INDIAN MARITIME UNIVERSITY

(A Central University under Ministry of Ports, Shipping and Waterways, Govt. of India)

School of Nautical Studies

One Year Diploma in Nautical Science (DNS)
Leading to
Bachelor of Science (B.Sc.) Applied Nautical Science

Regulations and Syllabus
(6TH Revision) – 2024
(With effect from August 2024 batch onwards)

INDIAN MARITIME UNIVERSITY

(A Central University under Ministry of Ports, Shipping and Waterways, *Govt. of India)*

School of Nautical Studies

Diploma in Nautical Science (DNS)

Leading to

Bachelor of Science (B.Sc.) (Applied Nautical Science)

REGULATIONS AND SYLLABUS

(6th Revision) - 2024

(With effect from August 2024 batch onwards)

Course Curriculum
One Year Diploma in Nautical Science (DNS)
leading to
3 years B.Sc. (Applied Nautical Science) Degree

i) First year consists of two **"Six-month semesters"**. Successful completion of first year leads to award of Diploma in Nautical Science (DNS).

ii) Completion of subsequent Education and Training as per course curriculum leads to award of B.Sc. (Applied Nautical Science) Degree.

The Course curriculum for the "**One-year Diploma in Nautical Science (DNS) leading to B.Sc. (Applied Nautical Science) Degree**" includes the requirements of the STCW Convention of IMO Model Course 7.03 and Directorate General of Shipping, for competencies required for an "Officer in Charge of a Navigational Watch". This Course Curriculum has the approval of the Indian Maritime University and Directorate General of Shipping, Government of India.

(This 6th Revision DNS Syllabus of 2024 supersedes 5th Revision DNS Syllabus of 2021)

Preface

The syllabus for the One Year Diploma in Nautical Science (DNS) leading to B.Sc. (Applied Nautical Science) Degree has been drawn by a high powered committee constituted by IMU under the guidance of the Honorable Vice-Chancellor. The Syllabus is drawn up keeping the objective of providing education and training, including competencies that one would require to progress in the career from a Cadet to a Master Mariner.

The syllabus contents have been drawn up keeping in mind the country's recently revised education policy at the 10+2 level, which is the entry level qualification for this programme.

A Nautical Science career in academic areas demands very high level of knowledge and competencies in Navigation, Seamanship, Cargo handling, Ship Operations, along with Human Resource.

A Nautical Science career demands a very high level of discipline and overall growth of an Officer to take up a highly demanding job of a Navigating Officer aboard a modern merchant ship. In view of this, a highly integrated education and training schedule is drawn up to provide for development of the extracurricular facets of an individual. This includes the necessary regimental training in uniform for disciplined education.

The 36 months programme includes 12 months of pre-sea training (First six months & Second six months), 18 months of on board training (DLP mode), followed by 6 months of post sea training for preparation and successful completion of Second Mate (Foreign Going) Competency Examination.

One Year Diploma in Nautical Science (DNS) Syllabus

The 12 month DNS syllabus has been drawn to provide underpinning knowledge and competencies for growth of an individual at ascending levels onboard ship and later ashore. In depth training is imparted in specialized fields of shipping like Terrestrial and Celestial Navigation; Bridge Equipment, Watch keeping, Meteorology; Cargo Handling, Stowage and Seamanship; Ship Construction and Ship Stability; MARPOL and COLREGS and Contingency Preparedness, Marine Eng. Practical. Training is also imparted, to improve the written and spoken English, teaching the cadet importance of teamwork, leadership, positive attitude, Book Review, News Paper Reading and interpersonal relationships. The Syllabus includes theoretical and practical aspects of subjects like Mathematics, Physics and Computers Practical.

The set of Text books to be issued to the students by the Institutes have been recommended. Reference books for the Institute's Library have also been recommended.

Keeping in mind significant changes made to STCW Convention in 2010 and also the latest amendments and the revised Second Mate syllabus, the Syllabus Revision Committees have revised the DNS Syllabus 2012 in Feb 2015, July 2018, June 2021, and now in May 2024.

The DNS programme incorporates a provision for open book examination in subjects like Navigation and Ship Stability (both semesters) where Nautical Almanac, Nautical tables, Tidal volumes and Stability booklets are referred for arriving at answers.

This 6th Revision of Syllabus for Diploma in Nautical Science leading to 3 year B.Sc (Applied Nautical Science) adhere to the "Minimum Credit Requirements to Award Degree" as per UGC's Curriculum and Credit Framework for Undergraduate Programmes as below

S.No	Broad Category of Course	Minimum Credit Requirement for 3-year UG (as per UGC)	Hence Minimum Credit Requirement for 1-year Programme	Actual Credits allotted under each category in DNS leading to B.Sc. (Applied Nautical Science)
1	Major (Core)	60	20	38
2	Minor Stream (MS)	24	8	8.5
3	Multidisciplinary (MD)	9	3	4.5
4	Ability Enhancement Courses (AE)	8	3	3
5	Skill Enhancement Courses (SE)	9	3	3
6	Value Added Courses common for all UG (VA)	6 to 8	2 to 3	3
7	Summer Internship(SI)	2 to 4	1 to 2	1
	Total	**120**	**40**	**61**

In the current syllabus, some of the significant revisions are listed below –

- Swimming, Harbor/ Port visits, Industrial visits brought under the syllabus
- Terrestrial Navigation is Combined with Chart Work Theory
- Celestial Navigation topics have been trimmed to suit programme
- ECDIS is taught extensively in both Theory aswell as in Chart Work practical.
- Familiarization with Bridge Equipment's on OOW simulator has been introduced.
- COLREGS taught in the first semester enabling student to appear shipping companies' placement exams during 2nd semester.
- Increased emphasis on SMCP terms under Maritime English course
- In Maritime English additional topics as per Industry requirements with respect to communication skills have been included such as Book Review, News Paper reading session, Letter and Report writing etc.,
- Basics of Cyber Security has been included in Computer lab.
- Seamanship and Workshop practical syllabus has been separated as two different practical subjects with ease of conducting practical classes and End Semester Exams.
- A *Book review session* is included in Maritime English subject, as well as slated as a Separate Studio Activities practical.
- Apart from above there are various minor changes which were affected.Some reshuffling of topics between the semesters was also carried out basis inputs from various faculty from MTIs.

Training Activities

- **Proficiency in English Language**

  A *Book Review* assignment has been introduced in both the Semesters under English Subject and Studio Activities practical respectively in 1st and 2nd Semester. This is done with a hope to trigger cadets' interest in Reading habits, a hobby which has potential to transform lives.

- **Swimming**

  Upon admission of a batch, non-swimmers should be identified at the earliest and swimming training should be arranged to ensure that all cadets pass the swimming test as per applicable DGS requirements before passing out, a Field Practice Practical assigned for the same.

- **Harbour / Ship visits –**

  It is recommended that as far as practicable MTIs should arrange a Harbour / Ship visit and Industry visits during the training programme.

- **Sports, Parade and Extra-curricular activities (Yoga,Meditation, Theatrics)**
  Sports, Parade and other Extra-curricular activities (Yoga, Meditation, Theatrics, and various Clubs etc.) should be promoted during the training programme to enhance OLQ & nurture soft skills amongst the cadets passing out.

On successful completion of Semester-I and II Examinations, the cadet will be awarded a Diploma in Nautical Science and with two basic modular courses(Basic Safety Training (BST) course and Security Training for Seafarers with Designated Security Duties (STSDSD) certificates the Cadet will be eligible for onboard training.

The pedagogy will be as per UGC guidelines and STCW Model Course 7.03, i.e. a blend of classroom lectures, practical training, Simulator based training, Group activities / Presentations, etc. to the possible extent.

To verify the learning of the cadets, continuous assessment in the form of Formative and Summative assessments is planned.

Acknowledgement

The Syllabus revision committee whole heartedly thanking

The Hon'ble Vice-Chancellor, IMU

Pro-Vice Chancellor, IMU

Controller of Examinations, IMU

School Board Members of Nautical Studies, IMU

Industry Experts - MASSA, CMMI, SYNERGY Marine Group, Kattupalli Port

Principal (Retd) National College Tiruchirapalli

Faculty of IMU Campuses (Chennai, Navi-Mumbai, Kochi)

HIMT College and other affiliated colleges

Who have offered valuable direction and key inputs during revision of the syllabus.

Syllabus Revision Committee 2024

One-year Diploma in Nautical Science (DNS) leading to B.Sc. (Applied Nautical Science) Degree Syllabus 2024 (6th Revision) has been revised in May 2024. In this regard, a Syllabus Revision Committee was constituted with following members:

1. Capt. Ganesan Velayutham, Chairman (HoD School of Nautical Studies, IMU Chennai Campus)
2. Prof. (Capt.) S. Kishore IMU Chennai, Member (Professor of Practice, IMU Navi Mumbai Campus)
3. Capt S.M Halbe, Member from School Board (CEO MASSA)
4. Capt Sudarsan Srinivasan, Member Industry Expert (Director, Training Synergy Maritime Recruitment Services Pvt Ltd Mumbai)
5. Capt Ivan Franco Member Industry Expert (Pilot Kattupalli Port)
6. Dr R Sundhararaman Member External Expert from Academia (Principal (Retd) National College Tiruchirapalli)
7. Capt Sujit Kumar Pathak, Member (Associate Professor & HoD I/c IMU Kochi Campus)
8. Capt A K Majumder, Member (Associate Professor & HoD I/c IMU Navi Mumbai Campus)
9. Capt Suneel V Sule, Member Expert from Affiliated Institute (Principal, Anglo Eastern Maritime Academy)
10. Capt Anand Subramanian, Member Expert from Affiliated Institute (Principal-HIMT College)
11. Capt. S. Viswanathan, Special Invitee (Associate Professor, IMU Chennai Campus)
12. Smt Sridevi Devasena, Convenor (Assistant Professor, IMU Chennai Campus)

Table of Content

S.No	Content	Page No
1	Regulations for Diploma in Nautical Science (DNS) Leading to B.Sc., Applied Nautical Science Programme	7
2	Programme Structure	14
3	Curriculum	16
4	**Detailed Teaching Syllabus Semester I**	19
5	UD11T6101 - Maritime English	20
6	UD11T6102 - Mathematics	26
7	UD11T6103 - Physics	28
8	UD11T6104 - Terrestrial Navigation	30
9	UD11T6105 - Cargo Work - I	34
10	UD11T6106 - Ship Construction and Ship Stability - I	41
11	UD11T6107 - Bridge Equipment and COLREGS	44
12	UD11P6108 - Physics Practical	48
13	UD11P6109 - Chart Work Plotting and ECDIS simulator Practical	50
14	UD11P6110 - Seamanship Practical	52
15	UD11F6111 - Field Practice (Swimming and Industry Visit)	55
16	**Detailed Teaching Syllabus Semester II**	57
17	UD11T6201 - Marine Meteorology	58
18	UD11T6202 - Contingency Preparedness	63
19	UD11T6203 - Marine Pollution Prevention	66
20	UD11T6204 - Celestial Navigation	72
21	UD11T6205 - Cargo Work II	76
22	UD11T6206 - Ship Construction and Ship Stability - II	80
23	UD11T6207 - Bridge Electronic Equipment and Watch Keeping	83
24	UD11P6208 - Computer Practical	88
25	UD11P6209 - Nav Equipment and OOW simulator Practical	91
26	UD11P6210 - Engine Room Machinery and Workshop Practical	93
27	UD11F6211 - Book Review	96
28	Question Paper Template for Core courses	97
29	Question Paper Template for other non-core courses (like - Minor Stream/ Multi-Disciplinary/ Ability Enhancement Course/ Skill Enhancement Course/ Value Added Course)	98
30	Books Prescribed by "Indian Maritime University" For Issuance to Students	99

Regulations for Diploma in Nautical Science (DNS) Leading to B.Sc., Applied Nautical Science Programme (With effect from 2024 -25)

1. **Scope**

The following regulations apply to the programme **Diploma in Nautical Science (DNS) Leading to B.Sc., (Applied Nautical Science)** offered by Indian Maritime University (IMU)-Chennai. It shall come into force in the academic year 2024-25 onwards.

