University of Mumbai

No. UG/07 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/77 of 2015-16, dated 15th September, 2015 relating to the revised syllabus as per the (CBSGS) for the Third Year (Sem. V & VI) 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 (6) have been accepted by the Academic Council at its meeting held on 23rd July, 2020 vide item No. 4.71 and that in accordance therewith, the revised syllabus as per the (CBCS) of T.Y. B.Sc. Nautical Science (Sem- V&VI) 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).

(Dr. Vinod Patil)
I/c REGISTRAR

MUMBAI – 400 032
11th November, 2020

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/4.71/23/07/2020

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No. UG/ 07 -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.

AC - 23rd July, 2020

Item No. 4.71

UNIVERSITY OF MUMBAI

SyllabusFor
Program:
B. Sc.Nautical Science (NS)
Syllabus for Semester V&VI

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

AC – 23rd July, 2020

Item No.4.71

UNIVERSITY OF MUMBAI

Syllabus for Approval

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 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 –V

Course Code	Title of the Course	Per Week		Per Semester		Marks		Credits		Total
		L	P	L	P	TH	PR	L	P	
Core Course										
USNSc502	Navigation –III	3	1	45	15	100	50	3	2	5
	Voyage Planning & Collision Prevention–III	3	2	45	30	100	50			
USNSc503	Ship Operation Technology-III	3	1	45	15	100	50	3	2	5
	Ship Operation Technology - IV	3	1	45	15	100	50			
	Naval Architecture-III	4		60		100				
USNSc501	Navigation - IV	3	1	45	15	100	50	2	2	4
AECC – Ability Enhancement Compulsory Course										
USNSc501	Maritime Law	4		60		100		1		1
SEC - Skill Enhancement Course										
USNSc501	Shipping Management	4		60		100		1		1
DSE – Elective: Discipline Specific										
USNSc504	Environmental Science-III	3	1	45	15	100	50	2	2	4
	Marine Engineering & Control System - III	3	1	45	15	100	50			
Total		**33**	**8**	**495**	**120**	**1000**	**350**	**12**	**8**	**20**

Semester VI

Course Code	Title of the Course	Per Week		Per Semester		Marks		Credits		Total
		L	P	L	P	TH	PR	L	P	
Core Course										
USNSc602	Navigation –III	3	1	45	15	100	50	3	2	5
	Voyage Planning & Collision Prevention– III	3	2	45	30	100	50			
USNSc603	Ship Operation Technology-III	3	1	45	15	100	50	3	2	5
	Ship Operation Technology - IV	3	1	45	15	100	50			
	Naval Architecture-III	4		60		100				
USNSc601	Navigation - IV	3	1	45	15	100	50	2	2	4
AECC – Ability Enhancement Compulsory Course										
USNSc601	Maritime Law	4		60		100		1		1
SEC - Skill Enhancement Course										
USNSc601	Shipping Management	4		60		100		1		1
DSE – Elective: Discipline Specific										
USNSc604	Environmental Science-III	3	1	45	15	100	50	2	2	4
	Marine Engineering & Control System - III	3	1	45	15	100	50			
Total		**33**	**8**	**495**	**120**	**1000**	**350**	**12**	**8**	**20**

Objective: - This subject exposes the students to Navigation - IV, Shipping Management & Maritime Law

Contents of syllabus for USNSC 501 – NAVIGATION IV

Semester V

Unit No.	Topics/Sub Topics	Theory	Practical
	Note: With respect to Navigational Aids, Operating Procedures include characteristics, limitations, care and maintenance.		
Unit I	**Magnetic Compass:** The construction of the magnetic compass and binnacle. Knowledge of Terrestrial Magnetism and Ship's Magnetism (Permanent and induced etc.). The method of determination and compensation by means of components of the effects of a ship's magnetic field on the magnetic compass. The approximate coefficients A,B,C,D, and E. Conditions which might produce coefficient A and E. Analysis of a table of deviation to obtain appropriate coefficients. Methods of obtaining a table of deviation. Calculations on the above. General principles of compass corrections and the method of correction for coefficient B,C, and D. Heeling error and its cause, effect and method of correction. Siting of compasseswith reference to the proximity of magnetic material and electrical appliances. Care and maintenance of liquid compasses. Calculation on the above.	**20 Hrs.**	
Unit II	**Gyro Compass:** The properties of the free gyroscope. The relationship between applied force and precession. The effect of earth's rotation on a free gyroscope. Drift, tilt and damping.Errors associated with gyro compasses including latitude, course and speed error, ballistic deflection and its relation to change of speed error. Latitude, course and speed correction, rolling error and how it is minimized. The principal parts of gyro compass, follow up and repeater systems.	**10Hrs.**	
Unit III	**Satellite navigation**:General features of Navigational satellite. Orbits of Satellites. Full description of the Global Positioning System, (GPS and DGPS). **Automatic Identification System** (**AIS)**: Operation as per Manual, precautions and limitations, care and maintenance **Course Recorder:** Explain working of course recorder, use, care and record keeping, Starting course recorder, Changing of paper of course recorder. **Autopilot:** Principle, functions, auto pilot alarm, Various settings of the auto-pilot for optimal Performance, Adaptive Autopilot. **Use ofRate of Turn Indicator (ROTI)** **Long Range Identification and Tracking (LRIT)**: working principles and operating procedure	**15 Hrs.**	
Practical	**Magnetic compass:** Familiarization with various types of magnetic compasses used on Merchant ships. Routine maintenance of the compass.		**15 Hrs.**

	Gyro-compass: Familiarization with various types of Gyro-compasses used on Merchant ships. Explain procedure starting and stopping and routine maintenance.		

