of wire ropes, plaited wire rope. Plastic covered wire rope – Advantages & Disadvantages. Non-rotating wire rope. 8. Care and maintenance of wire ropes. 9. Measuring sizes of ropes, wire and chains. 10. Breaking strength, Proof load and safe working load of ropes, wires and chains. 11. To calculate the size of rope or wire required for lifting a weight with a tackle CODE OF SAFE WORKING PRACTICES 1. Safety precautions while operating hatch covers; 2. Method of guarding of openings		
Unit III	DECK APPLIANCES 1. Description of the hand-lead line. Procedure for taking a cast. 2. Different types of logs - Patent log, impeller log, electromagnetic log, pitot log. Principles of their operation. 3. The electric telegraph, description and its operation. 4. Windlass & cargo winches – description and their operation. 5. Steering gear – Use, mode of operation – Auto/FU/NFU/Emergency 6. Deck fittings for mooring 7. Moorings arrangement. Doubling of lines, slip ropes, fire wire/rope CODE OF SAFE WORKING PRACTICES 1. Safety precautions while on mooring stations;	15 Hrs.	

	2. Safety precautions while rigging gangway and pilot ladder;		
Practical	1. Cleaning and polishing of brass and copper. 2. Swinging out and lowering a lifeboat from gravity davits. Use of Tricing pendants & Bowsing - in Tackle 3. Handling of life boat under oars – coming alongside, getting away and picking up a man overboard. 4. Use of sea anchor and steering oar. 5. Starting the engine of a motor lifeboat. 6. Hoisting a lifeboat on davits. Checking the working of cut-off switches. 7. Boat and fire drill. Sounding emergency signal. Action on hearing the emergency signal. 8. Coiling ropes. Cutting wire ropes. Opening a new coil. 9. Reading of drafts marks (meter & feet)		15 Hrs.

***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. Survival in Lifeboat and Liferaft | Capt. S.K. Puri |
| 2. Survival at Sea | C.H. Wright |
| 3. Theory and Practice of Seamanship | Danton |
| 4. Seamanship Notes | Kemp & Young |
| 5. Life saving Appliances Rules | Govt. of India |
| 6. Fire fighting Appliances Rules | Govt. of India |
| 7. SOLAS, 1974 as amended | IMO |
| 8. LSA Code | IMO |
| 9. FSS Code | IMO |
| 10. STCW 1978, as amended | IMO |

Contents of syllabus for USNSC103 – Cargo Work & Marine Communication Semester I

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<u>CARGO GEAR</u> Blocks: Parts of a block, different types of block, non-toppling and snatch blocks. External binding. Internal binding. Strapped. Markings on a block. Size of a block and sheave, size of rope to be used in a block. Relationship between diameter of sheave and diameter of rope. Overhauling of block. Tackles: Names of parts of a tackle, using a tackle to advantages or disadvantage. Mechanical advantage, velocity ratio or 'power gained', efficiency of a tackle; relationship between pull on the hauling part and load. Types of tackles/purchases used on ships. Shackles: Various types. Markings on shackles. Tonsberg & Mandal Shackles MARINE COMMUNICATION Meaning of bunting, halyard, at the dip, close up, half mast, hoist, fly, tackline	10 Hrs. 5 Hrs.	
Unit II	Cargo hooks: Various types. Markings on cargo hooks. Ropes: Care of ropes and wires used for cargo gear. Derrick rigs: The union purchase. Setting up of a union purchase. Importance of preventer guys. Maximum load to be used for angle between runners. Swinging derrick with powered guys. Putting winches in double gear. The Yo-Yo gear. Working of ships cranes. Hoisting, lowering and securing a derrick. MARINE COMMUNICATION Courtesy flag, ship's numbers, jack flag, quarantine flag, pilot flag, blue peter.	10 Hrs. 5 Hrs.	
Unit III	Stresses: Calculating the stresses in various parts of a derrick rig. Calculating the tension on ropes and wires of a purchase and finding the correct size to be used. MARINE COMMUNICATION	10 Hrs	