2. **Definitions**

In these Regulations, unless the context otherwise requires

i. UGC means University Grants Commission
ii. IMU means Indian Maritime University, Chennai
iii. DGS means Directorate General of Shipping
iv. MMD means The Mercantile Marine Department
v. NEP means National Education Policy
vi. DLP Distance Learning Programme
vii. SSTP means Structured Shipboard Training Programme
viii. 2nd Mate (FG) means Second Mate's Foreign Going
ix. OOW means Officer of the Watch
x. COLREGS means Collision Regulations (The International Regulations for Preventing Collisions at Sea 1972)
xi. ECDIS means Electronic Chart Display and Information System
xii. NAV means Navigation
xiii. 'School' means School of Nautical Studies of Indian Maritime University
xiv. 'Programme Structure' means a list of courses that deal with an academic programme, specifying the duration of the programme, admission criteria, syllabus, Credits, hours of teaching, the pattern of evaluation (internal/external), end-semester examination schemes, minimum marks passing for the course, and a minimum number of credits required for successful completion of the programme.
xv. 'Academic Programme' means an entire course of study comprising programme structure and evaluation schemes designed to be taught and evaluated by an DNS
xvi. 'Course' means an individual subject component that contributes to the completion of an Academic Programme.
xvii. **'Credit' means** The workload relating to a course/subject is measured in terms of credit hours. A credit is a unit by which the coursework is measured. Certain number of credits is assigned to all courses or subjects in this DNS Programme. In general, one credit approximately equals 15 hours of lecture/tutorial class or 30 hours of practical work/project work/Field Practices design class per semester.
xviii. Lecture courses: Courses involving lectures relating to a field or discipline by an expert or qualified personnel in a field of learning, work/vocation, or professional practice.
xix. Tutorial courses: Courses involving problem-solving and discussions relating to a field or discipline under the guidance of qualified personnel in a field of learning, work/vocation, or professional practice.
xx. Laboratory/practical work: A course requiring students to participate in a project or practical or lab activity that applies previously learned/studied principles/theory related to the chosen field of learning, work/vocation, or professional practice under the supervision of an expert or qualified individual in the field of learning, work/vocation or professional practice.

xxi. Studio activities: Studio activities involve the engagement of students in creative or artistic activities. Every student is engaged in performing a creative activity to obtain a specific outcome. Studio-based activities involve visual- or aesthetic focused experiential work.

xxii. Field practice/projects: Courses requiring students to participate in field-based learning/projects generally under the supervision of an expert of the given external entity

3. **About the University:**

The Indian Maritime University (IMU), a Central University, was established through an Act of Parliament (No. 22 of 2008) on 14 November 2008. As a Central University, it is poised to play a key role in developing the required human resources for the maritime sector. The IMU, being the first of its kind in the country, will cater to the educational requirements of the maritime fraternity. IMU has a panel of dedicated experienced faculty members, state-of-the-art infrastructure, and efficient administration. IMU's strength and uniqueness lie in its ability to integrate theories and practices and its commitment to providing quality maritime education, training, and consultancy. IMU's headquarters is in Chennai, and regional campuses are in Chennai, Mumbai, Kolkata, Visakhapatnam, and Cochin.

4. **DNS leading to B.Sc.(Applied Nautical Science)**

The Indian Maritime University offers DNS leading to B.Sc., (Applied Nautical Science) programme, under the School of Nautical Studies. The duration of the course is 1 year which consists of two Six-semesters.

5. **Programme Learning Outcomes (PLO)**

The Diploma in Nautical Science programme enables students to attain, by the time of completion of the course

No	Graduate Attributes	PLOs	Program Learning Outcomes
1	Disciplinary knowledge	PLO1	Acquire fundamental knowledge about the Merchant vessel and its safe and secure Navigation and Operation at sea and in port
2	Disciplinary technical skills	PLO2	Equip with technical skills for carrying various tasks onboard Merchant vessels in support level
3	Disciplinary non-technical skills	PLO3	Equip with non-technical skills for a smooth and secured shipboard operations in support level
4	Moral, Ethical and Socio cultural competence	PLO4	Be a socially responsible and well behaved maritime professional with global vision

6. **Entry Requirements:**

Admissions to DNS (Diploma in Nautical Science) will be conducted through IMU CET (Indian Maritime University's Common Entrance Test) which is mandatory.

Eligibility Criteria

i) 10+2/equivalent with Physics, Chemistry, and Mathematics (PCM) Average-Minimum 60% and with minimum of 50% marks in English subject in 10th/12th Examination.

OR

B.Sc. in Physics, Mathematics, Chemistry or Electronics with Physics as individual subject in one of the years, with an average of not less than 55% of the marks in the final year.

OR

B.E./ B.Tech. Degree from IIT or from a college recognised by AICTE with an average of not less than 50% of the marks in the final year.

ii) **Marital status:** Unmarried.

Note: The candidate should have a minimum of 50% marks in English subject in 10th/12th

Age Criteria

Maximum age:

For Male: General-25 years, OBC(NCL)-28 years, SC/ST-30 years.

For Female: General-27 years, OBC(NCL)-30 years, SC/ST-32 years.

The reference date for calculation of the age will be from the date of commencement of the Academic Session.

Relaxation

For SC/ST candidates: *There will be a 5% relaxation in eligibility marks of PCM; however, it will not apply to English Marks*.

Relaxation of 5% in English marks will be applicable to candidates who are native of the Lakshadweep and Andaman & Nicobar Islands and belong to recognized Scheduled Tribes of the islands and who & both of whose parents were born in these islands & belong to the Scheduled Tribes of those islands.

Eligibility Criteria - Medical Certificate requirement

Physical Fitness - Candidates seeking admission to this DNS Programme must be medically fit including eye sight and hearing as prescribed in the Merchant Shipping (Medical Examination) Rules, 2000, as amended. At the time of admission, candidates will be required to produce certificate of medical fitness issued by doctors approved by the Directorate General of Shipping, Mumbai.

Eye sight: There shall be no evidence of any morbid condition of either eye or of the lids of either eye which may be liable to risk of aggravation or recurrence. Candidates must possess good binocular vision (Fusion faculty and full field of vision in both eyes). Movement of the eyeballs must be full in all directions and the pupils should react normally to light and accommodation. Normal colour vision shall be tested by Ishihara Test Chart. Distance-Vision unaided 1.0*(6/6) in better eye and 0.67*(6/9) in another eye.

(Refer the page at https://www.dgshipping.gov.in/Content/MaritimeHealthBranch.aspx)

Note - Only unmarried candidates are eligible to apply for these programmes. It is strongly recommended that candidates seeking admission to the Marine Programmes have a Passport. Please ensure that the name on the passport is the same as that given on the 10th Std. Certificate.

If any amendments take place to the above criteria in future the same would be applicable.

7. **Attendance:**

(As per IMU Ordinance 06 of 2019 Circular 1927)

All students must put in a minimum of 85% of attendance in a semester in order to appear in the end-semester examinations (Theory and Practical) of the Indian Maritime University.

If any amendments take place to the above Ordinance in future the same would be applicable.

8. **Condonation Fee:**

If a student has put in less than 85% but above or equal to 75% of attendance, owing to reasons such as medical, bereavement or any other, the Campus Director/Principal is empowered to condone the shortage of attendance subject to the collection of the prescribed Condonation

Fee for Attendance.

If any amendments take place to the above Ordinance in future the same would be applicable.

9. **Break-in-Studies:(As per IMU Ordinance 06 of 2019 Circular 1927)**

There will be no Condonation of attendance below 75% under any circumstances whatsoever. A student who has put in less than 75% attendance will not be permitted to write the university's End Semester Examination and will not be permitted to move further to the next semester. It will be treated as a case of 'Break-in-Studies' and he will be required to repeat the incomplete semester in the next academic year. However, such students are permitted to write the arrear examinations of previous semesters Before rejoining the Programme, he must pay (i) the Condonation Fee for Break in Studies as prescribed by the University, (ii) pay the Semester Fees for the concerned semester once again where he is repeating an incomplete semester, and (iii) obtain prior permission from the Vice-Chancellor.

If any amendments take place to the above Ordinance in future the same would be applicable.

10. **Daily Routine of the students**

Being a Regimental course the Daily Routine of Academic working days and holidays should be followed as per IMU / DGS guidelines

11. **Procedure for awarding Internal Assessment (IA) Marks:**

There will be no minimum pass mark for Internal Assessment for all programmes.

a. The maximum marks for each theory paper will be 100 marks, out of which 30 marks will be for Internal Assessment and 70 marks for University Examination.
b. The maximum marks for each practical paper will be 100 marks, out of which 50 marks will be for Internal Assessment and 50 marks for University Examination.

The component-wise breakup of the 'Internal Assessment' for the Theory subject/papers shall be as follows:

S No	Component	Marks
1	Class Test 1 (Oral test)	5
2	Class Test 2 (Written test as Model Examination in university question paper pattern after completing at least 90% of the entire syllabus and shall be converted to a weightage of 15 marks)	15
3	Teachers Assessment (which include seminar-5 marks and attendance 5 marks based para 11 (d))	10
	Total	30

The component-wise breakup of the 'Internal Assessment' for the Practical subject/ papers shall be as follows:

S No	Component	Marks
1	Teachers Assessment which may include parameters such assignments/behavior in class, responses/attentiveness in class etc.	10
2	Lab work records (including record work and model exam)	40
	Total	50

The component-wise breakup of the 'Internal Assessment' for the Book Review/Field Practice shall be as follows:

S No	Component	Marks
1	Teachers Assessment which may include parameters such assignments/behavior in class, responses/attentiveness in class etc.	10
2	Report on field practice /Book review	40
	Total	50

a) **Class Test 1 (Oral Test)**: verbal question answers test shall be conducted by the subject teacher to assess the knowledge of the student in the particular subject in real-time.

b) **Class Test 2 (Written):** A three-hour written examination (the pattern should be of semester question paper) for a maximum of 100 marks, shall be conducted upon completion of at least 90% of the syllabus. The score may be converted to a maximum of 15 marks.

c) **Seminar**: individual/group seminar in which the students have to make presentation/discussion on a small topic assigned by the teacher in the respective subject in the presence of the teacher and it can be assessed for 5 marks

d) **Attendance:** There shall be 5 marks for regularity in attending lectures and tutorials, and the credit for regularity in each paper, based on attendance, shall be as follows: -

Less than 70%	- 0 mark
70% or more but less than 75%	- 1 marks
75% or more but less than 80%	- 2 marks
80% or more but less than 85%	- 3 marks
85% or more but less than 90%	- 4 marks
90% and above	- 5 marks

e) **Teacher Assessment -** Teachers Assessment which may include parameters such assignments / Attire/ Behavior in class, responses/attentiveness in class etc.

f) **Practical (Lab Work / Record Keeping):** Every completed Practical (Lab Work / Record Keeping) shall be evaluated for a maximum of 40 marks. Average mark of all the prescribed experiments / exercises done during the entire semester shall be taken as Practical (Lab Work/ Record Keeping) marks. Model Practical Exam may be conducted and due weightage may be given.

g) **Book Review/Field Practice:** students should submit book review/detailed report on the exercise carried out/visit (for field practice) Report on Book review/ Field practice submitted by the student shall be evaluated for a maximum of 40 marks.

h) There shall be **NO** minimum pass mark for the Internal Assessment (IA) for Theory and Practical subjects.

i) Circular 1749 dealing with "Internal Assessment of Practical and Theory papers for the various programmes conducted by IMU" is applicable for this section.