Contents of syllabus for USNSC 601 – NAVIGATION IV
Semester VI

Unit No.	Topics/Sub Topics	Theory	Practical
	Note: With respect to Navigational Aids, Operating Procedures include characteristics, limitations, care and maintenance.		
Unit I	**Voyage Data Recorder (VDR):**Operation as per Manual, precautions and limitations, care and maintenance **Bridge Navigation Watch Alarm System:**Operation as per Manual, precautions and limitations, care and maintenance **Ship Security Alert System (SSAS):**Operation as per Manual, precautions and limitations, care and maintenance **ECDIS:** The working of an ECDIS, Raster and Vector charts, ENC's**,** sensors, advantages and limitations of the equipment. Carriage requirement **Dynamic Positioning Systems:** A brief introduction to the principles.	**15 Hrs.**	
Unit II	**Sonar Aids:** **Echo Sounder:**Principle and working. Operational controls. Choice of site for echo sounder transducers. Errors causing display of faulty or unreliable soundings. **Doppler Log:**Description of the system. Errors and their remedies. **Electromagnetic Log:**Principle and errors **Berthing aids:**Brief description of systems using sound propagation and systems using radio waves propagation.	**15 Hrs.**	
Unit III	**Radar:**Characteristics of a Radar set - its limitations, errors and accuracy, radiation hazards, anamolous propagation, spurious echoes, Block diagram, factors (internal and external) that affect Radar detection and interpretation, influence of weather, various types of displays, Radar logbook, use of radar for navigation and collision avoidance, knowledge of ARPA Radar. Racon, Ramark Beacons and SART. **Bridge Resource Management (BRM):** Knowledge of bridge resource management principles including allocation, assignment, prioritization of resources, effective communication, assertiveness, leadership and obtaining & maintaining situational awareness.	**15 Hrs.**	
Practical	**Echo Sounder:**To take sounding using both visual and graphictypes. (Actual instrument or simulator). **Radar:**Practical adjustment of operational controls. To carryout performance check. Use of performance monitor. To takerange and bearing of targets. To identify land		**15 Hrs.**

	objects on theNavigation Chart using radar observations. Evaluation of risk ofcollision using relative & true plotting techniques and ARPARadar. **ECDIS** - IMO Performance standard for ECDIS, Difference between ENC and SENC, Safety Contours and Safety Depth, Features of ECDIS, Limitations of ECDIS Raster Charts, Vector Chart, Simplified Symbols (5012), Traditional Symbols, Chart Quality and Accuracy (M Quality), Chart Scale, Information Layers. Practical - Draw courses Graphically and Alphanumerically, Indicate Courses and Distances, Set Track Limits, Set appropriate Alarms, Carry out Route Check, Modify Route, Create Maps, Prepare Schedule, Obtain Tidal Information, Chart Assistant **GPS, AIS, BNWAS, SSAS, VDR***:*Familiarity with usage.		

***There will be continuous assessment of skills being acquired through class work, practical and periodic assignments / project works / tests/ orals etc.**
***Journal to be submitted at the end of each term for assessment**

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

Reference Books:

1. Ships Magnetism & the Magnetic Compass	F.G. Merrifield
2. Notes on Compass Work	Kemp & Young
3. Radar and Electronic Navigation	G.J. Sonnerberg
4. Shipborne Radar	Capt. H. Subramanium
5. RADAR and ARPA Manual	A.G. Bole & W.O. Dineley
6. The Ship's Compass	Klinker& Grant
7. Magnetic Compass Deviation & Correction	W. Denne
8. Marine Gyro Compass for Ships Officers	A. Frost
9. Radar Observer's Handbook	W. Burger
10. Marine Electronic Navigation by appleyard	S.F. Appleyard
11. Electronic Aids to Navigation; Position Fixing	L. Tetley & D. Calcutt
12. Ship's Magnetic Compass	Capt. Joseph & Capt. Rewari

Contents of syllabus for USNSC 501 – Maritime Law
Semester V

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**Conventions and Codes –** **IMO Instruments:** Conventions, Protocols, Codes, Recommendations, and Guidelines. (purpose and examples of each) **Brief overview of following conventions–** STCW, FAL, SAR, SUA, NAIROBI, SALVAGE, NUCLEAR, ATHENS, LLMC. **Brief overview of ILO & MLC 2006**	**20 Hrs.**	

	IMO Codes: ISM Code (outline of contents of all chapters, latest amendments, certification, audits. Human error, commitment and motivation. Impact and practice of Risk management), ISPS Code (Security threats, SSO, CSO, PFSO, SSP, ISSC, Security duties, Security Levels, Restricted areas, Security equipment, Declaration of security, Contingency plans to deal with security incidents), Code of Casualty Investigation, IGF Code, INF Code, Polar Code, III Code. **Piracy** – Best Management Practices for protection against Piracy of Somalia, West Africa, Malacca &Singapore Straits etc. **Flag State, Port State Control** (authority, inspections, detentions, common deficiencies, MOUs and their benefits)		
Unit II	Concept of Law-Civil, Criminal Law, Public Law, Private Law, Public and Private International Law. Indian contract Act with reference to following: Agreement, Offer and Acceptance, consideration, consent, capacity to contract, valid, void and voidable contracts, quasi contract, breach of contract, remedies for breach, discharge of contract, agency bailment.	**20 Hrs.**	
Unit III	Scope of Maritime Law – Sources, Subjects and objects. UNCLOS: Continental Shelf, Exclusive Economic Zone, Sea Bed, Admiralty Jurisdiction International aspects of Registration of Ships, building contracts and mortgage. Nationality of ships, flags of convenience& flag of discrimination.	**20 Hrs.**	

Contents of syllabus for USNSC 601 – Maritime Law
Semester VI

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	Indian Merchant Shipping Act, 1958 in general withspecial reference to; a) Definitions. Section 3. b) Registration of Indian Ships Sections 20 to 74. c) Seamen and Apprentices. Sections 88 to 218. d) Limitation and Liability. Sections 352 to 352 F. e) Investigation and Inquiries. Sections 357 to 389.	**20 Hrs.**	
Unit II	Contract of affreightment: a) General aspects of Carriage of Goods by Sea Act, 1925. b) The Indian Multimodal Transport of Goods Act, 1993. c) Hague Visby Rules; Hamburg Rules. d) Charter Party – Various Clauses and their Interpretations.	**20 Hrs.**	
Unit III	**Marine Insurance Act** – Insurable interest in a policy,difference between marine insurance policies andother policies, different types of marine insurancepolicies, perils of sea, claim. Settlement of claims. Legal remedies maritime liens, at common law,general legal remedies as given in specific relief act.Writs	**20 Hrs.**	

	injunction Indian Arbitration and Conciliation Act. 1996. **General Average:** Particular and general average, York-Antwerp Rules, Examples of GA and PA Acts.		

