

University of Mumbai



No. UG/09 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/76 of 2015-16, dated 15th September, 2015 relating to the revised syllabus as per the (CBSGS) for the Second Year (Sem. III & IV) 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 (5) have been accepted by the Academic Council at its meeting held on 23rd July, 2020 vide item No. 4.70 and that in accordance therewith, to the revised syllabus as per the (CBCS) of S.Y. B.Sc. Nautical Science (Sem – III & IV) 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/4.70/23/07/2020

No. UG/ 09 -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 sBoard 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.

AC - 23rd July, 2020

Item No. 4.70

UNIVERSITY OF MUMBAI



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

(Choice Based Credit System with effect
from the academic year 2020-21)

AC – 23rd July, 2020

Item No. 4.70

UNIVERSITY OF MUMBAI



Syllabus for Approval

Sr. No.	Heading	Particulars
1.	Title of the Program	B.Sc. (Nautical Science)
2.	Eligibility for Admission	<ul style="list-style-type: none">• 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 :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. VinodSuryavanshi	Convener/BOS Chairperson
2)	Capt. (Dr.) Ashutosh Apandkar	Invitee/Ex BOS Chairperson
3)	Capt. Mahadeo Makane	Member (Teacher)
4)	Capt. LaxmanDubey	Member (Teacher)
5)	Capt. SandeepG. 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 –III

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	100	50			
	Naval Architecture-II	3		45		100				
AECC – Ability Enhancement Compulsory Course										
USNSc301	Applied Mathematics-III	4		60		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		31	10	465	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-IV	4		60		100		3	1	4
	Nautical Physics & Electronics-IV	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		31	10	465	150	1000	400	12	8	20

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

**Contents of syllabus for USNSC 301 – APPLIED MATHEMATICS -III
Semester III**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>Bessel Functions, Legendre Polynomials & 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 $J(x)$, Relation between Laplace equation and Legendre differential equation, Its solution by series methods, Recurrence relations for $P_n(x)$, Rodriguez's formula for $P(x)$, Partial differential equation governing Transverse Vibrations of an elastic string, its solution using Fourier Series, Vibrations of a rectangular and circular membrane. Heat equation, steady – state configuration for heat flow and Laplace equation in two and three dimensions, Variable heat flow in one dimension.</p>	20 Hrs.	
Unit II	<p>Laplace Transforms: Function of bounded variation (Statement only), Laplace transforms of $1, t^n, e^{at}, \sin(at), \cos(at), \sinh(at), \cosh(at), \operatorname{erf}(t)$, Shifting properties. Expressions (with Proofs) for : (i) $L\{t^n f(t)\}$ (ii) $L\{f(t)\}/T$ (iii) $L\{\int^t f(u) du\}$ (iv) $L\{d^n f(t)/dt^n\}$ Evaluation of inverse Laplace Transforms, partial fraction methods, convolution theorem. Application to solve initial and boundary value problems involving ordinary differential equations with one independent variable.</p>	20 Hrs.	

Unit III	Complex Variables: 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 polarco-ordinates. Harmonic functions, Orthogonal trajectories.Analytical and Milne – Thomson method to find $f(z)$ from itsreal 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, itsapplication to evaluate real integrals.	20 Hrs.	
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**Contents of syllabus for USNSC 401 – APPLIED MATHEMATICS - IV
Semester IV**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	Numerical Methods: Newton– Raphson method, bisection method. Finite differences offirst and higher order, forward, backward differences, difference tables,shift operator – E. Interpolation: linear and quadratic interpolation, Newton’s forward and backward difference interpolation formulas, Langrangian interpolation, Solutions to systems of linear algebraic equations: Gause elimination, Gauss-Jordan method, Gauss-Seidel iteration Jacobi iteration.	20 Hrs.	
Unit II	Matrices: Types of matrices. Adjoint of a matrix. Inverse of a matrix.Elementary transformations, rank of a matrix. Reduction to a normal form. Linear programming-problems and applications.Characteristic polynomial. Cayley Hamilton theorem. Functions of a square matrix, Minimal Polynomial, Diagonable matrix.Quadratic forms, Orthogonal.	20 Hrs.	
Unit III	Statistics: Frequency distribution, Measures of central tendency; Mean, Median and Mode, Measures of variability, Range, Percentiles, Variance, Standard	20 Hrs.	

	Deviation, Skewness, Moments, Discrete random variables and their probability distributions, Binomial and Poisson's distributions, coefficient of Correlation, Lines of Regression – Rank Correlation		
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***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:-

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|--|-----------------------------|
| 1. A Text book for applied mathematics | Wartikar P.N. &WartikarJ.N. |
| 2. A Text Book of Matrices | Shanti Narayan |
| 3. Mathematical Statistics | J.N.Kapur, H.C. Saxena |
| 4. Statistics in Schaum's Series | Murray R.Spiegel |
| 5. Probability& Statistics for engineers | Myers |
| 6. Higher Engineering Mathematics | Dr. B.S. Grewal |
| 7. Numerical methods for engineers | S.K. Gupta |
| 8. Operation Research, An introduction | H.A. Taha |
| 9. Operation research methods & Problems | Sasieni, Yaspan, Friedman |
| 10. Linear Programming | G. Hadley |

Contents of syllabus for USNSC301 – NAUTICAL PHYSICS& ELECTRONICS - III

Semester III

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>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.</p> <p>Electrical Bridge Circuits:</p>	15 Hrs.	