If any amendments take place to the above Ordinance in future the same would be applicable.

12. **Procedure for awarding End Semester University Exam Marks:**

a) Theory Papers: Examination of 3 hours' duration shall be conducted and evaluated for a maximum of 70 marks.

b) Practical Papers: Shall be conducted and evaluated for maximum of 50 marks.

c) Book Review/Field Practice: Viva-voce shall be conducted for maximum of 50 marks by the External Examiner appointed by IMU Examination Section along with the university practical examination

c) There shall be a common minimum pass mark 50% in the External (for both Theory and Practical) Examinations and 50 % overall. The overall passing minimum 50% (for 100 marks) is computed by totaling the internal assessment marks and the University examination marks obtained by the student.

Pass Mark percentage for all subjects shall be as per Circular No.1749 dated 06-03-2017 ***If any amendments take place to the above Ordinance in future the same would be applicable.***

13. **Question Paper Pattern for End Semester Examination:**

The question paper for all the courses shall be set for a maximum mark of 70 and will have three sections. Section A, Section B and Section C.

Questions in every Section should be distributed equally across each unit of the course.

SECTION-A (10 x 1 mark = 10 Marks)

This section will consist of ten compulsory questions 2 question from each unit.

From each unit one MCQ or TRUE/FALSE and one fill in the blanks shall be asked. Each answer will be evaluated for 1 mark.

SECTION-B (5 x 2marks = 10 Marks)

This section will consist of five compulsory questions one from each unit. Answers to these questions should not exceed 100 words each. Each answer will be evaluated for 2 marks.

SECTION-C (5 x 10 marks = 50 Marks)

The answer shall not exceed 500 words and will be assessed for 10 marks each.

For Core Courses (CC) - This section shall consist of five compulsory questions one from each unit (No choices)

For Non-Core Courses -This section will consist of Seven 10 mark questions and the student may answer any Five with Two Choices.

This section should consist of five 10 mark question one from each unit and two 10 mark questions covering at least any 4 units of importance for 5 marks each.

14. **Evaluation of Answer Scripts**

Answer scripts of the University examination will be subjected to single valuations by a Panel of Examiners constituted by the Competent Authority. However, Guidelines for valuation and 'Declaration of Results' framed by the competent authority from time to time will apply.

15. **Arrear paper**

A student with arrears can repeat the papers along with the subsequent semester examinations or as and when the same can be conducted by IMU (Please refer IMU Circular No.1743,1920, 2403). In such cases, the internal marks obtained by the student will be carried over for computation of total marks

16. **Classification of Marks**

Absolute grading method under common Choice Based Credit System (CBCS) as per IMU Circular 2402 dated 31.01.2024
As a measure of students' performance referring to IMU Circular No 2402, a grading system using the following letter grades and corresponding grade points per credit, as shown below, will be followed

S.No	Grade	Description	Grade Points	Range of marks
1	A+	Excellent	10	90-100
2	A	Very Good	9	80-89
3	B	Good	8	70-79
4	C	Fair	7	60-69
5	D	Pass	6	50-59
6	F	Fail	0	<50
7	AB	Absent	0	-
8	X	Debarred	0	-

17. **Award of Degree**

Students who have successfully completed the programme (semester I and semester II) will be awarded two semester mark statement by the University and a course completion certificate by respective colleges on Diploma in Nautical Science, which will enable the students to produce to the shipping companies for the onboard training slot.

Then the student has to undergo Sea time training as Deck Cadet for 18 months. This ship board training is considered as Semesters III, IV and V in Distance Learning Programme (DLP). During the training the cadet needs to follow a Structured Shipboard Training Programme or SSTP. The SSTP has been designed so that on successful completion, a cadet is permitted to sit for a 2nd Mate (FG) examination conducted by DGS under the IMO STCW convention as amended in 2010.

On completion of the SSTP, and on fulfilling other criteria as given in this notification, a cadet is eligible to appear in the IMU examination one theory paper per semester (Semester III, IV, and V examinations of the B.Sc. Applied Nautical Sciences). Credits earned from the SSTP and the marks in this IMU semester III, IV and V written Examination, both constitute the final marks of the Semester III, IV, and V.

Subsequently the cadet has to undergo 4 months of post-sea shore-based training (considered as Semester VI of the B.Sc. Applied Nautical Sciences) which is the preparatory course for the 2nd Mates examination conducted by the Director General of Shipping (DGS), at approved institutes. The cadet also has to complete mandatory STCW courses (ROC/ARPA, GMDSS, PSCRB, AFF, MFA, and ECDIS) for his/her Second Mates (FG) license which takes approximately 2 months.

Candidates passing 2nd Mates (Foreign Going) (Semester VI) examination successfully and having passed all the five semester examinations of the IMU shall qualify for the award of B.Sc. (Applied Nautical Sciences) degree by the University

Degree Certificate

For those who are declared qualified for the Bachelor of Science (Applied Nautical Science) degree, the convocation form will be issued. The degree certificate will be issued to the students only if they apply for the same in the prescribed convocation form, along with the fee specified in the application form. The degree will be conferred in person or in absentia as requested.

Programme Structure - Diploma in Nautical Science (DNS) Leading to B.Sc., (Applied Nautical Science)

Syllabus Index

SEMESTER - I						
S.No	**Course code**	**Course Title**	**Course Category**	**Total Lecture/ practical Hours per week**	**Total Lecture / Practical Hours per semester**	**Total Credits**
Theory Courses						
1	UD11T6101	Maritime English	SE	3	45	3
2	UD11T6102	Mathematics	MS	3	45	3
3	UD11T6103	Physics	MS	3	45	3
4	UD11T6104	Terrestrial Navigation	CC	4	60	4
5	UD11T6105	Cargo Work - I	CC	4	60	4
6	UD11T6106	Ship Construction and Ship Stability - I	CC	4	60	4
7	UD11T6107	Bridge Equipment and COLREGS	CC	4	60	4
Practical Courses						
8	UD11P6108	Physics Practical	PL <MS>	2	30	1
9	UD11P6109	Chart Work Plotting and ECDIS Simulator Practical	PL <CC>	4	60	2
10	UD11P6110	Seamanship Practical	PL <CC>	4	60	2
11	UD11F6111	Field Practice (Swimming and Industry visit)	FP <SI>	1	15	0.5
		Total		**36**	**540**	**30.5**
SEMESTER - II						
S.No	**Course code**	**Course Title**	**Course Category**	**Total Lecture/ practical Hours per week**	**Total Lecture/ Practical Hours per semester**	**Total Credits**
Theory Courses						
1	UD11T6201	Marine Meteorology	AE	3	45	3
2	UD11T6202	Contingency Preparedness	MD	3	45	3
3	UD11T6203	Marine Pollution Prevention	VA	3	45	3
4	UD11T6204	Celestial Navigation	CC	4	60	4
5	UD11T6205	Cargo Work II	CC	4	60	4
6	UD11T6206	Ship Construction and Ship Stability - II	CC	4	60	4
7	UD11T6207	Bridge Electronic Equipment and Watch Keeping	CC	4	60	4
Practical Courses						
9	UD11P6208	Computer Practical	PL <MS>	3	45	1.5
8	UD11P6209	Nav Equipment and OOW Simulator Practical	PL <CC>	4	60	2
10	UD11P6210	Engine Room Machinery and Workshop Practical	PL <MD>	3	45	1.5
11	UD11F6211	Book Review	SA <SI>	1	15	0.5
		Total		**36**	**540**	**30.5**

Nomenclature

In 'Course Code' Column

The alphabet T/P/F means

I. T-Theory

II. P- Practical

III. F - Field Practice, Extracurricular, Book Review

In the 'Course Category Column'

I. CC - Core Course

II. MS - Minor Stream

III. MD - Multi-Disciplinary

IV. AE - Ability Enhancement Courses

V. SE - Skill Enhancement Course

VI. VA - Value Added Courses Common for All UG

VII. PL - Practical Lab

VIII. SI - Summer Internship

IX. FP - Field Practice

a. Field practice includes a comprehensive approach to swimming/aquatic skills and Industrial visits, visits to Port / Harbour, Ship, lighthouses, Meteorological labs etc.