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

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

Reference Books:

1. Merchant Shipping Act, 1958 — Govt. of India
2. The Indian Multimodal Transport of Goods Act,1993 — Govt. of India
3. Carriage of Goods by Sea Act, 1925 — Govt. of India
4. Marine Insurance Act, 1963 — Govt. of India
5. The Arbitration and Conciliation Act, 1996 — Govt. of India
6. The Indian contract Act — Govt. of India
7. STCW Convention and Code, 1978 as amended — IMO
8. Hague/Visby, Hamburg Rules
9. Charter parties & Bills of Lading — Thomas E. Scrutton
10. Business & Law for the Shipmaster — F.N. Hopkins
11. Shipping Law — Grime R.
12. MLC 2006 — ILO
13. UNCLOS, 1982
14. FAL Convention — IMO
15. SAR Convention — IMO
16. SUA Convention — IMO
17. NAIROBI Convention — IMO
18. NUCLEAR Convention — IMO
19. ATHENS Convention — IMO
20. Convention on LLMC — IMO
21. ISPS Code — IMO
22. ISM Code — IMO
23. Code of Casualty Investigation — IMO
24. IGF Code — IMO
25. INF Code — IMO
26. Polar Code — IMO
27. IMO Instruments Implementation (III) Code — IMO
28. Best Management Practices for protection against Piracy of Somalia based Piracy

Contents of syllabus for USNSC 501 – Shipping Management
Semester V

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**MARINE MANAGEMENT** **Managing & Managers:** Organization and the need for management; the management process; types of managers; management level and skills; managerial roles; the challenge of management. **The evolution of management theory:** Why study management theory? The classical Management theories;	**20 Hrs.**	

	the behavioural school; the quantitative school – operations research and Management science; the evolution of management theory **The external environment of organisations**: the external environment and its importance; Elements of the direct-action environment; elements of the indirect-action environment; theories of total organisation environments, managing the total environment. **Planning and strategic management:** Planning – an overview; the formal planning process; the evolution of the concept of strategy. **Social responsibility and ethics:** the changing concept of social responsibilities; the shift to ethics; the tools of ethics; the challenge of relativism.		
Unit II	**MARINE MANAGEMENT** **Strategy implementation:** Matching strategy implementation to strategy; matching structure and strategy; institutionalizing strategy. **Decision Making:** Problem and opportunity finding, the nature of managerial decision making; the rational model of decision making, challenges to the rational model,improving the effectiveness of decision making and problem solving. **Planning and decision – making tools & techniques:** themanagement science approach; the management scienceprocess; planning for the future – forecasting; planningfor the future – scheduling; planning to meet goals with certainty; planning to meet goals with uncertainty. **Organisational structure, co-ordination, and design:**organisational structure; types of organizational structures; co- ordination; organisational design. **Authority, delegation, and decentralisation:** Authority, power, and influence; line and staff authority; delegation; job design; decentralisation.	**20 Hrs.**	
Unit III	**COMMERCIAL SHIPPING MANAGEMENT** **International Trade and Shipping:** Seaborne trade of theworld composition and direction of cargoes – different typesof ships which carry them – Technological development –Role of Shipping on national economic development. **Basic Structure of Shipping Industry:** Types of Shipping services – Liner and Tramp – Role of Intermediaries in shipping business: Freight brokers, clearing and ForwardingAgents, Stevedores – Shipbrokers, Bunker and Storessuppliers etc. Shipping Agencies. **Liner Trades** – characteristics – Liner Conferences – HowFreight rates are fixed, Components of Liner Freight – Non – Conference lines – competition. Procedures of Shippingcargoes and related documentation; Mate's Receipt, Bill ofLading. Unit load systems – containerization and multimodaltransport. **Tramp Trades** – Chartering – different types of	**20 Hrs.**	

	chartering ships – their relevance to trades – Procedures anddocumentation relating chartering – Charter markets of theworld – How freight / charterhire is fixed. **Organisation of shippingcompany** – Manpower planning –Business and cargo management – Statutory regulations to be complied with like Foreign Exchange Regulation. **Behavior based safety (Importance of human element).** **Mental health and wellness at sea**		

Contents of syllabus for USNSC 601 – Shipping Management
Semester VI

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**MARINE MANAGEMENT** **Human resource management:** the HRM process – a traditional view; human resource planning; recruitment; selection, orientation or socialisation, training and development; performance appraisal; promotions, transfer, demotions, and separations; HRM and strategy. **Managing organisational change and innovation:** Why planned change is needed? A model of the change process; type of planned change; organisational development; managing creativity and innovation. **Motivation, performance and job satisfaction:** Theories of motivation – an overview; content theories of motivation; process theories of motivation; reinforcement theory, a system view of motivation in organisations. **Leadership:** Defining leadership; the trait approach of leadership; the behavioural approach to leadership; contingency approaches to leadership; the future of leadership theory. **Groups and committees:** types of groups; characteristics of groups; problem solving in groups; making formal group effective. **Communication and negotiation**: the importance of communication; interpersonal communication; barriers toeffective interpersonal communication; communication inorganisations, using communication skills – negotiating to manage conflicts. **Effective control:** the meaning of control; types of control methods; designing control systems; financial controls; budgetary control methods. **Operations management:** the nature of operations; the importance of operations management; designing operations systems; operational planning and control decisions; quality control. **Information systems:** information and control; management information systems; designing a computer – based MIS; implementing a computer – based MIS; end-user computing; the impact of computers and MIS on managers and organisations.	**25 Hrs.**	
Unit II	**Pre - Sea Human Resource Development and Life Skills Program:**(Introduction of Human Resource Development Programme for training of seafarers at Pre-sea stage – DGS Circular 24 of 2005)	**15 Hrs.**	

	Topics covered: • Introduction to the Industry, • Behavioural patterns & Attitudes with due cognizance to implementation of legislation • Communication and the Art of listening • Prioritization, Time Management & Planning • Mental Gymnastics & Creative Problem solving • Anger/Violence Prevention/Aggression Control &Conflict Management • Management of Stress, Distress situations, Accidents proneness. • Emotional Management, Management of Depression / Fear / Fatigue / Revenge v/s Forgiveness, Coping with anxiety of being away from home. • Use of Drugs & Alcohol. Sexual health • Team Bonding		
Unit III	**COMMERCIAL SHIPPING MANAGEMENT** **Role of ports:** Port locations – Functions and range ofservices – Financial aspects of utilisation and cargo handling. India's ports, their organisation and administration. Modernisation and development of ports **Role of Customs:** Customs Act and documents relating to customs relating to ship operations and trade. **Indian Shipping Development:** India's Merchant Fleet – Role of Government – Maritime Administration in India – India's Shipping Policy. **Maritime Frauds:** Safeguards to be taken to prevent frauds with special reference to shipping industry, operators and seafaring personnel. **Maritime Cyber Security and use of digital tools (remote surveys, etc)** **Role of International Organization:** UNO, IMF, World Bank, IMO, ILO, UNCTAD, UNCITRAL, WTO, ITF, WHO. **Shipping and Special Needs:** Awareness on the M.S. (Recruitment and Placement of Seafarers), Rules, 2005. Attached module: Implementation of Merchant Shipping (Recruitment and of Seafarers) Rules, 2005 Spreading awareness among Indian Seafarers thereof- DG Shipping Order 6 of 2006. Topics Covered: MS Act 1958 • Overview • Section 95 (registration of recruitment and placement agencies) • Part VII (Employment of seafarers on Indian flag vessels	**20 Hrs.**	