	<p>Bridge circuits, Wheatstone Bridge, Maxwell Inductance and Capacitance Bridges, De Sauty Bridge, Schering Bridge, Hay's Bridge, Definition of Q of coil, Applied Problems.</p> <p>Instrumentation: Calibration, Accuracy, Precision, Methods of measurement of temperature, pressure, Fluid flow, venturi tube, sound level meter, thermister and its application as heat sensors, transducers.</p>		
Unit II	<p>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. Comparison of AM, FM & PM</p> <p>Demodulation Techniques: Demodulation of A.M. waves, diode detector, transistor modulator, detection efficiency, amplitude distortion. Demodulation of FM waves, frequency demodulator.</p> <p>Digital Communications: Types of pulse modulation, generation and demodulation of Pulse Amplitude Modulation (PAM) waves, distortion in PAM, Pulse Duration (width) modulation (PWM or PDM). Pulse Code Modulation (PCM), generations and demodulation of PCM, direct FM transmitter, Armstrong FM system, mobile communication systems.</p>	25 Hrs.	
Unit III	<p>Wave propagation: Basic electromagnetic spectrum, mechanism of wave propagation, field strength, propagation through troposphere, propagation models, radio horizon, troposphere monitoring techniques, sky – wave propagation, ionosphere, microwave links and other communication links, noise in communication systems.</p> <p>Radio receivers & Transmitters: Straight and regenerative receivers, turned RF receivers, superheterodyne receivers, AM receivers, stereo FM multiplexed reception, noise consideration, AM transmitter, FM transmitter</p>	20 Hrs	

	<p>Antennas: Resonant antenna, antenna gain, radiation resistance, impedance matching, feeders, resonant line feed, grounded antennas, higher frequency antennas, dipole arrays, Yagi – Uda antenna, Rhombic antenna, microwave antenna, active antenna, horn antenna, dielectric antenna.</p> <p>Radar Communication: Elements of radar system, radar range, limitations of radar, radar altimeters and beacons, interrogating radars, Instrument Landing System (ILS), Visual VHF Omni Range (VOR), Tactical Air Navigation (TACAN), Radio Direction Finding (RDF).</p> <p>Satellite Communication: Satellite links, eclipses, orbits and inclination, satellite construction, communication frequencies, domestic satellites, telemetry.</p>		
Practical	<p>EXPERIMENTS</p> <ol style="list-style-type: none"> 1. Use of a C.R.O. – measurement of voltage, frequency, time & phase shift. 2. Low pass, High pass filters (R-C) 3. Band pass & Band stop filters (R-C) 4. Series & Parallel resonance (R-C-L) – Q factor 5. Class A Power Amplifier 6. Amplitude Modulation 7. Frequency Modulation 8. Pulse Code Modulation – Generator & Demodulator 9. Study of PLL 10. Diode as a peak detector for A.M. & F.M. <p>NOTE: A minimum of 8 experiments are expected to be performed</p>		30 Hrs.

Contents of syllabus for USNSC401 – NAUTICAL PHYSICS& ELECRONICS - IV

Semester IV

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>Network Theorems and its applications: Kirchoff's Law, Classification of Network elements, Constant Voltage and Current Source, Nodal Analysis, Thevenin's Theorem, Maxwell Theorem, Superposition Theorem, Norton's Theorem, Millman' Theorem, Maximum power transfer Theorem, Applied Numericals.</p> <p>ANALOG CIRCUITS</p> <p>Transistor Biasing: Operating point, Base bias (Fixed bias), Emitter bias, Voltage divider bias, D.C. load lines, Transistor saturation, Transistor as a switch, Bias Stabilization. Ref.: M:</p> <p>Transistor Amplifier : C.E. amplifier, DC and AC equivalent circuits, small signal operation, voltage gain, current gain, Input and output impedance, Frequency response, DC and AC load lines, Class A operation, Power gain, Decibel Voltage gain, A typical emitter follower circuit Ref.: M:</p> <p>Operational Amplifier: The basis differential and Common Mode Operation, Basic Opamp Specifications, Practical Opamp circuits – Schmitt Trigger and square wave generator, Inverting and Non-inverting amplifiers, voltage follower, Summing Amplifier, Difference Amplifier, Integrator and Differentiator. Ref.: BN, M</p>	25 Hrs.	
Unit II	<p>DIGITAL CIRCUITS</p> <p>Number System and Logic Gates: Binary numbers, binary to decimal conversion, Decimal to binary conversion, (Octal and hexadecimal numbers, Binary to Octal and binary – Hexadecimal inter conversion), NOT, OR, AND, NAND, NOR Logic gates, EXOR Gate, arithmetic and data processing circuits (half adder, full adder, multiplexer and de multiplexer), De Morgan's theorems; Boolean algebra, NAND and NOR as a basic building blocks, Logic levels for TTLICs Ref: ML</p> <p>Clocks and Timers: 555 times, basic timing concept, 555 block diagram, monostable and</p>	20 Hrs.	

	<p>astablemultivibrators, Voltage ControlledOscillator (VCO), ramp generator. Ref: M NAND gate as a clock. Ref: ML. Flip flops and counters:RS flip flop, Clocked RS flip flop, D flip flop, JK flip-flop,Master Slave concept Schmitt trigger, Flip-Flops used as binary ripple counters, decade counter. Ref: ML</p>		
Unit III	<p>Feedback Types:Voltage and current feedback, Effects of negative feedback on amplifier parameters, derivation only for gain with feedback (No other derivations), typical single transistor circuits for voltage series and current series feedback. Oscillator operation Barkhausen criteria, RC oscillators – phase shift and Wein Bridge (op-amp and transistor), LC oscillators – Colpitts and Hartley (transistor and op-amp), crystal oscillator. Ref:BN:Ch. 18.1 – 18.8 except 18.4 Cathode Ray Oscilloscope:Construction, working and basic measurements. 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 Ref: G: Ch. 1, 2, 4 (except 3.4), 4 (except 4.5, 4.6), 5:</p>	15 Hrs.	
Practical	<p>EXPERIMENTS</p> <ol style="list-style-type: none"> 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 4) Op-Amp summer & difference amplifiers. 5) Op-amp – square wave generator, slew rate 6) Timer – astablemultivibrators. 7) Timer- monostable mutivibrators. 8) Wien Bridge Oscillator – transistor & op-amp 		30 Hrs.