X. SA - Studio activities

XI. FP <SI> – DNS being specialized studies; the Field shall be considered on par with summer internship.

Curriculum for Diploma in Nautical Science (DNS) Leading to B.Sc., (Applied Nautical Science) Programme

SEMESTER I										
S. No	**Course code**	**Course Title**	**Course Category**	**Internal Assessment (IA) - 30 Marks**			**End Semester Examination (ESE) – 70 Marks**		**Total Max marks (IA + ESE)**	**Total Pass Marks (IA + ESE)**
				Teacher Assessment (Seminar 5 marks + Attendance 5 marks)	**Class Test (Test 1 Orals-5 Marks + Test 2 Written -15 Marks)**	**Total Marks**	**Max Marks**	**Pass Marks**		
Theory Courses										
1	UD11T6101	Maritime English	SE	10	20	30	70	35/70	100	50/100
2	UD11T6102	Mathematics	MS	10	20	30	70	35/70	100	50/100
3	UD11T6103	Physics	MS	10	20	30	70	35/70	100	50/100
4	UD11T6104	Terrestrial Navigation	CC	10	20	30	70	35/70	100	50/100
5	UD11T6105	Cargo Work - I	CC	10	20	30	70	35/70	100	50/100
6	UD11T6106	Ship Construction and Ship Stability - I	CC	10	20	30	70	35/70	100	50/100
7	UD11T6107	Bridge Equipment and COLREGS	CC	10	20	30	70	35/70	100	50/100
Practical Courses										
8	UD11P6108	Physics Practical	PL <MS>	10	40	50	50	25/50	100	50/100
9	UD11P6109	Chart Work Plotting and ECDIS Simulator Practical	PL <CC>	10	40	50	50	25/50	100	50/100
10	UD11P6110	Seamanship Practical	PL <CC>	10	40	50	50	25/50	100	50/100
11	UD11F6111	Field Practice (Swimming & Industry visit)	FP <SI>	10	40	50	50	25/50	100	50/100
		Totals		**110**	**300**	**410**	**690**	**-**	**1100**	**-**

Note: UD11F6111– End Semester Examination will be, Viva Voce - conducted by an External Examiner appointed by IMU Examination Section along with the Practical Examination

SEMESTER II										
S. No	**Course code**	**Course Title**	**Course Category**	**Internal Assessment (IA) - 30 Marks**			**End Semester Examination (ESE) – 70 Marks**		**Total Max marks (IA + ESE)**	**Total Pass Marks (IA + ESE)**
				Teacher Assessment (Seminar 5 marks + Attendance 5 marks)	**Class Test (Test 1 Orals -5 Marks + Test 2 Written-15 Marks)**	**Total Marks**	**Max Marks**	**Pass Marks**		
Theory Courses										
1	UD11T6201	Marine Meteorology	AE	10	20	30	70	35/70	100	50/100
2	UD11T6202	Contingency Preparedness	MD	10	20	30	70	35/70	100	50/100
3	UD11T6203	Marine Pollution Prevention	VA	10	20	30	70	35/70	100	50/100
4	UD11T6204	Celestial Navigation	CC	10	20	30	70	35/70	100	50/100
5	UD11T6205	Cargo Work II	CC	10	20	30	70	35/70	100	50/100
6	UD11T6206	Ship Construction and Ship Stability - II	CC	10	20	30	70	35/70	100	50/100
7	UD11T6207	Bridge Electronic Equipment and Watch Keeping	CC	10	20	30	70	35/70	100	50/100
Practical Courses										
8	UD11P6208	Computer Practical	PL <MS>	10	40	50	50	25/50	100	50/100
9	UD11P6209	Nav Equipment and OOW Simulator Practical	PL <CC>	10	40	50	50	25/50	100	50/100
10	UD11P6210	Engine Room Machinery and Workshop Practical	PL <MD>	10	40	50	50	25/50	100	50/100
11	UD11F6211	Book review	SA <SI>	10	40	50	50	25/50	100	50/100
		Totals		**110**	**300**	**410**	**690**	**-**	**1100**	**-**

Note: UD11F6211– End Semester Examination will be, Viva Voce - conducted by an External Examiner appointed by IMU Examination Section along with the practical examination

Detailed teaching syllabus - Semester I

SEMESTER - I						
S.No	**Course code**	**Course Title**	**Course Category**	**Total Lecture/ practical Hours per week**	**Total Lecture / Practical Hours per semester**	**Total Credits**
Theory Courses						
1	UD11T6101	Maritime English	SE	3	45	3
2	UD11T6102	Mathematics	MS	3	45	3
3	UD11T6103	Physics	MS	3	45	3
4	UD11T6104	Terrestrial Navigation	CC	4	60	4
5	UD11T6105	Cargo Work - I	CC	4	60	4
6	UD11T6106	Ship Construction and Ship Stability - I	CC	4	60	4
7	UD11T6107	Bridge Equipment and COLREGS	CC	4	60	4
Practical Courses						
8	UD11P6108	Physics Practical	PL <MS>	2	30	1
9	UD11P6109	Chart Work Plotting and ECDIS Simulator Practical	PL <CC>	4	60	2
10	UD11P6110	Seamanship Practical	PL <CC>	4	60	2
11	UD11F6111	Field Practice (Swimming & Industry visit)	FP <SI>	1	15	0.5
		Total		**36**	**540**	**30.5**

Skill Enhancement Course (SE)	UD11T6101- Maritime English	LECTURE HOURS	CREDITS
		45	3

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Recognize formal elements of English communication.
CLO2	Understand the use of Standard Maritime Communication Phrases
CLO3	Write Letter, Email, Report & Log book, Read and understand relevant maritime news from News papers
CLO4	Comprehend passages and appreciate rich Maritime heritage of India
CLO5	Understand gender sensitization

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	M	M	M
CLO2	H	M	M	-
CLO3	H	M	M	M
CLO4	H	M	M	-
CLO5	H	M	M	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45
1	**Introduction to Communication in English**		**9**
1.1	Explain: Concept, Process, Forms, Style, Importance of effective communication on-board ship	U	
1.2	State the difference between General and Technical Communication	K	
1.3	Explain the Barriers to communication and ways to overcome the barriers	U	
1.4	State the Means/Modes of communication on board ship	K	
	News Paper Reading		
1.5	Maritime related news – National and International	AP	
1.6	news analysis in groups/ individual short (300 words) essays.	AP	
1.7	Extracts of Major Geopolitical events relevant for shipping and logistics industry	AP	
1.8	Inspirational news and events - and discussion/ write up based on this	AP	
2	**Standard Maritime Communication Phrases**		**9**
2.1	State the Objective of using Standard Maritime Communication Phrases for effective onboard communication onboard.	K	

2.2	Explain the use use of SMCP vs General English in the back drop of multinational crew	U	
2.3	State the following from SMCP – Procedure, Phonetic Spelling, Responses, Signals – Distress / Urgency / Safety, Corrections, Readiness, Repetition, Numbers, Positions, Bearings, Courses, Distances, Speed, Time, Geographical Names, Avoiding use of Ambiguous words.	K	
2.4	State the Glossary words: General Terms (limited to the following only)Abandon Vessel, Adrift, Berth, Cable, Capsize, Close up, Convoy, Derelict, dragging (of anchor), ETA, ETD, Fathom, Fire Patrol, Flooding, Rendezvous, Shackle, Standby, Stand-clear, Stand-on, Standing orders,	K	
2.5	State the Onboard Communication Phrases - Standard Wheel Orders, Standard Engine Orders, Anchoring, Tug Assistance, Berthing and Unberthing	K	
3	**Writing Skill**		**9**
3.1	Practice on Writing Process (identify, organize and list the points/ideas related to a given topic in a proper logical sequence and write a rough draft and final draft), Sentence Structure, Sentence Coherence, Paragraph Writing.	AP	
3.2	Practice Letter Writing: Types, Parts, Style and Tone, Requisition Letter, Grievance Letter, Various applications writing.	AP	
3.3	Practice - Resume writing, - Cadets to make their resume	AP	
3.4	Practice Email Writing: Types, Parts, Style and Tone, Leave Email, Grievance email, Email requesting some information from Shipping company.	AP	
3.5	Practice Factual Reports (Informative): Types of Reports (Routine/Special), Incident Report, Accident Report, Visit Report, Feedback.	AP	
3.6	Practice Log book writing & Diary writing.	AP	
	Reading Comprehension		
3.7	Comprehend - passages - Prose and short stories out of below mentioned maritime related books:	U	
	Heritage of Indian Sea Navigation - B. Arunachalam		
	Swadeshi Steam : V.O. Chidambaram Pillai and the Battle against the British Maritime Empire - A.R. Venkatachalapathy		
	The Ocean of Churn: How the Indian Ocean Shaped Human History - Sanjeev Sanyal		
3.8	Book Review on any Fiction / Non Fiction book of cadets choice, Same to be presented to the whole class.	AP	
4	**Gender Sensitization**		**9**
4.1	Understand gender sensitization	U	
	Historical Perspective		
	Early Medieval Period		
	The Dawn of the 20th Century – A New Beginning		
	Women in Maritime History		
	Women in Indian Maritime		

	Recent Statistics The Way Forward		
	Importance of Gender Sensitization		
	Benefits of a Gender-Sensitive Workplace		
	Difference between Gender Sensitivity and Non-		
	Gender Sensitivity in a Workplace		
4.2	Understand Gender and Sex	U	
	Gender Stereotypes		
	Gender		
	How Gender Differences Develop		
	Why is it Important to Understand the Differences between Gender and Sex?		
	Why is Understanding this Distinction in Shipping		
	Important?		
4.3	Explain Gender Roles	U	
	Gender Stereotypes		
	Exercises – Biases of Participants		
	Times then vs Times now		
	How Gender Roles and Gender Stereotypes lead to		
	Discrimination		
	How Gender Roles Affect Us		
	How Times are Changing		
	Looking at the Person beyond Established Gender Roles		
	Learnings and Insights		
4.4	Understand Discrimination and Safety of Women Seafarers	U	
	Introduction		
	What Do Statistics Tell Us?		
	What is Gender Discrimination?		
	Types of Gender Discrimination		
	How Does Gender Inequality Affect Women?		
	How do Women Deal with Discrimination and		
	Adapt in the Workplace?		
	Ways To Encourage Women to Be a Part Of		
	Maritime		
	Safety Concerns of Women Seafarers		
	How can this issue be dealt with?		
	Organizations/Institutions Working for the Cause		
	Laws against Harassment in Maritime		
	The Way Forward		
4.5	Comprehend Gender Harassment	U	
	Types of Harassment		
	Power Dynamics and Harassment		
	Gender Harassment in the Maritime Industry		
	Consequences of Harassment		
	What Could be Done by Victims?		
	Indian Laws against Psychological Harassment		

	What Kind of Change is Necessary to Promote a Culture of Gender Equality On board?		
4.6	Understand Digital Media: A Boon and Bane for Women at Sea	U	
	The Boons and Banes of Internet and Digital Media		
	Potential Threat of Cyber Crimes against Women Seafarers Prevention is Key		
	Dos and Don'ts for Male Seafarers		
	Dos and Don'ts for Women Seafarers		
4.7	Explain Legal Factors in Gender-Related Issues On board	U	
	Introduction		
	Global Recognition of Women Seafarers' Rights		
	and Regulations for the Same		
	United Nations for Seafarers		
	Maritime Labour Convention (2006)		
	Indian Regulations for Women Seafarers		
	Indian Constitution and Gender Sensitivity		
	Vishaka Guidelines		
	Kudumbashree		
	The DG SHIPPING GUIDELINES Notice No. 07 of		
	Redressal of Complaints		
4.8	Describe Physical and Mental Health in Women Seafarers	U	
	Physical Health		
	Premenstrual Syndrome (PMS)		
	Premenstrual Dysphoric Disorder (PMDD)		
	Menopause		
	Symptoms of Menopause		
	Physical Activity and Women		
	Benefits of Physical Activity		
	Reasons for Physical Inactivity in Women		
	Appropriate Physical Activity for Women		
	Barriers and Tips for Women to Overcome those		
	Barriers to Exercise		
	Research article		
	Effects of Gender Discrimination on Physical Health		
	Physical Health in Women Seafarers		
	Health Challenges Related to Work		
	Psychological Issues in Women Seafarers		
	Women's Mental Health: Some Facts		
4.9	Understand Challenges Faced by Women Ratings On board	U	
	Work Stereotypes		
	Socio-Cultural Background of Ratings		
	Vocational Training Required for Ratings		
	Accommodation of Ratings		
	The Way Forward		
	Importance of Finding Solutions to the Problems of		
	Female Ratings		