	Recruitment and placement rules 2005 • Introduction & definitions • Significance of the RPS, Rules, 2005 • Purpose of the rule • Benefit to seafarers under the rule • Responsibilities of employer • Rights and responsibilities of the seafarer • How to access information regarding registered recruitment and placement agencies Article of Agreement (Indian Ships) • Lecture on general content of agreement • Responsibilities of employer & seafarer • Discussion on the content Article of Agreement (foreign flag ship) • Lecture on general content of agreement • Relevance of RPS, Rule 2005 on foreign ships • Responsibilities of foreign employer & seafarer • Discussion on the content.		

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

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

Reference Books:

1. Management — Stiner & Freeman
2. The Practice of Management — Drucker P.
3. People in Organizations: Introduction to organizational behavior — Mitchell, T. R.
4. Consumer Behavior: Basic findings & Management Implications — Zaltman G.
5. The Mathematics of Investment — W L Hart
6. Information System: Theory and Practice — Burch Jr.
7. A Concept of corporate planning — Russel L. Ackoff
8. IACOCCA: An autobiography — Lee Iacocca
9. An introduction to Financial Management — Solomon & Pringle
10. Human Resource management — R.S. Dwivedi
11. An introduction Database Systems — Dale C.J.
12. Monetary Planning for India — Gupta Suraj B.
13. International Maritime Fraud — Ellen & Campbell
14. Elements of Shipping — Alan E. Branch
15. Containerization, Multimodal Transport& Infrastructure development in India — Dr. K.V. Hariharan
16. RPSL Rules — Govt. of India

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

Contents of syllabus for USNSC 502 – NAVIGATION III

Semester V

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**Section A -** Birth of universe, stars, planets and their satellites. Signs of the Zodiac. Recognition of principal stars with reference to their constellations. Stellar magnitudes. **Section B -** Solution of Spherical triangle by Haversine formula, Sine formula, Cosine formula, four part formula & Napier's Analogies.Application of right angled & quadrantal spherical triangles.	**15 Hrs.**	
Unit II	**Section A -** Kepler's Law. Distance of planets from the sun. Bodes law. Inferior and superior planets. Axial revolution of planets. Relative motion of planets in their orbits. Elongation; Morning and evening star; Reasons for change of SHA/RA of Sun, Moon and planets. Solar prominences, solar spot cycle and its effect on terrestrial magnetism. **Section B -** To obtain a position by use of position lines obtained fromTwo or more observations with or without run (Simultaneous or staggered). The cocked hat and its interpretations.	**15 Hrs.**	
Unit III	**Section A -** Earth-moon system, moon's orbital and axial rotation, phases of the moon, liberation. Lunar month. Eclipses – solar & lunar; Conditions necessary for occurrence ofa solar or lunar eclipse. Occultation planet or star. Precession of equinoxes. **Section B -** Calculations based on Sem I, II, III & IV portion ofpractical navigation,	**15 Hrs.**	
Practical	**SEXTANT:** To useSextant for the accurate measurement of vertical & horizontal sextant angles. To identify adjustable errors of the sextant and to correct such errors. To measure altitudes of heavenly bodies when possible and do sight calculation. **GYRO COMPASS:** To know procedure of starting &stopping of Gyro Compass. Routine maintenance. Use of Azimuth ring to take bearing of both celestial and terrestrial objects.		**15 Hrs.**

Contents of syllabus for USNSC 602 – NAVIGATION III
Semester VI

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**SECTION-A** Great circle sailing – Initial & Final courses and distances, Pole, vertex, course on crossing the equator. Figure drawingof a GC track approximately to scale. Composite great circle sailing. **SECTION-B** Practical problems on Great Circle sailing. Use of ABC tables to find initial course, final course, Pole and Vertex of a Great Circle & great circle distance.	**15 Hrs.**	
Unit II	**SECTION-A** Twilight – Civil, nautical and astronomical – conditionsnecessary for twilight all night; calculation of time of twilight by perusal of almanac with appropriate	**15 Hrs.**	

	corrections, simple calculations based on above. Circumpolar bodies; conditions necessary for a body to be circumpolar. Maximum azimuth. Problems on these topics. **SECTION-B** Practical problems on composite circle.		
Unit III	**SECTION-A** Relationship between tides & phases of the moon – springand neap tides; priming & lagging. Calculations based on 1st& 2nd year's portion of Principles of Navigation. **SECTION-B** Calculations based on I,II,III,IV& Vth Semester portion ofpractical navigation.	**15 Hrs.**	
Practical	**METEOROLOGICAL INSTRUMENTS:** To take observations and apply corrections to obtain accurate barometric pressure using both Mercurial & Aneroid Barometers.To take readings on Barograph and measure pressure tendency. To obtain Relative Humidity using dry & wet bulb thermometer. The use of Psychrometer. Use of anemometer and wind wane.		**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. Subramanium
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. Subramanium
8. Nories Nautical Table
9. Nautical Almanac

Contents of syllabus for USNSC 502 – VPCP III
Semester V

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**VOYAGE PLANNING** 1. To find the time and height of HW and LW at standard ports and at secondary ports by Tidal differences. 2. To find the time at which the tide reaches a specified height or the heights of the tide at a given time and hence the correction to be applied to soundings or charted heights of shore objects. **COLLISION PREVENTION** Annexes I and II of International Regulations for prevention of collision at Sea	**18 Hrs.**	

Unit II	**VOYAGE PLANNING** A systematic knowledge and use of the contents of the following documents in relation to Safety of Navigation - Sailing Directions, List of Light & Fog Signals, List of Radio Signals. Contents of Mariner's Hand book **COLLISION PREVENTION** Annexes III and IV of International Regulations for prevention of collision at Sea	**15 Hrs.**	
Unit III	**COLLISION PREVENTION** Revision of all the rules & IALA buoyage System	**12 Hrs.**	
Practical	**VOYAGE PLANNING** Practical of first year and second year pertaining to Position fixing by various methods, current & leeway, running fix and three points bearing. **COLLISION PREVENTION** The students will be required to identify various collision situations by day and by night. Practical to be held using a Magnetic Board, Wooden models, ROR Cards or any other aid to simulate such conditions. Candidates will be required to deal with each collision situations broadly under the heading 'recognition', 'responsibility', 'action', 'appropriate sound signal' and 'any ordinary practice of seaman'.		**30 Hrs.**