	<p>versions.</p> <p>9) Study of Basic Logic Gates – NOT, AND, OR, NAND, NOR.</p> <p>10) DeMorgan’s Laws & use of NAND & NOR as basic building blocks.</p> <p>11) J-K Flip Flop – truth table, Ripple & Decade counters.</p> <p>12) Microprocessors: Learning (get to know) the Hardware of a microprocessor.</p> <p>NOTE: A minimum of 8 experiments are expected to be performed.</p>		
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***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**

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

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

Reference Books:

1. Communication Electronics N.D. Deshpande, D.A. Deshpande
2. Operational Amplifiers & Linear integrated circuits Coughlin & Driscoll
3. Electronic Devices & Circuit Theory Coughlin & Driscoll
4. Basic Electronics – A text-lab Manual Zbar&Malvino

Contents of syllabus for USNSC 301 –Computer Science Semester III

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>Basic Hardware Familiarization: Different functional parts of a computer and their functions. Computer peripherals: Monitor, Printer, Key board, Hard disk and Mouse.</p> <p>Operating System: Explain the Windows Operating System. Explain different types of files and their extension. Finding, sorting and hyper linking a file.</p> <p>Basics of C: History of C. C character set, C operators. Formatted input and output. Data Types. Constants and variables.</p> <p>Operators: Arithmetic, Increment &</p>	08 Hrs.	

	Decrement, Modulo division, Relational, Logical, Conditional and Comma and decision making.		
Unit II	<p>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.</p> <p>Computer arithmetic: Binary, Octal, Decimal & Hexadecimal numbers systems and mutual conversion. Memory measurement: Bits, Bytes, KB, MB, GB, TB. Units of run-time measurement: sec, ms, μs, ns, ps, fs, as. Different computer environments: Batch processing, Time sharing.</p> <p>C Programming: While, do and do-While loops.</p>	15 Hrs.	
Unit III	<p>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.</p> <p>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.</p> <p>C Programming: For loop. Switch-Case, continue and break statements.</p>	22 Hrs	
Practical	<p>MS-Word: Introducing tables and columns. Mail merging address for envelopes.</p> <p>MS-Excel: Creating and opening workbook and entering data. Use of formulas, functions and named ranges to process data.</p> <p>C Programming: To understand various types of control statements, To understand various loops and the switch- case statement.</p>		15 Hrs.

Contents of syllabus for USNSC 401 –Computer Science

Semester IV

Unit No.	Topics/Sub Topics	Theory	Practical																		
Unit I	<p>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.</p> <p>PDF: Explain why use a PDF file. Create a PDF document.</p> <p>C Programming: Arrays: Declaration and initialization of one dimensional, two dimensional and character arrays. String handling functions from standard library (strlen(), strcpy(), strcat (), strcmp ()).</p>	8 Hrs.																			
Unit II	<p>E-Commerce: The information technologies and its related business. E- Commerce concepts. Cryptography and Digital Signature Protocols for Transactions.</p> <p>C Programming: Functions: Need of functions, defining functions, function call with return values.</p>	15 Hrs.																			
Unit III	<p>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.</p> <p>C Programming: Pointers: Understanding pointers. Declaring pointervariable, accessing address of a variable and pointer expressions. Structures: Defining structure, declaring and accessing structure members.</p>	22 Hrs.																			
Practical	<ul style="list-style-type: none"> 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: <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Field Name</th> <th>Data Type</th> <th>Field Size orFormat</th> </tr> </thead> <tbody> <tr> <td>ID</td> <td>Number</td> <td>10</td> </tr> <tr> <td>Primary Key</td> <td>Text</td> <td></td> </tr> <tr> <td>Name</td> <td>Text</td> <td>15</td> </tr> <tr> <td>Surname</td> <td>Text</td> <td>15</td> </tr> <tr> <td>Telephone</td> <td>Number</td> <td>Number Long Integer</td> </tr> </tbody> </table>	Field Name	Data Type	Field Size orFormat	ID	Number	10	Primary Key	Text		Name	Text	15	Surname	Text	15	Telephone	Number	Number Long Integer		15 Hrs.
Field Name	Data Type	Field Size orFormat																			
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		
		<i>Save the table as "Students Table"</i>				
		<ul style="list-style-type: none"> • 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				
		<ul style="list-style-type: none"> • 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. Practical Microsoft Office 2007: June Jamrich Parsons
2. Computer Fundamentals Architecture and Organization: B Ram
3. Let us 'C' Kanitkar, 3rd BPB
4. Computer Networking from LAN's to WAN's, Hardware, Software & Security
5. Turbo C reference manual
6. Programming in C: Kris A. Jamsa Galgotia Publications Pvt. Ltd.
7. Mastering turbo C: Kelly/Bootle EPB
8. Turbo C programming technique: Stevens A. : BPB
9. Computer Virus – prevention, detection & removal Kapur R : BPB
10. Introduction to computer science vol. I & II Jain S. : BPB
11. Introducing computers I, II & III Mehta S. BPB