Unit III	CARGO CARE: - Importance of cargo care to economical operation of ship. Care of cargo on board ship. Securing cargo by using Bull-dog grips and bottle screws. Securing by chains and tensioners. Container lashing and securing. Fire prevention, interaction, temperature variations leading to sweat Damage (cargo sweat & ship sweat), sea water damage, ventilation to avoid hazardous gas accumulations, dunnage, separations, bulkheads, shifting boards.	15 Hrs.	
Practical	1. Morse signalling with Aldis lamp on mains and battery 2. Morse signalling with Daylight signalling Apparatus 3. Practical usage of "International Code of Signals". 4. Conduct practical exercise on the use of blocks, snatch blocks and the differential pulley (chainblocks). 5. Demonstrate the method of reeving a threefold purchase. (group activity of 2-3 cadets) 6. Overhauling of blocks 7. Conduct practical exercises on the use and maintenance of various types of blocks, tackles, shackles and bottle screws / turnbuckles, including opening, greasing, (group activity of 2-3 cadets) 8. Demonstrate the use of container lashing gear. (group activity of 2-3 cadets)		15 Hrs.

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

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

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

Reference Books:

1. Theory and Practice of Seamanship
2. Seamanship Notes
3. Cargo Work

Danton
Kemp & Young
Kemp & Young

4. Cargo Work for Ship's officers
5. Cargo Work & Maintenance
6. International Code of Signals
7. Stowage of Cargo

Capt. E. Fernandes
 Capt. E. Fernandes
 HMSO
 Capt. O.O. Thomas

**Contents of syllabus for USNSC 103 – NAVAL ARCHITECTURE I
 Semester I**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	INTRODUCTION: Development of ocean-going Merchant Ships. Modern merchant ships. TYPES OF SHIPS: types of ships based on nature of cargo. Passenger Liners, Ferries. Specialized carriers for General Cargo, Bulk, Oil (Crude Oil and Products) OBO's, Container, RO-Ro, Lash, LPG, LNG, Cattle, Cars, etc. Special features of above types of ships. DEFINITIONS & MEANINGS: LOA, LBP, EB, MB, Depth, Draft, Freeboard, Camber, Sheer, Rake, Rise of floor, Tumble Home, etc. GENERAL LAYOUT OF SHIPS: - General Cargo Ship, Bulk Carrier, Oil Tanker and Container Ship. Simple sketches of the same.	15 Hrs.	
Unit II	PRINCIPAL PARTS OF A SHIP: Bow, Stern, Shell plating, Double Bottom Tanks, Cargo Holds, Tween Deck, Deep Tanks, Fore-peak and After Peak store rooms and tanks, Plates Keels and Duct Keels. Forecastle deck, Quarter Deck, Main/Weather decks, Hatch covers, Cargo Gear, anchoring and mooring equipments, etc. MACHINERY SPACES: Engine Room: Engine Casing, subdivisions of Engine Room. Steering Gear, Pump rooms, Mast houses, Workshops, etc. SUPERSTRUCTURE: Wheel House, accommodation spaces, cabins, galley, pantry, dining saloons, recreation rooms, various stores and lockers, cold storage spaces, etc.	16 Hrs.	
Unit III	SHIP STABILITY: Laws of floatation. Buoyancy, Reserve buoyancy, Displacement, Deadweight. Change of draft due to change of density. TPC. FWA. DWA. The centre of gravity of a ship and factors affecting the same. The	14 Hrs	