Contents of syllabus for USNSC 602 – VPCP III
Semester VI

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**VOYAGE PLANNING** A systematic knowledge and use of the contents of the following documents in relation to Safety of Navigation – Ocean Passages of the world, Notices to Mariners, M & MS Notices, Guide to Port Entry Brief knowledge of digital publications used on board ships	**15 Hrs.**	
Unit II	**VOYAGE PLANNING** Selection of ocean routes, Shore-based Weather Routeing.Components of Passage planning, Planning & executing a coastal passage, Navigation in pilotage waters, Information to be marked on voyage charts to enhance safety of navigation, Approaching and passing through aTraffic Separation Scheme.	**15 Hrs.**	
Unit III	**Radar plotting:** True Plot (Basic Idea) Relative plot Exercises Determining bow pass distance Revision of radar plotting syllabus done in second year Deciding action for collision avoidance taking into consideration the COLREGS.	**15 Hrs.**	
Practical	**VOYAGE PLANNING** Demonstration of the ability to plan a passage taking into consideration important factors such as depth of water, distance off dangers, current, traffic separation schemes, navigations aids available, etc. **COLLISION PREVENTION**		**30 Hrs.**

	Recognition of various buoys & marks under IALA system and appropriate actions required under the Rules. Collision situations in restricted visibility with or without Radar, Statutory obligations under both circumstances.		

***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. Subramanium
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- III, Ship Operational Technology - IV & Naval Architecture Paper – III

Contents of syllabus for USNSC 503 – SOT III

Semester V

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	1. Study of IMO codes and guidelines for the carriage of dangerous goods, chemicals in bulks, liquefied gases in bulk. 2. Dangerous goods in packaged form (SOLAS, Ch. VII, IMDG Code and MARPOL Annex III). Classification of IMDG cargo with distinctive labels and examples. Use of IMDG Code, UN No., General Index, MFAG, EmS. Compatibility and segregation table, precautions during stowage handling and loading of explosives. GUIDELINES FOR REPORTING INCIDENTS INVOLVING DANGEROUS GOODS, HARMFUL SUBSTANCES AND/OR MARINE POLLUTANTS (A.851/20) 3. Chemical Tankers (SOLAS Ch. VII, MARPOL Annex II, IBC Code) - Type 1, Type2 and Type 3 chemical tankers. Various categories (X, Y, Z, OS) of cargoes. Hazards associated with chemical cargoes and control	**20 Hrs.**	

	measures. Purpose and use of IBC Code. Discharge criteria. Changing grades of cargoes. P & A Manual. 4. Gas Tankers: (Ch. VII of SOLAS, SIGTTO and IGC Code) - LNG, LPG, LEG and chemical gases in bulk. Type A, Type B and Type C tanks; each tank is fitted with high level alarm and auto-shut off. Purpose and objectives of the IGC Code. Hazards of gas cargoes and control measures adopted.		
Unit II	1. Outline knowledge of "Code of safe practices for ships carrying Timber deck Cargo". 2. International Grain Code. 3. International convention for safe container (CSC) 4. Ro – Ro Ships - Preparation of car decks for loading, procedures for opening, closing and securing of bow, stern and side doors and ramps and its water tight integrity. 5. Offshore Supply Vessels - Type and features of OSV, use and purpose of OSV. Basic knowledge of OSV code.	**15 Hrs.**	
Unit III	Basic knowledge of the various components of a shipboard GMDSS station.	**10 Hrs**	
Practical	**MARINE COMMUNICATION** To send and receive Morse code by flash lamp up to six words per minute. Knowledge of operation of GMDSS Radio Station equipment.		**15 hrs.**

Contents of syllabus for USNSC 603 – SOT III
Semester VI

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	1. Principles involving the carriage of oil. Procedure to follow at tanker terminals. Detail study of tanker terminal codes for handling of petroleum products, bulk liquids chemicals and liquefied gases. Avoidance of accidental pollution's and precautions to be taken. 2. Knowledge of contents of International safety guide for oil tankers and terminals (ISGOTT). Study of Tankers with respect to: Types of pumps, valves, pipeline systems, Ullaging, temperature, interface. 3. Cargo calculation. 4. Operation of loading, discharging, ballasting, deballasting, inerting, purging, tank washing including COW, gas freeing. 5. Flammability diagram. 6. Operation and maintenance of various gas measuring instruments including personal gas monitor. 7. Man entry procedures. Rescue teams. 8. Control of oil spill with reference to MARPOL 9. Basic knowledge of Loading manual, COW Manual	**20 Hrs.**	

Unit II	1. Study of bulk carriers with respect to: Loading, discharging, ballasting, de-ballasting operations. 2. Precautions to be taken for high density cargoes, DRI, and concentrates. 3. Requirements under IMSBC 4. Calculations relating to above topics – Draft Survey 5. Ability to interpret given figures for BM & SF. 6. Inspection report; Assess reported defects and damage to cargo spaces, hatch covers, ballast tanks and take appropriate action. 1. Common damage/defects in WT transverse bulkheads at ends of dry cargo hold of bulk carrier. Cracks found at connection of stool of transverse bulkhead and tank tops in bulk carrier.	**15 Hrs.**	
Unit III	Communication procedures under GMDSS in Distress & Safety situations in accordance with regulations contained in SOLAS, ITU and other publications.	**10 Hrs.**	
Practical	1. Knowledge of operation of radioequipment to be carried and used in a lifeboat & life raft. (EPIRB, SART, etc). 2. Basic commercial working & logbook procedures using the simulator.		**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.	Seamanship and Cargo Work	Capt. J. Dinger
3.	Cargo work	Capt. L.G. Taylor
4.	Stowage of Cargo	O.O. Thomas
5.	Grain Rules	I.M.O
6.	Code of Safe Practice for Bulk Cargo	I.M.O
7.	International Bulk Chemicals code 1986	I.M.O
8.	I.M.D.G. Code Consolidated edition 1988	I.M.O
9.	Marpol 73/78 Consolidated Edition	I.M.O
10.	Load Line convention 1966	I.M.O
11.	Guidelines for Tank washing with Crude Oil	Institute of Chamber of Shipping
12.	The Chemistry of Oil Tankers Fires and the Inert Gas System	Capt. G.S. Heredia
13.	Tankers Handbook for Officers	Capt. C. Baptist
14.	Tankers Practice	G.A.B. King
15.	Tankers Practice	Rutherford
16.	International Safety Guide for Oil Tankers & Terminals (ISGOTT)	ICS
17.	Amendments to SOLAS Convention Manual for Maritime mobile Communication and Maritime Mobile Satellite Communication	I.T.U
18.	International Volume of Radio Signals	HMSO