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

**Contents of syllabus for USNSC 302 – NAVIGATION II
Semester III**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>Section A - 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. Nautical Almanac: Information in Nautical Almanac and using it for celestial observations</p> <p>Section B – 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).</p>	15 Hrs.	
Unit II	<p>Section A 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. Principles of position lines. Geographical position, circle of position, why P/L is at right angles to the Azimuth – exceptions.</p> <p>Section B – To find the latitude by meridian altitude of a heavenly body. To calculate meridian passage time and approx meridian altitude for setting on the sextant(computed altitude).</p>	20 Hrs.	
Unit III	<p>Section A Position to draw the P/L. Effect of change of DR position on position for P/L and practical applications.</p> <p>Section B Latitude and position line by observation of Polaris.</p>	10 Hrs.	
Practical	Sextant – To use sextant for altitude of heavenly bodies. Then to correct the sextant altitude to true		15 Hrs.

	altitude required for astronomical calculations – Individual and total corrections.		
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Contents of syllabus for USNSC 402 – NAVIGATION II

Semester IV

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>Section A - Azimuths and amplitudes; Derivation of formula: Sin amp =Sin decl. sec lat. Apparent altitude of Sun, Moon at time of theoretical rising or setting.</p> <p>Section B To find the compass error and deviation from amplitude of Sun and Moon. From an observation of any heavenly body near the meridian, to find the direction of the position line and the latitude corresponding to the D.R. longitude through which the PL passes. Time limits for ex-meridian sight.</p>	15 Hrs.	
Unit II	<p>Section A - Rising, culmination and setting of heavenly bodies. To find time of meridian passage, sunrise, sunset, moon rise and moon set by calculation and by perusal of nautical almanac with appropriate corrections.</p> <p>Section B - To find the longitude corresponding to the DR latitude through which the position line passes and the direction of position line from an observation of any heavenly body. (Long by chron).</p>	15 Hrs.	
Unit III	<p>Section A - True and apparent motion of bodies. Solar time, Solar day; apparent sun, mean sun, and dynamical mean sun; equation of time. Time and hour angle, Hour circles, Greenwich time, local time, zone time & standard time. Keeping time at sea, advancing & retarding of clocks with change of longitude; International date line. Sidereal time, sidereal day, why stars rise four minutes earlier each day, conversion of solar time to sidereal time and vice-versa.</p> <p>Section B - To find the intercept, Intercept termination point and direction of position line from an observation of any heavenly body. (Intercept Method).</p>	15 Hrs.	
Practical	Use of Azimuth Mirror and pelorus.		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. Principles of Navigation | Capt. P.M. Sarma |
| 2. Principles of Navigation | Capt. Joseph & Capt. Rewari |
| 3. Practical Navigation | Capt. H. Subramaniam |
| 4. Admiralty Manual of Navigation Vol. I & II | |
| 5. The Principles & Practice of Navigation | A. Frost |
| 6. Nicholl's Concise Guide Vol. I & II | |
| 7. Bridge equipment, Charts & Publications | Capt. H. Subramaniam |
| 8. Nories Nautical Table | |
| 9. Nautical Almanac | |

Contents of syllabus for USNSC 302 – VPCP II Semester III

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	VOYAGE PLANNING Elementary Knowledge of Passage Planning and execution – 4 stages of passage planning. Landfall in fog 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 first year level. IRPCS – Part C – Rules 20 to 26	10 Hrs.	
Unit II	VOYAGE PLANNING Development of electronic Chart display system. Raster & Vector Charts COLLISION PREVENTION IRPCS – Part C – Rules 27 to 31 The IALA system of buoyage	10 Hrs.	
Unit III	VOYAGE PLANNING 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 time and thence the correction to be applied to soundings or charted heights of shore objects. COLLISION PREVENTION IRPCS – Part D – Rules 32 to 37, Part E – Rule 38	10 Hrs.	
Practical	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 Bow' method. 3) The use of a station pointer to plot ships		30 Hrs.

	<p>position - given two horizontal angles.</p> <p>4) Collision situations in restricted visibility with or without Radar. Statutory obligations under both circumstances.</p> <p>5) Recognition of various buoys and marks under IALA system and appropriate actions required under the rules.</p>		
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Contents of syllabus for USNSC 402 – VPCP II

Semester IV

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>VOYAGE PLANNING The interpretation of a chart or plan, particularly the information given about Lights, Buoys, Radio Beacons and other Navigational Aids.</p> <p>COLLISION PREVENTION IRPCS Part F – Rules 39 to 41 Precautions while using floating navigational aids, such as buoys, light vessels etc.</p>	10 Hrs.	
Unit II	<p>VOYAGE PLANNING Depths and height contours. Tidal Streams Traffic lanes and separation zones. Recognition of the coast and radar responsive targets. Chart correction.</p> <p>COLLISION PREVENTION Radar Plotting. Relative plot - Report to Master. Set and Drift.</p>	10 Hrs.	
Unit III	<p>VOYAGE PLANNING Geographical Range, Luminous Range, Nominal range; and their significance.</p> <p>COLLISION PREVENTION Radar Plotting - Action by own ship, Action by Target ship.</p>	10 Hrs.	
Practical	<p>VOYAGE PLANNING</p> <ol style="list-style-type: none"> 1. Use of single position line obtained from a celestial observation when near a coast to keep safe distance off the coast. 2. To find course made good using the three point bearing method – with & without current <p>COLLISION PREVENTION</p> <ol style="list-style-type: none"> 1. 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. 2. Candidates will be required to deal with each 		30 Hrs.

	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.		