4.10	Explain Education Among Seafarers Current Scenario in the Seafaring Community	U	
	Role of Family		
	Area of Improvement		
4.11	Describe Gender-Sensitive Communication	U	
	Using Gender-Sensitive Language		
	Body Language/ Communication at Sea		
	Facial Expressions and Eye Contact		
	Body Movements and Gestures		
	Personal Distances		
	Touch		
	Understanding Body Language		
	Understanding Differences in Communication		
	across Cultures		
	Do's and Don'ts while communicating with women		
	from different nationalities		
	What to do When Faced with an Uncomfortable		
	Situation?		
	Things to Keep in Mind while Communicating with		
	the Other Gender		
4.12	Explain Occupational Sexism	U	
	Male-Domination and Sexism		
	Society and Sexism		
	Occupational Sexism in India		
	Occupational Sexism in Maritime Industry		
	What The Industry Can Do		
	What Male Seafarers Can Do		
	What Women Seafarers Can Do		
5	**Human Factors: Shipping and Special Needs**		**9**
	Nature of the job and demands of the careers in the merchant navy		
5.1	Describe Nature of the job at sea.		
5.2	Explain demands of the career – technical, practical, physical, emotional and psychological.		
5.3	List Personal traits that will assist in effective functioning onboard.		
5.4	List the essentials of personal hygiene.		
5.5	Explain the importance of Physical fitness, health and personal hygiene onboard.		
5.6	Write a note on the travel arrangements for joining a ship.		
	Functions and responsibilities		
5.7	List the functions of Fleet Personnel Department, Technical Management Department, Commercial Management Department, Safety and Quality Management Department, and Designated Person Ashore.		
5.8	Understand the roles of ship owner, ship charterer, port agents, ship manager, shipper, consignee		
5.9	Sketch shipboard organizational chart.		

5.10 5.11	Explain the functions of Deck Department, Engine Department, and Saloon Department. List/Describe the functions and responsibilities of shipboard staff: Master, Chief Officer, Second Officer, Third Officer, Deck Cadet, Bosun, Chief Engineer Officer, Second Engineer Officer, Third Engineer Officer, and Electro-Technical Officer.		
5.12	Explain cadets' role onboard and expectations from them.		
	Social Etiquettes.		
5.13	Explain social norms in maritime profession,		
5.14	State importance of using proper greetings in oral and written communications,		
5.15	Illustrate importance of turnout,		
5.16	Demonstrate table manners, personal hygiene, Interaction with foreigners,		
5.17	Demonstrate ethnic/religious/gender sensitivity		

TEXT BOOKS
Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House, Publisher: Routledge Taylor & Francis Course Notes by the Faculty
REFERENCE BOOKS
1. IMO Standard Marine Communication Phrases (SMCP) London / 2003 - by International Maritime Organisation 2. Heritage of Indian Sea Navigation - B. Arunachalam, Maritime History Society, 2002 3. Swadeshi Steam: V.O. Chidambaram Pillai and the Battle against the British Maritime Empire - A.R. Venkatachalapathy, Penguin, 22 December 2023 4. The Ocean of Churn: How the Indian Ocean Shaped Human History - Sanjeev Sanyal Penguin Random House India 10 August 2016 5. Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House, Publisher: Routledge Taylor & Francis
Pedagogy
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.

Minor Stream (MS)	UD11T6102 - Mathematics	LECTURE HOURS	CREDITS
		45	3

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Calculate distances and heights by using trigonometric functions
CLO2	Solve problems based on spherical trigonometry
CLO3	Calculate areas, volumes of various geometric shapes
CLO4	Apply mean, mode, medium and SD in statistics
CLO5	Calculate interpolation of various numerical

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	M	H	L	-
CLO2	M	H	L	-
CLO3	M	H	L	-
CLO4	M	H	L	-
CLO5	M	H	L	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45
1	**Trigonometry**		**9**
1.1	Understand basic Trigonometric identities	U	
1.2	Describe relationship between trigonometric ratios	U	
1.3	Calculate Heights & Distances by using trigonometric formulas	AP	
2	**Spherical Trigonometry**		**9**
2.1	Understand Oblique Triangles (Sine, Cosine, Haversine Formula)	U	
2.2	Understand Right angled Spherical Triangles	U	
2.3	Comprehend Quadrilateral Spherical Triangle	U	
2.4	Calculate sides and angles of a spherical triangle by using relevant formulas	AP	
3	**Coordinate Geometry and Mensuration**		**9**
3.1	Define circles, parabolas, ellipses, hyperbolas and their properties	K	
3.2	Describe the formulas related to circles, parabolas, ellipses, hyperbolas	U	
3.3	Calculate total areas, surface area, volume of different geometry and cones, spheres, hemisphere and cylinders	AP	
4	**Statistics**		**9**
4.1	Define Mean, Median, Mode, Standard Deviation, Coefficient of variation	K	

4.2	Calculate Mean, Median, Mode, Standard Deviation and Coefficient of variation of various distributions	AP	
4.3	Define efficiency, Consistency	K	
4.4	Understand Basic Probability (Addition law, Multiplication law)	U	
4.5	Understand conditional Probability	U	
4.6	Define Bayes Theorem	K	
4.7	Calculate probability of various occurrences	AP	
4.8	Calculate based on bayes theorem		
5	**Interpolation, Numerical Integration and Vectors**		**9**
5.1	Calculate Simple interpolation of hydrostatic data of ship	AP	
5.2	Understand Newton's interpolation for uniform increase of X	U	
5.3	Comprehend Lagrange's Interpolation for Non Uniform Increase of X	U	
5.4	Understand Trapezoidal Rule for numerical integration	U	
5.5	Calculate areas, volume based on Simpson's 1/3rd rule	AP	
5.6	Calculate areas, volume based on Simpson's 3/8th rule	AP	
5.7	Explain The Difference Between Scalar and Vector Quantities.	U	
5.8	Explain And Solve Addition and Subtraction Of Vectors, And Multiplication Of Vectors By Scalars.	U	
5.9	Explain Position Vectors, Resolution Of Vectors and Applications.	U	
5.10	Solve Problems Involving Forces, Velocities and Accelerations.	AP	

TEXT BOOKS
1) Spherical Trigonometry by Capt. H. Subramaniam, Edition 1, Published by Vijaya Publications, Published on 20-Aug-2019. 2) Engineering Mathematics by H Grewal, Standard Edition, Published by Khanna Publishers, Published on 1-Jan-1965
REFERENCE BOOKS
1. Co-ordinate Geometry - by S.L. Loney 2. Plane Trigonometry - by S.L. Loney 3. Solid Geometry - by S.L. Loney 4. Mathematical Statistics - by Kapur, J.N. and Saxena. H.C. 5. Statistics & Probability for Engineers - by Myers
Pedagogy
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.

Minor Stream (MS)	UD11T6103 - Physics	LECTURE HOURS	CREDITS
		45	3

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand the concept of stability with rotation, spinning top, Gyro inertia & gyroscopic motion
CLO2	Understand the application of reflection to the measurement of depth by echo sounder.
CLO3	Comprehend static electricity & its hazards.
CLO4	Understand the concept of various types of antennas.
CLO5	Describe the propagation of radio waves.

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	H	L	-
CLO2	H	H	L	-
CLO3	H	H	L	L
CLO4	H	M	L	-
CLO5	H	M	L	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45
1	**Mechanics and Hydromechanics**		**9**
1.1	Define moment of inertia and radius of gyration, angular velocity, angular acceleration, angular momentum, couple & torque, centripetal & centrifugal forces.	K	
1.2	Define work, energy and power, Circular motion and rotation-Explain-stability with rotation, spinning top, Gyro inertia & gyroscopic motion.	K	
1.3	Explain Bernoulli's theorem and its application.	U	
1.4	Define Streamline flow &turbulent flow in pipelines.	K	
1.5	State laws of flotation, Archimedes principle and Buoyancy.	K	
1.6	State Pascal's law and its applications (hydraulic lift, hydraulic Brake).	K	
2	**Sound, Heat and Thermodynamics**		**9**
2.1	Differentiate between longitudinal and transverse waves with examples.	AN	
2.2	Explain the characteristics of sound: Loudness, Pitch and Quality.	U	
2.3	Define decibel.	K	
2.4	State the approximate range of audible sound.	K	
2.5	Describe the application of reflection to the measurement of depth by echo sounder and to the ultrasonic detector for checking hatch weather tightness.	U	

2.6	Explain Doppler Effect and its applications.	U	
2.7	Explain the Heat Transfer Mechanism - Conduction, Convection and Radiation.	U	
2.8	Explain Expansion of solids, liquids and gases, Gas Laws	U	
2.9	Explain and Define Heat capacity, specific heat capacity, Sensible heat, Latent heat.	U	
2.10	Explain Heat engine and refrigerator	U	
3	**Light and Electromagnetic wave**		**9**
3.1	Explain Electromagnetic spectrum and describe its various parts in short.	U	
3.2	Explain the bending of EM Waves by ionosphere.	U	
3.3	Explain the propagation of radio waves.	U	
3.4	Explain the phenomenon of total internal reflection of light.	U	
3.5	Apply its application in mirage/ Periscope / prism Binocular / Azimuthal mirror.	AP	
3.6	sketch a Sextant showing the arrangement of mirrors, the path of rays to the observer's eye and how the angle between the two objects is measured.	AP	
4	**Current and Static Electricity**		**9**
4.1	Define electric current, emf, potential difference etc.	K	
4.2	Define ohm's law its application & limitation.	K	
4.3	State and Explain Kirchhoff's Current Law and Kirchhoff's Voltage Law.	K	
4.4	Explain static electricity and state its hazards.	U	
4.5	Explain heating effect of electric current and its applications (geysers, electric bulbs etc).	U	
4.6	Explain self and mutual induction, series and parallel combination of inductors (no derivations).	U	
5	**Transmitters**		**9**
5.1	Explain working of a radio transmitter and receiver with Block diagram.	U	
5.2	Explain the concept of antennas- straight and Yagi uda antenna.	U	
5.3	Explain thermistor and its application as heat sensors.	U	
5.4	Explain Radar transmitters and receivers	U	
5.5	Explain flow rate measurement in Liquid/ Gas.	U	

TEXT BOOKS	
1	Electrical Technology by B. L. Thereja&A.K Theraja, Volume 1Published by S.Chand,Published on 10 Jun 2006.
2	Principles of Electronics by V. K. Mehta,Rohit Metha, Edition 7,Published by S.chand,Published on 3 Feb 2014
REFERENCE BOOKS	
1	Engineering Physics by R. K Gaur, Dhanpat Rai, 1 January 2012
Pedagogy	
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.	