19.	International Code of Signals	I.M.O
20.	GMDSS for GOC	Clifford Merchant

Contents of syllabus for USNSC 503 – SOT IV
Semester V

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	1. STCW Chapter VIII - Watch keeping at sea, at anchor & in port.Taking over, keeping and handing over of a watch Preparation for proceeding to sea, making port and entering harbours. Navigation with Pilot On board. 2. Berthing alongside and leaving quays under various conditions of wind & tide. 3. Knowledge of maneuvering trials, measured mile, stopping distance, turning circles, advance, transfer etc. - IMO requirement for the same. 4. Shallow water effect, Interaction. Turning ship short round, emergency maneuvers, Man overboard. 5. Code of Safe Working Practices - Safety Committee, Safety officer	**15 Hrs.**	
Unit II	**1.** Use & care of Life Saving and Fire Fighting Appliances. **2.** Life Boat/Life raft – Statutory requirements **3.** Precautions in maneuvering for launching of boats or life rafts in bad weather. **4.** Prevention of fire at sea & in port. Oxidation, flashpoint, auto ignition temperature, and spontaneous combustion. **5.** Methods used to prevent the spread of fire. **6.** Code of Safe Working Practices - lock out and tag out Procedures, Risk assessment	**15 Hrs.**	
Unit III	1. Inspection and maintenance of ship and equipment, items to be covered include Hull, Bulkheads, DBs, Deep and Peak tanks, bilges, pipe lines, rudders, anchor and cables. Davits, safety equipment, derricks and other cargo gear, navigation lights. 2. A practical knowledge of siting and screening of ships navigational lights. 3. Surveys and classification of ships with reference to safety equipment and safety construction certificates with particular attention to maintenance aspect. 4. PMS - Inspection and maintenance of the ship and equipment; purpose of PMS; types of PMS. 5. Code of Safe Working Practices - Precautions while entering confined / enclosed space, Rescue from enclosed spaces	**15 Hrs**	
Practical	1. Thorough knowledge of various knots/bends/hitches/splicing/whippings 2. Demonstrate the method of belaying and racking a wire rope. 3. Conduct practical exercises on throwing heaving lines		**15 hrs.**

	4. Use of messenger line, rope and chain stoppers, mooring shackles, slip-ropes and fenders 5. Demonstrate the method of joining two mooring hawsers. 6. To transfer rope from mooring winch to bollards and making fast. 7. Removing of rust by chipping, preparation of surface, use of proper primers, brush painting		

Contents of syllabus for USNSC 603 – SOT IV
Semester VI

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	1. Damage control. Action to be taken following collision and grounding. Damage Control Plan & Booklet 2. Steps to be taken when disabled & in distress. 3. Preservation of passengers and crew in an event of emergency – Crowd management. 4. Abandoning ship – survival procedure. 5. Assisting a ship or aircraft in distress use of IAMSAR manual. 6. Code of Safe Working Practices - Permit system - hot work permit, cold work Permit, entry into enclosed space permit, working aloft permit, working over side permit, electrical isolation permit	**15 Hrs.**	
Unit II	1. Management of ship in heavy weather 2. Elementary ideas on Towing and being towed – Emergency Towing Arrangement. 3. Precautions to be observed to prevent pollution in port & on the high sea. 4. Code of Safe Working Practices - Importance of various Check lists.	**15 Hrs.**	
Unit III	1. Maintenance of Crew accommodation. 2. Methods of pest control. Fumigation of holds and living spaces. Safeguards in applying various methods. 3. Code of Safe Working Practices - Importance of personnel health and hygiene on board ship, Safe bunkering practices	**15 Hrs.**	
Practical	1. Handling of boat under Oars. Coming alongside and getting away. Picking up a man overboard. 2. Splicing of Fibre Ropes & Wire Ropes: Fibre Rope; eye splice, short splice, back splice. Wire Rope; Eye splice (group activity of 2-3 cadets). 3. Demonstrate the use of bulldog grips and bottle screws / turnbuckles in joining wires. 4. Demonstrate to cadets: taking drafts 5. The use of various gas measuring instruments. 6. Procedure for Enclosed space Entry including entry permit.		**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 — G. Danton
2. Seamanship Notes — Kemp and Young
3. Seamanship and Cargo work — Capt. J. Dinger
4. Nicholls's Seamanship and Nautical Knowledge — A.N. Cockcroft
5. Shipboard Operations — H.I. Laurey
6. Code of safe working practices for merchant seafarers MCA

Contents of syllabus for USNSC 503 – NAVAL ARCHITECTURE III

Semester V

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**SHIP STABILITY** Use of Simpson's rules for the computation of areas, second moment of areas, volumes, moments of volumes and centroids. Centre of pressure for regular shapes and parabolic shapes, when given horizontal or vertical ordinates. Derivation of the formulae for TPC, FWA, BM (Transverse), MCTC, Angle of Loll, Virtual loss of GMdue to free surface, Virtual loss of GM on dry docking,List with Zero GM, Wall sided formula and Attwood formula.	**20 Hrs.**	
Unit II	**SHIP STABILITY** Stability at moderate and large angles of heel. Use of the wall – sided formula. Effect of beam and freeboard on stability. Dynamical Stability – calculation of same by the GZ curve. Stability and trim when dry – docking or grounding. Theory of rolling. Synchronism.Parametric rolling The danger to a ship at the angle of loll. Ballasting sequence to rectify same. Calculation based on the same, Angle of loll by GZ curve Dangers to a ship with a heavy list. Dangers associated with deck cargoes including timber. Preventive and corrective actions to take.	**20 Hrs.**	
Unit III	**SHIP CONSTRUCTION** Properties of steel, aluminium and other construction materials used for shipbuilding. Effect of fire, heat, shock etc. on these materials. Midship section of specialized carriers – Passenger ships, Ro-Ro, LASH, Refrigerated cargo, LNG,LPG, Chemicals etc. An out-line knowledge of shipyard practice and procedure including drawing office methods,place and section marking; process control and prefabrication. Methods used in welding of steel ships. Welding of ferrous and non-ferrous metals as practiced in Shipyards. Testing and inspection of welds. Types of joint and edge preparations. Stresses set up due to welding. Stress relieving.	**20 Hrs**	