***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. A guide to The Collision avoidance Rules | A.N. Cockroft |
| 6. International Light, Shape and sound Signal | D.A. Moore |
| 7. Admiralty IALA Maritime Buoyage System | |
| 8. Modern Chartwork | W.H. Squair |
| 9. Navigation for Watchkeepers | L.W.J. Fifield |
| 10. Shipborne Radar | Capt. H. Subramaniam |
| 11. International regulations for Preventing Collision at Sea | IMO |
| 12. Manual of the Rule of the Road | Capt. S.K. Puri |

Objective: -This subject exposes the students to Ship Operation Technology Paper- II, Bridge Procedure and legal Knowledge& Naval Architecture Paper - II

Contents of syllabus for USNSC 303 – SOT II

Semester III

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	Section – A – CARGO WORK Introduction to codes and guidelines for carriage of dry bulk cargoes, bulk chemicals, bulk gas, Dangerous goods in bulk and packaged form Section –B - SEAMANSHIP ANCHOR WORK: 1. Use & types of anchors. 2. Cable assembly and their care including	20 Hrs.	

	<p>markings. Parts of and connecting a lugless shackle</p> <ol style="list-style-type: none"> 3. Anchoring Terms - cable, link, swivel, joining shackle, shackle as a term of length, bitter end, a'cockbill(anchor ready for letting go), Anchor aweigh, clear hawse, foul hawse, clear or foul anchor, anchor dragging, long stay, short stay, up and down, to veer cable, weighing anchor, yawing, brought up to three in water / four on deck etc. 4. Anchoring procedure – in deep & shallow water 5. Factors involved in determining the length of cable to be used 6. Securing anchor for sea, covering spurling pipe, use of bow stopper, sledge hammer, chain hook 7. Duties on anchor watch 8. Foul anchor or hawse 9. Hanging off an anchor 10. Breaking and slipping cables 11. Load on anchor due to wind, current, waves 12. Anchor holding power 13. Dragging anchor – How to check, what to do 14. Causes for loss of anchor 15. Use of anchor buoys, 16. Mooring – Standing & running moor <p>CODE OF SAFE WORKING PRACTICE - Safety precautions while anchoring;</p>		
<p>Unit II</p>	<p>Section – A – CARGO WORK Planning stowage of general cargo taking into account stowage factor, load density, port rotation, hazardous nature, special stowage requirements relating to cargoes not covered by special codes. Calculation based on the same. Use of dunnage for load distribution.</p> <p>Section –B - SEAMANSHIP SURVIVAL AT SEA:</p> <ol style="list-style-type: none"> 1. Boat drills and musters. Preparation of Muster list. 2. Action prior to, and after abandoning ship. 3. Managing the craft and personnel in the craft. 4. Handling of the craft. 5. Landing signals. 6. Outline knowledge of SOLAS requirements of life saving appliances. <p>CODE OF SAFE WORKING PRACTICE</p> <ol style="list-style-type: none"> 1. Safety precautions during the use of personnel basket; 2. Precautions while using portable ladder. 	<p>13 Hrs.</p>	

Unit III	<p>Section – A – CARGO WORK Principles of stowage/securing of cargo taking into account ship’s motion at sea (Outline knowledge of CSS Code & Cargo securing Manual (CSM))</p> <p>Section –B - SEAMANSHIP FIRE PREVENTION AND FIRE FIGHTING:</p> <ol style="list-style-type: none"> 1. Causes of fire. 2. The fire triangle. 3. Principles of fire fighting. 4. Types of fire and methods of extinguishing each type. 5. Various methods of detection and fighting of fire. 6. Causes of fires in tankers during various operations carried out by tankers and its prevention methods. 7. Outline knowledge of SOLAS requirements on FFA. <p>CODE OF SAFE WORKING PRACTICE</p> <ol style="list-style-type: none"> 1. Standard crane signals. 2. Safety precautions while using bosun’s chair and stages 	12Hrs	
Practical	<ol style="list-style-type: none"> 1. Rigging a pilot ladder/Use of manropes – Precautions for safety of men boarding by such ladders. 2. Maintenance & repair of various ladders used on board ships 3. Safety procedure involved in working aloft on stage and a Bosun’s chair (group activity of 2-3 cadets) 		15 hrs.

**Contents of syllabus for USNSC 403 – SOT II
Semester IV**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>Section – A – CARGO WORK</p> <ol style="list-style-type: none"> 1. Factory act 2. DOCK WORKERS (SAFETY, HEALTH AND WELFARE) ACT 3. Requirements for annealing and periodical testing of cargo gear 4. Chain register. 5. Methods of testing cargo gear <p>Section –B - SEAMANSHIP SHIP MANOEUVRING: Effect of various factors on maneuvering – Controllable & Uncontrollable factors. Concept of pivot point Management of ship in heavy weather.</p> <p>CODE OF SAFE WORKING PRACTICE</p> <ol style="list-style-type: none"> 1. Precautions while using electric, pneumatic and 	15 Hrs.	

	hydraulic (power) tools and appliances; 2. Precautions while working with compressed air;		
Unit II	<p>Section – A – CARGO WORK Machinery for handling of cargoes such as: Derrick and rigs, Cranes, Heavy lift crane, Winches including self tension winch, Conveyor belt/chute arrangement, Container handling systems.</p> <p>Section –B - SEAMANSHIP SHIP MANOEUVRING: 1. Precaution in maneuvering for launching of boats or life rafts in bad weather. 2. Methods of taking on board survivors from life boats and life rafts.</p> <p>CODE OF SAFE WORKING PRACTICE 1. Safety precautions while painting funnel, Radar mast; 2. Safety precautions while using bosun’s chair and stages;</p>	15 Hrs.	
Unit III	<p>Section – A – CARGO WORK Infrastructure built in ports for loading and discharging, such as cranes, gantries, conveyor belt system etc.</p> <p>Section –B - SEAMANSHIP GENERAL 1. Properties and uses of various paints. 2. Preparations for dry docking and undocking (DD Specs etc.). Use of side shores, bilge blocks and bilge shores. 3. Measures to be taken to prevent spillage of oil during cargo work, bunkering or oil transfer. 4. Oil record book – Requirements & entries 5. SOPEP</p> <p>CODE OF SAFE WORKING PRACTICE 1. Precautions while working with chipping machines; 2. Precautions whilst working on lathe machine.</p>	15 Hrs.	
Practical	1. Demonstrate the ability to climb a ship’s mast 2. Demonstrate ability to climb down stairs in accommodation and ladders. Show the procedure to carry objects up or down the ladders or stairs. Use of bow stopper, devil’s claw 3. To disconnect and connect a lugless shackle 4. Surface Preparation and painting		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. Cargo Work | Kemp and Young |
| 2. Stowage of cargo | O.O. Thomas |
| 3. Theory and Practice of Seamanship | Danton |
| 4. Seamanship & Cargo work | Dinger |
| 5. Seamanship Notes | Kemp and Young |
| 6. Code of safe working practices for merchant seafarers | MCA |