Core Course (CC)	UD11T6104 Terrestrial Navigation	LECTURE HOURS	CREDITS
		60	4

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Apply compass error to find out corrected compass and true courses
CLO2	Calculate courses and distances by plane, parallel and Mercator sailing
CLO3	Calculate great circle courses and distances on the earth
CLO4	Comprehend on charts and chart symbols
CLO5	Practice passage plan on the charts and ECDIS

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	H	M	M
CLO2	H	H	M	M
CLO3	H	H	M	M
CLO4	H	H	M	M
CLO5	H	H	M	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 60
1	**Earth, Compasses, Parallel and Plane Sailing:**		**12**
1.1	Define Great circle, Small circle, Spherical angle, Spherical triangle, poles of a great circle.	K	
1.2	Define Earth poles, Equator and Meridians, Describe the approximate polar and equatorial circumferences of the Earth. Describe the earth as an ellipsoid, Define compression and states its value.	K	
1.3	Define latitude and Parallel of latitude (Lat), Prime meridian and Longitude (Long). Define difference of Latitude and difference of Longitude.	K	
1.4	Define international nautical mile, cable and Knot, Define Geographical mile; Statute mile, comparison of nautical mile with kilometre.	K	
1.5	Describe the direction on the earth surface, Describe the direction of the ships head on Gyro compass (Gyro course). Describe the direction of the ships head on the magnetic compass (compass course). Define True, Magnetic and Compass north. Box the Compass.	U	
1.6	Find Deviation (Dev) and Variation (Var) from tables and charts, Deviation cards, annual rate of change of Magnetic Variation. Apply variation to the Error of magnetic compass to find the Deviation for the directions of ships head. (Cadet's rule)	AP	

1.7	Calculate true course from compass course, calculate compass course from true course, Measure compass error using transit bearing, apply compass error to the ships head and compass bearing to convert it to true. State that the magnetic variation can be found using isogonal lines and charts. Calculate compass error and gyro error, from transit bearing and bearing from any distant fixed objects.	AP	
	Parallel and Plane sailing:		
1.8	Define departure and states the relationship to the difference of longitude. Explain the relationship between departure and difference of longitude in cases involving a change of latitude by using mean latitude. Define true course and Rhumb line.	K	
1.9	Derive the plane sailing formulae. Prove the plane sailing formula Dep / D'Long = Cos Lat.	AP	
1.10	Calculate the distance between two positions on the same parallel of Latitude. Calculate the difference of longitude for a given distance run along a parallel of latitude.	AP	
1.11	Derive the final position after sailing along a parallel of latitude. Demonstrate the uses of the plane sailing formulae. Understand the meaning of, and can derive mean latitude. Calculate the correct departure to use in a plane sailing problem.	AP	
1.12	Calculate the course and distance between two positions, using the plane sailing formula. Derive the information required in parallel and plane sailing problem, using a traverse table and/or Non-Programmable Scientific calculator.	AP	
2	**Mercator Projection and Mercator Sailing**:		**12**
2.1	Understand the principles of Mercator projections and Charts.	U	
2.2	Advantages and Dis-advantages of Mercator Charts.	U	
2.3	Define Meridional Parts and Difference in Meridional Parts (DMP)	AP	
2.4	Latitude and Longitudinal scales and conversion of one to the other.	K	
2.5	Relationship between D'Long and DMP.	U	
2.6	Explain how to measure the distance between two positions on a Mercator chart based on the latitude of the two positions.	U	
2.7	Use the Mercator formula to calculate course and distance between two positions.	AP	
2.8	Use Mercator formula to calculate the final position, given the initial position vice versa, course and distance.	AP	
3	**Gnomonic Projection and Great Circle Sailing:**		**12**
3.1	Principles of Gnomonic projection.	U	
3.2	Describe the use of Gnomonic chart for plotting the Great circles between two points as straight lines	U	
3.3	Advantages and disadvantages of Gnomonic charts	U	
3.4	Explain the on-board procedure to transfer a Great circle course and distance from a Gnomonic chart to a Mercator chart.	U	
3.5	Demonstrate the understanding of Great Circle sailing for both the Hemispheres	AP	
3.6	Calculate the distance of Great Circle track.	AP	
3.7	Calculate initial and final course of Great Circle track.	AP	

4	**Chart Work Theory:**		**12**
4.1	Familiarization with Charts and Chart Catalogue and its uses	K	
4.2	Chart No, Scale, Depths, Heights, Tidal Information, Compass Rose, Distance Scale, Lat and Long familiarization on Chart.	K	
4.3	Demonstrate the tools for efficient Chart work such as Parallel Ruler, Plotting-Compass, Divider, 2B pencil, Eraser.	U	
4.4	Lists out the different types of Charts(Navigational and Thematic)	K	
4.5	Obtain Information from Charts: Chart Datum, Lights (All) Describe the characteristics of the light. Describe Geographical and Nominal Range of a Light	K	
4.6	Identifies Leading Lights, States the use of Leading lights. Identifies Sector lights, State the advantages of Sector lights	U	
4.7	Identifies the Chart Symbols as given in NP (INT)5011/5012 (ECDIS) limited to the symbols for the following: Rock, all the types wreck, obstructions, heights, depths and Nature of sea bed, tidal stream, current, off-shore installation, platform, mooring, submarine cable, submarine pipeline, tide and current, tracks, routes, areas and limits, traffic lanes and separation zones.	U	
4.8	**Describe the various methods by which Ship's position plotted on a Chart (Black/White board explanation only)**	K	
	i. Latitude and Longitude		
	ii. Bearing and Distance off from a Navigational mark		
	iii. Compass bearings of two or more shore objects		
	iv. Two Radar Distances		
	v. One Visual Bearing and one Radar Distance		
	vi. Explain DR, EP and Fix		
	vii. Explain how the Set, Rate of Current and Drift calculated		
	viii. Explain the Leeway		
	ix. Explain the calculation of Estimated Time of Arrival (ETA) and its importance.		
	x. Explain the Chart Correction how it is done on the Paper charts and ECDIS		
5	**Passage Plan theory, ECDIS theory, and Tides Calculations**		**12**
5.1	**Passage Planning**: Plan a voyage between two ports from berth to berth using the procedures for passage planning (taking into consideration important factors such as ship type, draft and displacement of ship, depth of water, distance off dangers, current, TSS, navigations aids available, Ocean Passages of the World, Sailing Directions, Routeing Charts, List of Lights and Fog Signals, List of Radio Signals, Guide to Port Entry etc.); Landfall in thick and clear weather; Selection of a suitable anchorage.	U	
	Explain the four stages of Passage Planning.		
5.2	Appraisal – Ascertain the charts and publication required for the passage (use the Admiralty Catalogue to identify the charts) and whether they are corrected and up-to-date, Extract all relevant information from the publications and obtain weather prognosis	U	

5.3	Planning – Plot courses on the charts, both small and large scale, way points, no-go areas, contingency anchorages, alerts, abort points and other relevant marks; Select a suitable anchorage; Selection of ocean routes; Prepare a Voyage Plan document.	U	
5.4	Execution- During the voyage, fix positions as indicated on the voyage plan, maintain sufficient bridge manning levels, obtain Navigational and weather warnings, maintain lookout and navigate to keep clear of other vessels and navigational hazards.	U	
5.5	Monitoring – Monitor frequently the traffic, position, weather, visibility and maintain a situational awareness at all times	U	
	ECDIS (Theory):		
5.6	Understand ECDIS, Generation and components of ECDIS.	U	
5.7	Describe Advantages and Disadvantages of ECDIS over paper chart; Limitations of ECDIS.	U	
5.8	Define: ENC, SENC, ECDIS, Standard Display, Base Display, Vector, chart, Raster Chart, ECS, RCDS, Safety Contours, Safety Depth, Shallow and Deep contours, SCAMIN, Over-scale, Under-scale, Duel Fuel System.	K	
5.9	Difference between Raster Chart and Vector Chart.	U	
5.10	State IMO Performance standard for ECDIS, Resolution MSC232(82)	K	
5.11	Understand Traditional Symbols (NP5011) and Simplified Symbols (NP5012), Chart Scale, Information Layers.	U	
5.12	Understand Chart Quality and Accuracy (CATZOC).	U	
	Tides Calculations (Standard Ports only)		
5.13	Describe the Basic Tidal theory including the cause and effect of Spring tide and Neap Tide	U	
5.14	Defines:	K	
	a. Range of Tide b. Duration of Tide c. Chart Datum d. Mean High Water Springs e. Mean Low Water Springs f. Highest Astronomical Tide g. Charted Elevation h. Vertical Clearance Heights		
5.15	Calculates the intermediate Times / Height of water for Standard Ports.	AP	
TEXT BOOKS:			
	1) Principles of Navigation by Capt. S.S.S. Rewari & Capt. T.K. Joseph, Edition 2,Published by Applied Research International, Published on 1 Jan 2018 2) Practical Navigation by Capt.H. Subramaniam 2010 Edition 3) Chart Work for Mariner by Capt. S.K. Puri, Edition 6, Published by Marine Publications of India, Published on 1 Jan 2016. 4) Selected pages of Tide Tables (Std Ports)		
REFERENCE BOOKS:			
1	Selected Pages from Admiralty tide tables for standard ports		
2	Ocean passages of the world		
3	The Admiralty Manual of Navigation: Principles of Navigation : Vol. 1-NauticalInstitute		
4	Admiralty publication NP 294 (How to keep charts up to date)		
Pedagogy			
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.			

CORE COURSE (CC)	UD11T6105 – Cargo work I	LECTURE HOURS	CREDITS
		60	4

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand the general principles of stowing, segregation and securing of cargo
CLO2	Understand deck cargoes, containers, bulk cargoes hazards including grain and other specialized cargo.
CLO3	Explain the procedure of hold inspection , hold preparation and ventilation of cargo.
CLO4	Understand the information contained in the IMDG Code and the classification of dangerous goods.
CLO5	Apply cargo stowage plan to carry out cargo loading, unloading and stowage

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	H	M	M
CLO2	H	H	M	M
CLO3	H	H	M	M
CLO4	H	H	M	M
CLO5	H	H	M	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 60
1	**Types of Cargo and Cargo Care**		**12**
	Types of Cargoes		
1.1	Introduction to Cargoes: General cargo, types of general cargoes, e.g. bales, boxes, bags, crates, cases, pallets. Bulk carrier, examples of bulk cargoes and method of loading by Conveyor and discharging by Grab. Container cargo, Ro-Ro cargo, Lo-Lo cargo, Passenger, Cattles, Crude Oil, Chemical and Gas (LPG and LNG)	K	
	Inspection and preparation of holds	K	
1.2	Outline the reasons for a general inspection of holds and lists items to be inspected	K	
1.3	Explain the importance of cleaning holds before loading	U	
1.4	Describe how to clean holds after discharge of a general cargo	U	
1.5	Describe the reasons for using dunnage	U	
1.6	State the types and sizes of material used for dunnage	K	
1.7	Describe the methods of dunnaging a hold for various cargoes and how to dispose of old dunnage	U	