Contents of syllabus for USNSC 603 – NAVAL ARCHITECTURE III
Semester VI

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**SHIP STABILITY** Bilging of compartment. Permeability of a compartment. Calculation on bilging and flooding of a compartment, symmetrical about centre line anywhere along the ship's length for a box-shaped vessel given centre MCTC.	**20 Hrs.**	
Unit II	**SHIP STABILITY** The inclining experiment. Shearing Forces and Bending Moment. The ship as a box girder. The calculation and graphical representation of the SF and BM for box-shaped vessel, on even keel, under various conditions of load. Modern methods of determining the effect of different conditions of load and ballast on the ships structure and stability – Loadicator Heel due to Turning, Heel due to beam wind	**20 Hrs.**	
Unit III	**SHIP CONSTRUCTION** Classification Societies and their functions. Cargo Ship Construction Rules. Survey of ships, ESP Code,Outline knowledge of tonnage regulations. Load Line Regulations. Assignment of freeboard. Sub divisional load lines on passenger ships. Structural fire protection on Passenger and Cargo ships. Knowledge of application of floodable length curves. Factor of subdivision. Criterion of service numeral. Permissible length affecting hull division on passenger ships.	**20 Hrs.**	

***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 Stability at Operational & Management Level — Capt. H. Subramanium
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. Load Line Convention — IMO
12. International tonnage Convention — IMO

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

Contents of Syllabus for USNSC 504 – Environmental Science - III

Semester V

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**Air Masses and Fronts:** Air masses: Basic concepts; Factors governing Development & properties; Classification; Convergence & Divergence. **Fronts:** Types; Associated weather; Frontal Depressions – Origin, life and movement; Forecasting Techniques. Non – Frontal Depressions. **Tropical Revolving Storms:** Characteristic areas & Nomenclature; Origin, Structure & movements; associated weather; Forecasting Techniques – Past & Present; Cyclone Tracking & warning bulletins for merchant ships under international conventions; Practical rules of navigation for manoeuvring in the vicinity of a T.R.S.	**20 Hrs.**	
Unit II	**Meteorological Analysis & Weather Forecasting:** Sources of Meteorological data; principles of weather analysis; Weather forecasting; Principles & Practices: Macro, Meso & Micro level forecasting.	**10 Hrs.**	
Unit III	**Environment Pollution:** Basic causes, Common pollutants. International Convention for the Prevention of Pollution from Ships (MARPOL) -Pollution by oil, chemicals, hazardous substances, Pollution by garbage and sewage. Atmospheric pollution by marine transportation.	**15 Hrs**	
Practical	1. Application of rules of Navigation when near or facing tropical storms – few exercises. 2. Principles of working and use of meteorological instruments.		**15 hrs.**

Contents of syllabus for USNSC 604 – Environmental Science - II

Semester VI

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**Meteorological & Reporting Systems:** Voluntary observing fleet under I.M.D; type & nature of information collected: Ship's Weather Code (coding and decoding), weather reporting from ships and its significance in weather forecasting. International system of weather reporting.	**10 Hrs.**	
Unit II	**Voyage Planning & Weather Routing of ships:** Basic considerations in Voyage Planning, selection and use of data. Weather Routeing; Basic parameters; least time track and ship's performance curves.	**10 Hrs.**	
Unit III	Pollution by micro-organisms in ballast water, measures for prevention.Conventions relating to prevention of marine pollutionother than MARPOL - HNS, LDC, OPRC, OPRC – HNS, INTERVENTION.	**25 Hrs.**	

	Anti Fouling Paint Pollution: Introduction, Brief History, IMO Regulation for Anti Fouling paints. **National Response Centre with respect to pollution prevention:** General idea **Ship Recycling:** Brief history, IMO Guidelines on ship recycling, concept of Green Passport for ships **National Pollutant Discharge Elimination System (NPDES) of US Clean water Act - overview** **Liability against marine pollution** - CLC, BUNKER, FUND, Supplementary FUND.		
Practical	1. Facsimile weather charts – interpretation of information contained therein. 2. Exercises on the selection of ocean routes on the basis of prognostic surface weather charts.		**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. Principles of meteorological analysis	W.J. Saucier
2. Marine Meteorology	Capt. H. Subramanium
3. Ship's Weather Code 1982	I.M.D.
4. Meteorology for Mariners	HMSO
5. Marine Observer's Hand book	HMSO
6. Atmosphere, Weather and Climate	R.G. Barry
7. General Meteorology	H.R. Byers
8. An introduction to Dynamic Meteorology	J.R. Holten
9. Physical Geography	Savindra Singh
10. Meteorological Analysis & Weather Forecasting	Petterssen
11. MARPOL 73/78 as amended	IMO
12. Weather Routeing of Ships	Motte R
13. Convention on Ballast Water	IMO
14. HNS Convention and Protocol	IMO
15. London Dumping Convention and Protocol	IMO
16. OPRC Convention	IMO
17. OPRC – HNS Protocol	IMO
18. INTERVENTION Convention	IMO
19. Convention on Anti Fouling Systems	IMO
20. Hong Kong Convention on Recycling of Ships	IMO
21. CLC Convention	IMO
22. Bunker Convention	IMO
23. Fund Convention	IMO

Contents of Syllabus for USNSC 504 – MECS - III
Semester V

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**AUTOMATION AND CONTROLENGINEERING** 1. Introduction, growth in shipboard automation, understanding terminology. Sensors Measuring elements for temperature, pressure, level, flow, etc.Transmitter and actuators. 2. Automatic control systems, open loop, closed loop control system, general principles.Controllers and proportional controller. Pneumatic, hydraulic, electric, electronic control systems. Applications in various shipboard operations. 3. Bridge control on main propulsion. Manoeuvring aids – CP. Propeller, bow thrusters. Care and precautions. 4. Trim indicator, heel indicator, draft gauge, load and stress indicators.	**18 Hrs.**	
Unit II	**AUTOMATION AND CONTROLENGINEERING** 1. Liquid cargo loading, storage and discharge operations. Monitoring. Remote level gauges. Types of remote control valves used on board ships. 2. Remote control operation of hatch covers. Remote operation for loading, discharging and ballasting operations. 3. Information display, data logging, alarm systems.Testing and maintenance.	**14 Hrs.**	
Unit III	**SAFETY ARRANGEMENTS** 1. Fire detectors, smoke, heat, flame etc. Fire alarm circuits. 2. Fire fighting systems: Fixed fire fighting installations for engine room, accommodation and cargo holds. CO_2 flooding, high pressure water system, water sprinkler system, bulk dry powder and foam systems. 3. Inert gas for cargo tanks. Inert gas production, generation from boiler flue gas etc. Inert gas generator plant. Use of O_2 analyzer, explosive meter, dragger pump and other portable measuring instruments. 4. Smoke helmets, breathing apparatus, fire suits and other safety equipments. 5. Role of classification society in quality of construction, machinery and operations. Surveys and importance of same. 6. Lifeboat engine, emergency fire pump engine lifeboat winch, operation and care.	**13 Hrs**	
Practical	**HYDRAULIC WORKSHOP** i) Identify various components used in hydraulic system. ii) Interpret basic hydraulic circuit diagrams .Explain with sketch the purpose and symbols of direction control valves and methods of their operation. iii) Identify symbols of various accessories used in hydraulics such as heater, cooler and filters, pressure		**15 hrs.**