Contents of syllabus for USNSC 303 – Bridge Procedure and legal Knowledge Semester III

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>BRIDGE PROCEDURE Bridge Procedures Guide and its Contents: - Understanding of the principles of safe watchkeeping as detailed in the ICS Bridge Procedures Guide. Navigation checklists Bridge manning levels: Circumstances in which the OOW (officers on watch) should call Master, extra lookouts, Explain responsibilities of OOW as in-charge of Navigational watch. Steering, Telegraph & BT Orders Guidelines for watch keeping at sea, at anchor and in port. VTS Procedure, Ship Reporting Systems. 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.</p>	15 Hrs.	
Unit II	<p>BRIDGE PROCEDURE Record keeping and Entries in logbook: Explain the importance of recording all relevant information in Logbooks.</p>	15 Hrs.	

	<p>Monitor navigational instruments and record their performance and other relevant details, Check and compare Compasses regularly for errors and apply them correctly, Record all movements and activities related to the navigation of the ship, IMO Guidelines for recording of events related to Navigation Res A. 916 (22).</p> <p>MARINE COMMUNICATION Radio Regulations relating to Maritime Services including maritime frequency allocation.</p> <p>LEGAL KNOWLEDGE Certificate of Officers, Seaman and Apprentices, Engagement, Management and discharge of crew, Manning scales. Contracts of employment, Wages and other remuneration, advances, allotments, Money orders, Payments into bank accounts. Desertion, deceased seaman, engagement of substitutes, repatriation.</p>		
<p>Unit III</p>	<p>BRIDGE PROCEDURE Use of Radar in navigation - Basic principles and use of radar. Obtaining position fix by radar bearings and ranges, possible errors, Reliability of fix, Aids to radar navigation: Use of passive (trails, history) and active aids, RACONs and SARTs. Explain AIS overlay on radar / ARPA, The use of parallel indexing technique in radar navigation:, wheel over positions and safety margins.</p> <p>CODE OF SAFE WORKING PRACTICE 1. Safety precautions while repairing radar; 2. Safety precautions while entering battery room;</p> <p>MARINE COMMUNICATION Satellite Communication and Altering system – Equipment on board and ashore. Methods adopted.</p> <p>LEGAL KNOWLEDGE The official Log Book and the law relating to entries therein. 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 provisions. Procedure in cases of infectious diseases, illness or accident. Maritime declaration of health. Port Health requirements.</p>	<p>15 Hrs</p>	

Practical	<p>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.</p> <p>Automatic Radar Plotting Aid (ARPA): Set vector lengths based on own vessel speed and range scale in use. Advantages and limitations of use of relative and true vectors and when to use which for optimum efficiency, The effect of course and speed changes on the display. Advantages of compass stabilization of a relative display, Use of Trial manoeuvre and predictive motion vectors.</p>		15 hrs.
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Contents of syllabus for USNSC 403 – Bridge Procedure and legal Knowledge Semester IV

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>BRIDGE PROCEDURE</p> <p>Keeping an effective anchor watch - Importance of Beam bearing, Use of Global Position Fixing System (GPS) and Radar during anchor watch, Turning circle in relation to length of vessel and length of cable used, Indication of anchor dragging, Swinging of vessel anchored to tide / wind, Use of shapes, lights and sound signals as per IRPCS 1972.</p> <p>LEGAL KNOWLEDGE</p> <p>Custom House procedure, entering and clearing ship. Load Line Marks, Entries and reports in respect of freeboard. Draft and allowance.</p> <p>Calculations on Lay day and Load Line (zone problems).</p> <p>Safety of the ship, crew and passengers. Assistance to vessels in distress and salvage. Duties of Master in the case of an accident.</p>	15 Hrs.	
Unit II	<p>BRIDGE PROCEDURE</p> <p>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)</p> <p>MARINE COMMUNICATION</p> <p>Global Maritime Distress and Safety System –</p>	15 Hrs.	