1.8	State that dirty dunnage may taint or contaminate the next cargo	K	
1.9	Describe the fitting or spar ceiling and explains its purpose	U	
1.10	State that bilges or drain wells should be clean, dry and sweet-smelling disinfectants used	K	
1.11	Explain how bilge suctions should be checked for efficient working scuppers and sounding pipes	U	
1.12	Describe how limbers and drain well covers should be treated to prevent suctions being blocked by small debris, but ensuring free drainage to the suctions	U	
1.13	State that the ballast lines to deep tanks should be blanked when preparing to load dry cargo	K	
1.14	State that the use of a deodorizing wash for ozonator may be necessary to remove strong odours from a previous cargo	K	
	-Segregation and separation of cargoes		
1.15 1.16 1.17 1.18 1.19 1.20 1.21 1.22	Explain the need for the segregation of different cargoes with reference to: – dangerous goods – dry cargo – wet cargo – clean cargo – dirty cargo – delicate cargo – valuable cargo, e.g. bank notes, personal effects	U	
1.23	Describe how the cargoes in the above objectives can be segregated	U	
1.24	Explain that separation between parcels of cargo for different consignees or different ports of discharge is required	U	
1.25	Describe methods of separating adjacent parcels of cargo	U	
1.26	Describe the use of port marking to separate parcels for discharge at different ports	U	
2	**Securing cargoes, Cargo handling equipment and safety**		**12**
2.1	Explain the need for solid stow and securing of all cargoes	U	
2.2	state that cargo liable to slide during rolling, such as steel rails, should be stowed fore and aft	K	
2.3	Describe methods of blocking, lashing, shoring, chocking cargo	U	
2.4	Describe method of securing cargo faces resulting from part discharge before making a sea passage	U	
2.5	Describe methods of securing heavy loads and heavy lifts	U	
2.6	Describe methods of stowing and securing vehicles and trailers	U	
2.7	State that unitized containers, trailers, portable tanks and other cargo units should be secured in accordance with the ship's cargo securing arrangements manual	K	
2.8	Describe passenger operations including passenger cargo, passenger comfort and safety	U	
	Cargo handling equipment		
2.9	describe the use of slings, snotters, canvas slings, trays, pallets, nets, chain slings, cant hooks, bale hooks and vehicle slings	U	

2.10	Describe the precautions to take when lifting bales with hooks in the bale bands and damage caused by hooks generally	U	
2.11	Describe the handling of common unitized and pre-slung loads	U	
2.12	Compare the advantages and disadvantages of ship's cranes and derricks for handling cargo	AN	
2.13	Explain the working of Cranes, various safety limits and markings.	U	
2.14	State the Entries to be made in Chain Register.	K	
2.15	State that gear should be set up in accordance with the ship's rigging plan Cargo handling safety	K	
2.16	State that all cargo gear should be visually inspected before the start of cargo operations each day and awareness of test certifications and registration	K	
2.17	Describe the importance of having a Safe Working Load (SWL) for the cargo gear	U	
2.18	Explain why the load on cargo gear should never exceed its safe working load	U	
2.19	State that all ropes and wires should come with the certificate of their properties. Calculate the Breaking strength of all types of ropes onboard ship.	AP	
2.20	State that ropes, wires, blocks and loose gear should be subject to frequent inspections while in use for cargo operations	K	
2.21	Explain how to determine when a cargo runner needs replacing	U	
2.22	State that mechanically or hydraulically operated hatches should be opened or closed by the ship's crew under the supervision of a responsible person	K	
2.23	State that hatch covers should be secured by locking devices to prevent them moving accidentally	K	
2.24	State that beams and covers of partially opened hatches should be secured to prevent their accidental displacement	K	
2.25	State that hatch openings should be securely fenced to a minimum height of 1 metre	K	
2.26	State that it is the ship's responsibility to cover hatches when notice of completion of work for the day is given by the stevedore in charge	K	
2.27	State that no person should use a ladder in the square of a hatch while cargo is being hoisted or lowered in that square	K	
2.28	State that no person should stand or pass under a suspended load	K	
2.29	Describe the provision of adequate lighting for working spaces, portable lights and precaution with dangerous cargoes, e.g. jute	U	
2.30	State that portable lights should be removed from cargo spaces as soon as they are no longer required	K	
2.31	State that unattended portable lights are potential fire hazards	K	
2.32	Describe the importance of maintaining close communication with the shore during the loading and unloading stage	U	
2.33	Describe the information that should be agreed between ship and shore before any loading or unloading operation	U	

2.34	Calculate the effort on the hauling part of a purchase for a given load and using this tension to find the correct size of rope/wire to be used.	AP	
2.35	calculate the mechanical advantage and efficiency of a system using a combination of two purchases to advantage/disadvantage.	AP	
3	**Deck cargo, Bulk cargo (other than grain), Bulk grain cargo, Ventilation and control**		**12**
3.1	State that cargoes, other than in containers, commonly carried on deck are:	K	
	- Dangerous goods not permitted below decks		
	- large units, difficult or impossible to stow below deck, which can safely be exposed to the elements		
	- Cargoes which can be exposed to the weather and which would occupy a very large space below decks		
	- livestock in limited numbers		
3.2	Explains why efficient securing of cargoes is essential for the safety of the ship as well as the cargo	U	
3.3	State that stowage and securing of deck cargo should be adequate for the worst conditions which could be experienced	K	
3.4	State that hatches should be securely closed and cleated before loading over them	K	
3.5	state that stowage should leave safe access to essential equipment and spaces needed to navigate and operate the ship such as: – sounding pipes to tanks and bilges – Devices for the remote operation of valves – Mooring arrangements – firefighting and life-saving equipment – crew accommodation and working spaces – protection for the crew	K	
3.6	State that deck cargo should not obstruct the view from the navigating bridge or over-side at the bow	K	
3.7	State that the weight of deck cargo should not exceed the maximum permissible load on the deck or hatches	K	
3.8	Describe how the effects of a concentrated load can be spread over a wider area by the use of dunnage and deck shoring taking into consideration the positioning of girders, transverses and longitudinals under the tank top	U	
3.9	Describe the guard lines or rails to be provided at the sides of a deck stow and at openings in the stow	U	
3.10	Describe the provision of means of safe access between the deck and the top of the stow	U	
3.11	Describe the method of safe stowage and securing of containers on deck on vessels not specially designed for the carriage of containers	U	
3.12	Describe in outline the contents of the IMO International Maritime Solid Bulk Cargo (IMBSC) Code – Defines: – angle of repose – cargoes which may liquefy – flow moisture point	U	

	– flow state		
	– transportable moisture limit		
	– Describe in detail the preparation of cargo holds prior to loading bulk cargoes		
3.13	Explain that separation between certain bulk cargoes and other than bulk cargoes or package of dangerous goods is required	U	
3.14	Explain that some bulk cargoes may deplete the oxygen content of holds or produce toxic gases and describe the precautions to take before entry of holds	U	
3.15	Describe the hazards associated with coal cargoes	U	
3.16	Describe the importance of monitoring the temperature of the holds associated with carriage of coal cargoes	U	
3.17	Describe the precautions to take during loading and discharging coal	U	
3.18	Explain how coal should be ventilated	U	
3.19	Define the following terms as used in the International Grain Code: – grain – filled compartment – partly filled compartment	K	
3.20	Describe the cleaning and preparation of holds and decks for the carriage of grain	U	
3.21	State that a thorough check for insect or rodent infestation should be made	K	
3.22	Describe the dangers associated with using insecticide in cargo holds	U	
3.23	Explain the importance of trimming and states how it should be made	U	
3.24	list the factors involved in the control of sweat by ventilation	K	
3.25	Distinguish between ship's sweat and cargo sweat and explains the conditions in which each is experienced	U	
3.26	Describe the system of natural ventilation and how it should be controlled to minimize the formation of sweat	U	
3.27	Describe forced ventilation and humidity control for cargo holds and states the properties measured and recorded at the control panel	U	
3.28	Explain how to operate the ventilation system described in the above objective	U	
3.29	State that ventilation is also required for the removal of heat, gases and odours	K	
3.30	State examples of cargoes requiring special ventilation	K	
4	**Dangerous, hazardous and harmful cargoes, Container cargo**		**12**
4.1	Explain the different types of containment covered by the term "packaged form"	U	
4.2	Describe the classification of dangerous goods in the International Maritime Dangerous Goods (IMDG) Code	U	

4.3	State that the duty officer should have information on the quantities, types of package, proper shipping names (correct technical names), classification, stowage and segregation of the dangerous goods to be handled	K	
4.4	State that the duty officer should have information on the special measures to be taken when a certain dangerous cargo is handled	K	
4.5	State that the measures to be taken in the event of an incident or accident should be made known and that any necessary equipment and sufficient crew to operate it should be available	K	
4.6	State that the actions to be taken are laid down in the IMO Emergency Procedures for Ships Carrying Dangerous Goods (EMS)	K	
4.7	State that IMO Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG) and the International Medical Guide for Ships (IMGS)	K	
4.8	State that any incident or accident during the handling of dangerous goods should be reported immediately to the person in charge of the operation and all cargo operations to be ceased	K	
4.9	State that any doubts about the suitability and integrity of packages should be reported to the master or chief mate	K	
4.10	State the fire precautions which should be taken when carrying dangerous goods	K	
4.11	Describe the precautions which should be taken while loading or discharging explosives	U	
4.12	Describe methods of securing containers on deck. Explain Container Lashing Materials.	U	
4.13	Describe the types and sizes of containers in use. Describe safety approval plate (CSC Plate)	U	
5	**Cargo calculations and cargo plans, Heavy Lift Ships/Ro- Ro Ships/Offshore Supply Vessels, Refrigerated cargo**		**12**
5.1	distinguish between bale capacity and grain capacity	AN	
5.2	define 'stowage factor' Breaking strength; Proof Load; Factor of Safety	K	
5.3	define 'broken stowage' and states how an allowance for it is made. Explain Load density.	K	
5.4	calculates the weight that the holds will contain given the capacity to hold and the stowage factor of the cargo,	AP	
5.5	calculates the space required given the weights and stowage factors of one or more cargoes,	AP	
5.6	calculate the quantity of Two different cargo given SF which can be loaded in a stated space, making allowance for broken stowage in order to Maximize the Freight	AP	
5.7	calculate the Freight that a ship owner will earn for the quantity of cargo given (SF) which can be loaded in a stated space, making allowance for broken stowage and load density	AP	

5.8	calculate the number of packages of given dimensions which can be loaded in a stated space, making allowance for broken stowage and load density	AP	
5.9	Use of Loadicator for stowage Plan, Trimming of Bulk Cargo, Draft Survey and calculation of cargo quantity.	K	
5.10	State information from cargo plans of general cargo ships or container ships	K	
5.11	Understand the uses of a hold capacity plan	U	
5.12	calculate to estimate the bulk cargo quantity- basic calculation (on bulk carrier)	AP	
5.13	State the significance of different loadline zones while loading cargo	K	
5.14	List the factors to be considered for Heavy Lift Operations.	K	
5.15	Describe the safe loading/discharging of ro-ro cargoes	K	
5.16	Define types and features of Offshore supply vessels	K	
5.17	Explain the Uses and purpose of OSVs. Introduction to DP Vessels	U	
5.18	Explain how holds and lockers are prepared for loading	U	
5.19	Explain the need for the pre-cooling of spaces and dunnage to be used	U	
5.20	Describe the dunnaging requirements for refrigerated cargo	U	
5.21	Give examples of commodities carried chilled	K	
5.22	Give examples of frozen cargoes	K	
5.23	list the inspections of the cargo which should be made before and during the loading	K	
5.24	Describe the use of brine traps in compartment drains – before this stage	U	
5.25	Explain the purpose of compartment temperature recordings	K	

TEXT BOOKS	
1	Cargo Work for Ship officer – Capt Errol Fernandes Published by Marinez Enterprises Published on 1 Jan 1993
REFERENCE BOOKS	
1	Cargo Notes- Dhananjay Swadi , Witherby Seamanship International Ltd, 2009
2	IMDG Code Vol I,II & Supplement, International Maritime Organization, 2022
3	IMO Grain Code ,CSC , IMSBC Code & BLU Code
4	Cargo Work for Maritime Operation- D.J. House, Routledge; 8th edition (13 July 2015)
Pedagogy	
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.	