	centre of buoyancy and factors affecting the same. Calculations involving KG and KB of a ship. The meaning of the terms Block coefficient, Water-plane coefficient, Mid-ship Coefficient, Prismatic Coefficient and relationship between them. Calculation based on Density, relative density, water pressure, flotation, displacement, deadweight, form coefficients, reserve buoyancy, TPC, FWA, DWA, load lines of ships, COG, COB.		
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**Contents of syllabus for USNSC 203 – NAVAL ARCHITECTURE I
Semester II**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	PRINCIPLES OF DESIGN: Common principles governing design and construction of various types of steel ships with respect to: (a) Longitudinal, transverse and vertical strength. (b) Continuity of strength (c) Strength – under static and dynamic conditions. (d) Stability (e) Water – tightness. (f) Conformity with statutory requirements.	14 Hrs.	
Unit II	STEEL FOR SHIP CONSTRUCTIONS: Types of steel used in ship construction. Steel plates and their treatment. Rolled sections – various shapes and standard sizes. Fabrication, Casting and forging and their use in construction. Testing of materials - various tests at production and building stages. RIVETING & WELDING: Riveting as a joining process. Welding – its predominant use in ship construction. Advantages of welding over riveting in ship construction. General ideas of Electric welding equipment, coated electrodes, methods used, etc. Gas welding, Gas cutting. Precautions while welding.	14 Hrs.	
Unit III	SHIP STABILITY: Use of displacement and TPC curves and scales to determine weight of cargo or ballast from draughts or freeboards. Metacentric height, Righting lever, Righting	17 Hrs.	

	Moment. Stable, Unstable and Neutral equilibrium. Free Surface Effect. Stiff and Tender ships. Difference between heel and list. Use of hydrostatic tables and curves as supplied to ships. Calculations based on GM, GZ, Righting moment (Moment of static stability), FSC, Hydrostatic curves, Hydrostatic Table, Hydrostatic Draft.		
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***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. Ship Construction notes | Kemp & Young |
| 2. Ship Construction for Engineers | Reid |
| 3. Ship Construction | Pursey |
| 4. Ship Construction | D J Eyres |
| 5. Ship Stability at Operational Level | Capt. H. Subramaniam |
| 6. Problems on MV Hindship | Capt. Joseph & Rewari |

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

**Contents of Syllabus for US NSC 104 – Environmental Science - I
Semester I**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	Geographical Features affecting Shipping– Climate, tides, wind, current, areas of bad weather, Time zone, International Dateline, Sea water density, Load line zones PHYSICAL METEOROLOGY CHARACTERISTICS OF THE EARTH'S ATMOSPHERE: Composition, hydrostatic equation, equation of state for dry air and moist air. Density variation. Vertical layers of the atmosphere, Ozone depletion, air pollution. ENERGY BUDGET: Radiation laws: Emission, Reflection, absorption and scattering. Solar and terrestrial radiation, Greenhouse effect and global warming, Heat exchange	16 Hrs.	

	processes. Radiation budget of the earth/atmospheric system. Environmental lapse rate and inversion. Diurnal, seasonal and geographical variation of temperature.		
Unit II	WATER VAPOUR IN THE ATMOSPHERE: Changes of state, specific, absolute and relative humidity, dew points temperature, humidity mixing ratio. Unsaturated and saturated states, super-cooling, frost point. Diurnal and seasonal variation of water vapour. ADIABATIC PROCESSES: Dry and saturated adiabatic lapse rates, Potential temperature. The tephigram and its uses. Stability analysis. CONDENSATION AND PRECIPITATION PHENOMENA: Condensation and freezing nuclei, condensation forms: Dew, frost, mist, fog, haze and clouds. Visibility. Development and classification of clouds. PRECIPITATION: Processes, forms and types. Principles and methods of surface meteorological observations.	14 Hrs.	
Unit III	OCEANOGRAPHY PHYSICAL PROPERTIES OF SEA WATER: Temperature, Salinity, density and pressure – their relationship and measurement. Optical properties, sound and light in the sea, colour of the sea water. SALINITY AND DENSITY: Distribution in surface layers of the ocean. Controlling processes. THE ENERGY BUDGET OF THE OCEANS: Spatial variation of temperature and evaporation. Heat balance. OCEANIC CIRCULATION SYSTEM: Causes and the spatial distribution of surface circulation. Seasonal changes. SUB-SURFACE CIRCULATION: Formation, source region and movement of water masses. OCEANIC WAVES AND TIDES: Types of waves, wave energy, behavior of waves in deep and shallow waters. Tide-producing forces. Types of tides. Tide prediction and analysis, tidal streams, co-tidal charts. Storm surges and tsunamis.	15 Hrs	
Practical	METEOROLOGY: The principles, construction and uses of various meteorological instruments, maximum and minimum thermometers, psychrometer/hygrometer, anemometer, wind vane. Barometers (aneroid and mercury) and		15 hrs.