	<p>principles and actual applications. 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.</p>		
Unit III	<p>MARINE COMMUNICATION Meteorological Broadcast – Routine weather messages and storm warnings. Search and Rescue Communications. IAMSAR 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.</p>	15 Hrs.	
Practical	<p>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.</p>		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

References –

- | | |
|---|-------------------|
| 1. Shipborne Radar | Capt. Subramaniam |
| 2. International Code of Signal | HMSO |
| 3. Business and Law | Hopkins |
| 4. Merchant shipping Act | GOI |
| 5. SOLAS | IMO |
| 6. International convention on Loadline | IMO |
| 7. Search and Rescue Manual | IMO |
| 8. Bridge Procedure Guide | ICS |
| 9. Bridge Team Management | NI |
| 10. Code of safe working practices for merchant seafarers | MCA |

**Contents of syllabus for USNSC 303 – NAVAL ARCHITECTURE II
Semester III**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>(A)SHIP STABILITY Concepts of BM & KM. Calculation based on BM & KM, KM Curves. Use of Simpson’s Rules in the computation of areas; volumes and centroids.</p> <p>(B)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.</p>	15 Hrs.	
Unit II	<p>(A)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. Concept of Pitch, Trim, GM_L, KM_L.</p> <p>(B)SHIP CONSTRUCTION An outline knowledge of the functions of Classification Societies. Surveys for assignment and retention of class.</p>	15 Hrs.	
Unit III	<p>(A)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 (MV Hindship).</p> <p>(B)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.</p>	15Hrs	

**Contents of syllabus for USNSC 403 – NAVAL ARCHITECTURE II
Semester IV**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p align="center">(A)SHIP STABILITY</p> <p>List – Calculation of List while Loading, Discharging and/or shifting weights, Correction of List.Combined list and trim. Draft increase due to list. List when initial GM is zero.</p> <p align="center">(B)SHIP CONSTRUCTION</p> <p>Rudders, construction and support. Stern frame, Propellers and Propeller shaft; stern tube and adjacent structure.</p>	15 Hrs.	
Unit II	<p align="center">(A)SHIP STABILITY</p> <p>Curve of statical stability and its practical usage,Cross Curves of stability, K. N. Curves, KN Values, determination of Righting moment using K.N. Values, Calculation based on the same. Calculation of List by GZ Curve. Carriage of deck cargoes and their effect on stability.</p> <p align="center">(B)SHIP CONSTRUCTION</p> <p>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. Sacrificial Anode & Impressed current system.</p>	15 Hrs.	
Unit III	<p align="center">(A)SHIP STABILITY</p> <p>Stowage of grain and stability aspects in respect thereofwith particular reference to calculations involved and the manner of presentation of the information relating to grainheeling Moments and the resulting angle of heel as presented in the National Statutory Regulations.</p> <p align="center">(B)SHIP CONSTRUCTION</p> <p>Stresses and strains in ships in still water and in a seaway. Parts of ship specially strengthened and stiffened to resist such stresses including panting and pounding.</p>	15 Hrs.	

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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 Stability at Operational & Management Level	Capt. H. Subramaniam
2. Ship Stability for Masters and Mates	Derret
3. Ship Stability Notes& Examples	Kemp & Young
4. Merchant Ship Stability	A.R. Lester
5. Problems on MV Hindship	Capt. Joseph & Rewari
6. Ship Construction for Marine Students	Reeds
7. Ship Construction sketches & Notes	Kemp & Young
8. Ship Construction	D J Eyres
9. Merchant Ship Construction	Pursey
10. Merchant Ship Construction	Dr D A Taylor
11. International Grain Code	IMO

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

**Contents of Syllabus for US NSC 304 – Environmental Science - II
Semester III**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	Formation of the earth and its structure - 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 Hrs.	
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 Hrs.	
Unit III	Exogenic forces: denudation – Weathering, mass-wasting and erosion – Marine landforms – Sea level changes – Classification of coasts.	13 Hrs	
Practical	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		15 hrs.

**Contents of syllabus for USNSC 404 – Environmental Science - II
Semester IV**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>Oceans: Major relief features of the ocean-floor – Bottom relief of Indian, Atlantic and Pacific oceans – Properties of oceanwater: temperature, salinity and density – Their vertical and horizontal distribution – Ocean 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 scenario. Oceanic water as a resource: navigation, power generation, source of drinking water etc. - Oceanic islands and their strategic significance – Indian Ocean islands.</p>	18 Hrs.	
Unit II	<p>Atmosphere: WIND: Factors affecting atmospheric motion & the resulting winds; Beaufort scale of wind force; Geostrophic wind; Gradient and Cyclostrophic winds; pressure gradient force, Coriolis force, Buys Ballot's law. 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</p>	14 Hrs.	
Unit III	<p>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</p>	13 Hrs.	
Practical	<ol style="list-style-type: none"> 1. True and apparent wind and its vector calculation; 2. Interpreting Wind Rose. 3. Interpretation of weather maps 4. Estimation of geostrophic wind speed from geostrophic scale. 5. Reading and interpretation of I.M.D. synoptic 		15 Hrs.

maps.		
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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. Physical Geography	Savindra Singh
2. An outline of Geomorphology	Wooldridge & Morgan
3. Continental Drift	D.H. and M.P. Tarling
4. Putnam's Geology	Birkland & Larson
5. Principles of Physical Geography	F.J. Monkhouse
6. Oceanography	J.J. Bhatt
7. Oceanography for geographers	R.C. Sharma
8. The Oceans: Realities & Prospects	R.C. Sharma
9. Atmosphere, Weather and Climate	R.G. Barry
10. Climate and Weather	Flohn Hermann
11. Introduction to Meteorology	Petterssen
12. The Atmosphere	Anthes R.A.
13. Climatology from Satellites	Barrett E.C.
14. World Weather and Climate	Riley D.R.
15. Introduction to Meteorology	Cole F. W.

Contents of Syllabus for US NSC 304 – MECS - II

Semester III

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	MECHANICAL ENGINEERING SCIENCE 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 Hrs.	