	control valves and flow control valves, actuators and pumps. iv) Use ermeto type couplings for joining pipes taking safety precautions. v) Execute common fault finding and rectification in hydraulic system taking safety precautions. (group activity of 2-3 cadets). vi) Use the hydraulic hand pump used for emergency operations in the hydraulic system taking safety precautions. vii) Carry out air purging in the hydraulic system taking safety precautions. viii) Tighten leaking hydraulic connections taking safety precautions. ix) Demonstrate the procedure to clean and replace filters in the system taking safety precautions (group activity of 2-3 cadets). x) Demonstrate the ability to prepare and start a hydraulic power pack system including accumulator and expansion tanks taking safety precautions (group activity of 2-3 cadets). xi) Demonstrate the understanding of working of hydraulic door closer taking safety precautions. **PNEUMATIC WORKSHOP** i) Identify the various equipment operated by pneumatics such as pneumatics wrench, lights, grinders, drilling machines, spray painting machines etc. ii) Identify various components used in pneumatics like relays, transmitters, actuators etc. iii) Identify symbols used in pneumatics and how they are different than the hydraulics. iv) Trace the simple pneumatic circuits v) Detect and rectify common faults in pneumatic circuits. vi) Demonstrate the ability to clean compressed air filters including dryers (dehumidifier) (group activity of 2-3 cadets) vii) Demonstrate the ability to overhaul the pneumatic tools / equipment such as pneumatic torque wrench (group activity of 4-5 cadets)		

Contents of syllabus for USNSC 604 – MECS - III
Semester VI

Unit No.	Topics/Sub Topics	Theory	Practical
Unit I	**MARINE ENGINEERING** **Auxiliaries:** a) Fuels: Different types and properties. Fuel storage & supply on board the ship. Fuel oil System. Treatment of fuel	**18 Hrs.**	

	b) Propellers & main shafting: types of propellers, fixed pitched & variable pitch propellers. Pitch, pitch angle, real and apparent slips, propeller efficiency, calculations based on same. Shafting tailend shaft, thrust block, intermediate shaft, alignment. c) Deck Machinery: Cargo winch, windlass, lifeboat winch. Hydraulic, Pneumatic electric drives. Safety features.		
Unit II	**MARINE ENGINEERING** **Main propulsion units (IC engine and others)** a) Process of exhausting, scavenging and supercharging. Scavenge fires. b) Lubricating oil, jacket (and other) cooling water systems. Types of lubricating oils for different duties. Simple C.W., L.O and F.O. flow circuits for large diesel engine. Reasons and methods of chemical treatment of C.W. system. Testing of jacket cooling water. c) Operations of IC engine as main propulsion engine. Warming up, starting manoeuvring, reversing and full power running of the main engine. Limitations and care required on IC engine during manoeuvring and at full power. d) Selection criterion of IC engines, power weight ratio, specific fuel consumption, indicated power, brake power, shaft power, delivered power, thrust power, effective power. Various efficiencies, calculations based on same. Maximum continuous rating (MCR). Calculation of fuel consumption, economic speed. Heat balance, various losses and calculations.	**14 Hrs.**	
Unit III	**MARINE ENGINEERING** **"Other propulsion units"** a) Turbines: Impulse and reaction turbine, gas turbines, steam turbine, operations & care. Turbines as prime movers for various duties including as cargo pumping operations on tankers. Steam turbine, gas turbine as main propulsion units. Advantages and disadvantages. Manoeuvring operations. b) Pollution control: Sewage treatment Plant, Sewage disposal methods,limits, regulations. Bilge oil water separator construction, operation & regulations. Control of pollution from machinery exhausts regulations and remedies. Incinerator construction and operations, regulations.Comminuter/Grinder, Ballast water treatment plant. NOx Technical Code	**13 Hrs.**	
Practical	**PUMP AND VALVES** i) Identifies various pumps used onboard ii) Identifies the parts of pumps viz centrifugal pump, gear pump, reciprocating pump and states its use. iii) Demonstrates the ability to remove ball bearing from a shaft. iv) Demonstrates the Starting of centrifugal pump. v) Identifies valves viz Globe valve, gate valve, non return valve, swing check valve. vi) Dismantle and assemble globe valve and gate valve		**15 Hrs.**

	carry out gland packing and gasket cutting. vii) Identifies parts of globe valve and gate valves. **DIESEL ENGINE** i) Identifies the parts of Medium and large diesel engine and states its use. ii) Identifies the parts of Medium and large diesel engine and states its use. iii) Demonstrates the Assembly of small diesel engine and its components. iv) Demonstrates the Starting and running operation of motor boat engines. **HEAT EXCHANGERS AND AIR COMPRESSOR** i) Identifies the types of heat exchanger and identify its parts. ii) Dismantle and assemble heat exchanger and describe the working of heat exchanger. iii) Demonstrates the importance of zinc anodes in heat exchanger. iv) Identifies the parts of reciprocating air compressor and states its use. v) Demonstrates the ability to start and stop a air compressor.		

***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 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
10. MARPOL 73/78 as amended — IMO
11. NOx Technical Code — IMO

Scheme of Examination (Theory)

(a) Internal assessment- 25 marks

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

b) Semester End Theory Examination – 75%

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

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

Theory – 75 Marks

Semester end examination		
Questions in Examination Paper	**Units**	**Maximum Marks**
Q - 1	1	15
Q - 2	2	15
Q - 3	3	15
Q - 4	1,2,3	15
Q - 5	Examiner Choice	15
	Total	**75**

Conduct of Practical Examination 50 Marks