	barograph. OCEANOGRAPHY: Use of main instruments and observational methods in the sea environment: Sensors for temperature, salinity, depth, velocity etc.		
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Contents of syllabus for USNSC 204 – Environmental Science - I
Semester II

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	1. The Multidisciplinary Nature Of Environmental Studies: Definition, Scope, Importance, Need for public awareness 1. NATURAL RESOURCES: Renewable and non-renewable resources: Natural resources and associated problems a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Case studies. d) Food resources: World food problem, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. ● Role of an individual in conservation of natural resources. ● Equitable use of resources for sustainable lifestyles. 2. ECOSYSTEMS:	16 Hrs.	

	a. Concept of an Ecosystem b. Structure and function of an ecosystem. c. Producers, consumers and decomposers. d. Energy flow in the ecosystem. e. Ecological succession. f. Food chains, food web and ecological pyramids. g. Introduction, types, characteristic features, structure and function of the following ecosystems: i. Forest ecosystem ii. Grassland ecosystem iii. Desert ecosystem iv. Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)		
Unit II	3. BIODIVERSITY AND ITS CONSERVATION: • Introduction – Definition: Genetic. Species and ecosystem diversity. • Biogeographical classification of India. • Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values. • Biodiversity at global, national and local levels. • India as a mega diversity nation. • Hot-spots of biodiversity. • Threats to biodiversity: Habitat loss, poaching of wildlife, man wildlife Conflicts. • Endangered and endemic species of India. • Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. 4. ENVIRONMENTAL POLLUTION Definition • Causes, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution	16 Hrs.	

	e. Noise pollution f. Thermal pollution g. Nuclear hazards • Solid waste management: Causes, effects and control measures of urban and industrial waste. • Role of an individual in prevention of pollution. • Pollution case studies. • Disaster management: Floods, earthquakes, cyclone and landslides.		
Unit III	5. SOCIAL ISSUES AND THE ENVIRONMENT: • From Unsustainable to Sustainable development. • Urban problems related to energy. • Water conservation, rain water harvesting, watershed management. • Resettlement and rehabilitation of people; its problems and concerns. Case studies. • Environmental ethics: Issues and possible solutions. • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. • Wasteland reclamation. • Consumerism and waste products. • Environment Protection Act. • Air (Prevention and Control of Pollution) Act. • Water (Prevention and Control of Pollution) Act. • Wildlife Protection Act. • Forest Conservation Act. • Issues involved in enforcement of environmental legislation. • Public Awareness. 6. HUMAN POPULATION AND THE ENVIRONMENT: • Population growth, variation among	13 Hrs.	

	nations. • Population explosion – Family Welfare Programme. • Environment and human health. • Human Rights. • Value Education. • HIV / AIDS. • Women and Child Welfare. • Role of Information Technology in Environment and Human health. • Case Studies.		
Practical	Field Work (i) Visit to a local area to document environmental assets – River / Forest / Grassland / Hill / Mountain. (ii) Visit to local polluted site – Urban / Rural / Industrial / Agricultural. (iii) Study of common plants, insects, birds. (iv) Study of simple ecosystems – Pond / River / Hill slopes, etc.		15 Hrs.