Unit II	ELECTRICAL ENGINEERING SCIENCE 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 Hrs.	
Unit III	ELECTRICAL ENGINEERING SCIENCE Transformers: High and Low voltage transformers, stepup/step down Transformers, Transformer efficiency and maintenance & care. Power distribution: Maniswitch boards, power distributionboards, Circuit breakers, measuring instruments, overloadtrip 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.	13 Hrs	
Practical	WELDING SHOP i) Demonstrate the safety precautions to be observed while welding including hot work permit. ii) Identify the arc and gas welding outfits and tools and welding kits. iii) Identify ferrous and non-ferrous metals. iv) Demonstrates the ability to carry out oxyacetylene gas welding and cutting. v) Connects the arc welding kit and selects the current /electrode to carry out arc welding beads vi) Demonstrate the ability to carry out arc welding but and lap joint. BENCH WORK i) Demonstrate the ability to perform a basic fitting jobs of given dimension by using proper hand toolssuchas files, hacksaw, chisel, hammer, scale, verniercaliper etc. ii) Demonstrate the use of screw gauge, vernier caliper, on the above said job. iii) Demonstrate the use of pedestal drilling machineon the above said job and carryout reamingoperation on the drilled hole.. iv) Demonstrate the ability to make internal threads byusing appropriate tap.		15 hrs.

	<p>v) Demonstrates the ability to carry out grinding operation on given job.</p> <p>ELECTRICAL WORKSHOP</p> <p>i) Identify electrical insulated hand tools.</p> <p>ii) Identify electrical measuring instruments such as multi meter, tong Tester & megger.</p> <p>iii) Demonstrate the ability to identify electrical conductors (wires and cables).</p> <p>iv) Demonstrate the ability to identify live and neutral by using test lamp and multimeter. .</p> <p>v) Identifies the color codes given to phase, neutral and earth</p> <p>vi) Identify the electrical accessories such as fuse, circuit breakers, choke, starters, earthing, pendent light holder, tube frame, witch, socket, etc. and demonstrates the use of it in electrical circuits.</p> <p>vii) Assemble a tube light fitting by using tube fittings and test it.</p> <p>viii) Assembles a switch board as per drawing and check its working.</p> <p>ix) Identifies safety precautions to take to avoid electrical hazards.</p>		
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**Contents of syllabus for USNSC 404 – MECS - II
Semester IV**

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	<p>MARINE ENGINEERING</p> <p>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 potable water. Storage and supply of fresh water in ships. Fresh water and sanitary water. Hydrophase systems.</p> <p>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</p>	18 Hrs.	

	chemical treatment. c) Compressed air - air compressor, uses of compressed air. Storage and distribution of compressed air		
Unit II	<p>MARINE ENGINEERING</p> <p>a) Refrigeration & Air conditioning: Principle of refrigeration, compression refrigeration cycle, components & operation. Arrangement of cold storage holds.</p> <p>b) Pumps – working principle, construction of different types of pumps. Selection of pumps for different duties onboard the ship.</p> <p>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.</p> <p>Principle of ‘Hunting Gear’ Electric steering gear. The Wheatstone principle of transmission of steering wheel signals. Variable delivery pump. Steering gear circuits. Safe-matic system. Inter-switching of follow-up and non follow-up steering systems.</p>	14 Hrs.	
Unit III	<p>MARINE ENGINEERING</p> <p>Internal Combustion Engine:</p> <p>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</p> <p>b) Components – construction, main components and working</p>	13 Hrs.	
Practical	<p>MACHINE SHOP</p> <p>i) Demonstrates safety precautions to be observed while working on lathe machine</p> <p>ii) Identifies the parts of lathe machine.</p> <p>iii) Centre the job on lathe machine</p> <p>iv) Demonstrates the use of lathe machine by using appropriate lathe tool to reduce diameter by 1.0 mm and carry out facing operation.</p> <p>CARPENTRY WORKSHOP</p> <p>i) Identify carpentry hand tools such as chisel, jack plane, augur, mortise gauge, etc.</p> <p>ii) Identify various wood for specific purposes treatment materials.</p>		15 Hrs.

	<p>iii) Identify various wood jointing material using adhesive, nails, screws etc.</p> <p>iv) Demonstrate the ability to execute wood jointing</p> <p>v) Demonstrate the ability to make a cement box; wooden box as per drawing by using appropriate tools, wood jointing method and wood jointing material / adhesives</p> <p>vi) Use of fiber glass repair kits.</p> <p>PLUMBING WORKSHOP</p> <p>i) Identify plumbing hand tools such as pipe wrench, dies, pipe benders, hacksaw, pipe vice, spanners, etc. (ship specific).</p> <p>ii) Identify leak stopping material such as Teflon, sealant, jubilee clips, ermeto couplings and demonstrate their use.</p> <p>iii) Demonstrate the procedures to cut threads on pipes by selecting appropriate die.</p> <p>iv) Demonstrate the ability to identify different pipes, pipe material and methods to join the pipes.</p> <p>v) Identify various taps, cocks and valves used in sanitary System, demonstrate ability to repair them (ship specific).</p> <p>vi) Identify various plumbing accessories such as ‘T’ joint, socket, reducer, adapter, etc. used in pipe fitting and demonstrate its use.</p> <p>vii) Cut the gasket as per sketch by selecting appropriate material and tools.</p> <p>viii) Demonstrate the ability to clear choked pipes in accommodation plumbing system by using appropriate tool / choke clearing material</p>		
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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. Basic Marine Engineering | J.K. Dhar |
| 2. Engineering knowledge for Deck Officers | Reed |
| 3. General Engineering knowledge Vol. 8 | Reed |
| 4. Mechanical Engineering Science | Hannah & Hiller |
| 5. Marine Auxiliary Machinery | Smith |
| 6. A text book of Workshop practice | R.S.Khumri and J.K.Gupta |
| 7. Unitor Welding Handbook | |
| 8. A Guide to Safety and Health at Work for Gas Welding and Flame Cutting – Occupational Safety and Health Branch Labor Department | |
| 9. Introduction to Hydraulic and pneumatic | S.Ilango& V. Soundararajan |

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