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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 % as per Training Circular No 4 of 2005 by DG Shipping, Govt of India

Reference Books:

- | | |
|--|----------------------|
| 1. Marine Meteorology | Capt. H. Subramaniam |
| 2. Atmosphere, Weather & Climate | Barry R.G. |
| 3. Introduction to theoretical Meteorology | Hess |
| 4. Meteorology for Mariners | HMSO |
| 5. An introduction to dynamic meteorology | James, R. Holton |
| 6. Environmental Studies | Erach Bharucha |

Contents of Syllabus for US NSC 104 – MECS - I
Semester I

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	MECHANICAL ENGINEERING SCIENCE 1) Strength of materials – Elasticity, Hook's	15 Hrs.	

	Law – Stress and Strain. Tensile, Compressive and Shear forces. Failure of materials under tension, compression, shear and fatigue. Examples related to Marine Engineering. 2) Cantilever and simply supported Beams, Shear force and Bending Moments, calculation of stresses and B.M. Diagrams for above and other systems of the ship. 3) Mechanical properties of common engineering materials – hardness, ductility, malleability, melting point etc.		
Unit II	MECHANICAL ENGINEERING SCIENCE 1) Fluid Mechanics – Flow of liquids and gases, Laminar and Turbulent flow, Resistance to flow. Viscosity – definition and meaning. Bernoulli's Theory – Simple treatment. 2) Loss of energy of fluid due to bends, friction, valves etc. Simple hydraulic equipments. 3) Thermodynamics – Properties of steam; Boiling point and effect of pressure on it; Saturated, dry and superheated steam; Dryness fraction. Meaning of Sensible Heat and Latent Heat.	15 Hrs.	
Unit III	ELECTRICAL ENGINEERING SCIENCE: Electrostatics, Electro-magnetism and Electricity. Electric current, Voltage, EMF, Ohm's Law, Direct Current (DC) and Alternating Current (AC). Simple electrical circuits, Kirschoff's laws, simple calculations, Wheatstone bridge	15 Hrs	
Practical	Brief description of drawing papers, pencils, Instruments & their use. Types of lines & dimensioning. Loci of points, orthographic projection of points, Straight lines, Planes, Solids. Isometric Projection. Concept of Form & shape, Plan, Elevation and End views of objects.		15 hrs.

Contents of syllabus for USNSC 204 – MECS - I
Semester II

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	MARINE ENGINEERING PRACTICE	14 Hrs.	

	General introduction and scope. Classification of ships as per propulsion plants. General layout of ship's Engine Rooms and machinery.		
Unit II	Main Engine Plants and supporting systems. Introduction about ship's Auxiliary Systems. Electrical Power Generation Plants – its supporting systems and importance.	19 Hrs.	
Unit III	Bilge, ballast, fire, cargo & other pipelines of different type of ships.	12 Hrs.	
Practical	Contd.from Semester I Contours, change of sections, hidden (Internal) construction, dotted lines, etc. Discussion on ship's plans. Isometric views, cut/cross sections. Simple assembly drawings. Engineering drawing by free hand sketching. NOTE: Sufficient time should be allotted for drawing-practice		15 Hrs.

***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 | N.D. Bhatt |
| 3. Engineering Knowledge for Deck officer | Reed |
| 4. General Engineering Knowledge Vol. 8 | Reed |
| 5. Mechanical Engineering Science | Hannah & Hillier |
| 6. Marine Auxiliary Machinery | D.W 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 40 marks for the Practical task assigned at the time of examination. The 10 marks are allotted Oral/Viva/Journal.

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 programme.

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 five questions.
 - 2. 1st question will be objective type from entire syllabus, 2nd question from unit 1, 3rd question from unit 2 and 4th Question from unit 3 and 5th question examiners choice.
 - 3. All questions will be 15 marks each.
 - 4. All questions shall be compulsory with internal choice within the questions for question number 2nd, 3rd, 4th & 5th.
 - 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