Core Course (CC)	UD11T6106 – Ship Construction and Ship Stability - I	LECTURE HOURS	CREDITS
		60	4

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Familiarize the terms and dimensions used on ship constructions
CLO2	Comprehend on the ships structures and plans
CLO3	Identify various ships sections and differentiate these sections between ships
CLO4	Apply stability formula in calculating basic vessel stability parameters
CLO5	Estimate the center of gravity of the vessel during cargo operation

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	H	M	M
CLO2	H	H	M	M
CLO3	H	H	M	M
CLO4	H	H	M	M
CLO5	H	H	M	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/ AP/AN/C)	LECTURE HOURS 60
	Ship Construction		
1	**Principle parts of ship and Definitions:**		**12**
1.1	Draw a neat picture of a Ship and explain the following principle parts of a ship. (Bow, Stern, Amidships, Port, Starboard, Bulbous Bow, Hull (Shell), Main Deck, Bridge, Accommodation, Main Mast, Fore Mast, Jack Staff, Ensign Staff, Bridge, Engine Room, Steering Gear Room, Funnel, Upper Deck, Mast House, Crane, Cargo Hold, Hatch Coaming, Hatch Cover, Booby Hatch, Bulwark, Gunwale, Mooring Winch, Windlass, Fairleads, Rollers, Cross Deck, Poop Deck, Fore Castle Deck, Tanks, Fore Peak Tank, Aft Peak Tanks, Double Bottom Tanks, Stores, Chain Locker, Propeller, Rudder, Keel, Gangway, Porthole, Bulkhead, Collision Bulkhead, Manhole, Weather Tight Doors)	AP	
1.2	**Define and Illustrate:** Forward Perpendicular (FP), After Perpendicular (AP), Length Between Perpendiculars (LBP), Amidships, Length On the Waterline (Wl), Length Overall (LOA), Base Line; Moulded - Depth, Beam and Draught; Extreme - Depth, Beam, Draught and Air Draft.	AP	
1.3	**Define and Illustrate:** Camber, Rise Of Floor, Tumblehome, Flare, Sheer Frd, Sheer Aft, Stem Rake, Keel Rake, Parallel Middle Body, Entrance, and Run.	AP	
2	**Load Line, Draft Marks and Hull Structures**		**12**
2.1	Draw Loadline Marks including Plimsoll for a ship. Label the horizontal & vertical distances (Exclude Timber Load Line) Draw Draft marks over 2 meters range (ONLY IN METERS)	AP	
2.2	Explain The Draft Marks, Plimsoll Line, Deck Line, Load Lines and Freeboard. Importance of Loadline	U	
2.3	Define Gross Tonnage (GT) And Net Tonnage (NT)	U	
2.4	Sketch Profile view (top and side view only) of A General Cargo vessel, Gearless Bulk Carrier and Label The Principal Parts of the ship as explained in	AP	

	1.1		
2.5	Explain the difference between Plan View, Profile View and Elevation View and also sketch and Label plan and Profile view (top and side view only) of A Typical Double Hull Tanker, Showing Bulkheads, Cofferdams, Pump-Room, Engine-Room, Bunker and Peak Tanks, and Cargo Tanks, Segregated Ballast Tanks. The Principal Parts of the ship as explained in 1.1	AP	
2.6	Sketch and Label plan and Profile view (top and side view only) of a Typical Gas Carrier, Showing Containment Systems, Compressor Rooms, Cofferdams, Engine-Room, Bunker and Peak Tanks, and Ballast Tanks. The Principal Parts of the ship as explained in 1.1	AP	
2.7	Sketch and Label plan and Profile view (top and side view only) of a Profile View of A Container Ship Showing Holds, D.B. Arrangements, Peak Tank Arrangements, and Engine Room & Cell Guide Arrangement. The Principal Parts of the ship as explained in 1.1	AP	
2.8	Sketch and Label plan and Profile view (top and side view only) of a Profile View of Ro-Ro Ship Showing Mid Ship Ramp Arrangement, Stern Ramp Arrangement, Car Decks, D.B. Arrangement, and Slope Ways. The Principal Parts of the ship as explained in 1.1	AP	
3	**Ship's Plans and Sections of Ship:**		**12**
3.1	Describe The Content Of Different Types Of Plans, E.G. G/A Plan, FFA Plan, LSA Plan, Pumping And Piping Arrangement, Shell Expansion Plan, Capacity Plan.	U	
3.2	Describe and Illustrates Standard Steel Sections Flat plate, offset Bulb plate, Equal Angle, Unequal Angle, Channel, Tee	AP	
3.3	Define Frames, Floors, Transverse Frames, Deck Beams, Knees, Brackets, Shell Plating, Decks, Tank Top, Stringers, Bulkheads And Stiffeners, Pillars, Hatch Girders And Beams, Coamings, Bulwarks	U	
3.4	Explain Shell Expansion Plan, Frames and Framing numbers	U	
3.5	Sketch The Deck Edge, Showing Attachment of Sheer Strake and Stringer Plates	AP	
3.6	Sketch Double Bottom Tanks and label principal parts	AP	
3.7	Sketch and Label – Sounding Pipes, Air pipe and Ventilator	AP	
	Ship Stability		
4	**Introduction to Ship Stability**		**12**
4.1	Explain Archimedes Principle & Principle of flotation.	U	
4.2	Compute underwater volumes of regular geometrical shapes and solve numerical on flotation.	AP	
4.3	Define Centre of Buoyancy as the geometric center of the underwater volume & the up thrust by the water is known as Buoyancy.	K	
4.4	Define Reserve buoyancy as the above water enclosed volume which provides buoyancy in case vessel becomes heavier.	K	
4.5	Define Load Displacement, Present displacement, Light displacement, Deadweight, Deadweight aboard & Deadweight available.	K	
4.6	Show mathematically Deadweight = Load displacement – Light displacement, Deadweight Available = Load displacement – Present displacement & Deadweight aboard = Present displacement – Light displacement.	AP	
4.7	Explain how the draft of a vessel changes due to change of density.	U	
	Stability Terminology:		
4.8	Sketch and define TPC. Show that TPC = density x A/100	AP	
9.9	Define Fresh Water Allowance (FWA). Show that FWA in cm can be calculated using formula W/40 TPC.	AP	
4.10	Define Dock Water Allowance (DWA).	K	
4.11	Calculate TPC, FWA & DWA in various densities.	AP	

4.12	Sketch & define Block co-efficient (Cb), Water-plane coefficient (Cw), Mid-ship Coefficient (Cm), Prismatic Coefficient (Cp).	AP	
4.13	Show the relationship between Cp, Cb& Cm.	AP	
4.14	Calculate TPC given maximum Length, breadth of water plane, density of water & Cw.	AP	
4.15	Calculate Displacement given maximum length, breadth, draft and density of water &Cb.	AP	
5	**Centre of Gravity :**		**12**
5.1	Define Centre of gravity of ship and factors affecting the same.	K	
5.2	State that COG on a ship can be pinpointed if the 3 references are known. Distance from Keel, Distance from Aft perpendicular (or amidships) & distance from fore and aft center line.	K	
5.3	Calculate movement of COG when only one operation is carried out using GG1 formula.	AP	
5.4	Calculate KG of a Ship when multiple operations are carried out using moments about the keel.	AP	
5.5	Determine the position of the longitudinal center of gravity (LCG) of a ship for different conditions of load & ballast using moments about the Aft Perpendicular.	AP	
5.6	Explain the effect on the position of center of gravity of a ship by adding, removing and/or shifting weights.	U	
	Centre of Buoyancy & Centre of Flotation		
5.7	Define Centre of buoyancy and factors affecting the same.	K	
5.8	State that COB on a ship can be pinpointed if the 3 references are known. Distance from Keel, Distance from Aft perpendicular (or amidships) & distance from fore and aft center line.	K	
5.9	Define Longitudinal Centre of Buoyancy (LCB) & factors affecting their positions.	K	
5.10	Calculate KB & LCB of a ship with regular geometrical shapes.	AP	
5.11	Define Centre of Floatation and factors affecting its position.	K	
	Density, Draft & Displacement:		
5.12	Construct Displacement, TPC & Deadweight curves to scale for a given data.	AP	
5.13	Use displacement and TPC curves to determine weights of cargo or ballast from draughts or freeboards.	U	

TEXT BOOKS

1. Ship Stability at the Operational Level- Capt. Subramaniam H, 1-Jan-2021
2. Ship Construction Notes for Ship Mates - by Edrich Fernandes Pro-Navigator Books 1999

REFERENCE BOOKS

1. Ship Stability for Masters & / Mates - Bryan Barrass , Capt D R Derrett , 5 September 2012
2. Ship Stability for Mates & Masters - Martin A. Rhodes 1 December 2003
3. Ship Construction Sketches & Notes - by Kemp & Young, 12 December 1997
4. Ship & Naval Architecture - by R. Munro-Smith, 1 May 1977
5. Ship Constructions - by D.J. Eyres, 22 May 2012
6. Ship Construction for Marine Engineer - by Paul A Russell , E A Stokoe , 04 Aug 2022

Pedagogy

Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.

Core Course (CC)	UD11T6107 Bridge Equipment and COLREGS	LECTURE HOURS	CREDITS
		60	4

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand bridge layout and steering control systems
CLO2	Apply navigational equipment knowledge to operate various bridge equipment
CLO3	Apply navigational watch procedures to keep anchor watches and record keeping on bridge
CLO4	Demonstrate collision prevention regulations and day and night signals
CLO5	Explain safe embarking and disembarking procedures of pilots

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	H	M	-
CLO2	H	H	M	-
CLO3	H	H	M	M
CLO4	H	H	M	M
CLO5	H	H	M	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 60
1	**Lay out of Bridge (Wheel House) and Navigational equipment**		**12**
1.1	Understand the general layout of the Bridge with its Navigational Equipment and also State the reason for inclination of bridge front window	U	
1.2	Understand Integrated Bridge Systems & its advantages & disadvantages.	U	
	Sextant:		
1.3	Draw and explain the principle of Sextant	AP	
1.4	Understand the Parts of the Sextant Describe all the Errors of the sextant	U	
	Dry & Wet card Magnetic Compass		
1.5	Understand the parts of the Magnetic compass	U	
1.6	Describe the method of determination and compensation of the effects of a ship's magnetic field on the magnetic compass.	U	
1.7	Describe the method of obtaining a table of deviations.	U	
1.8	Explain Heeling error effect and method of correction.	U	
1.9	Differentiate the dry and wet card compass	U	
1.10	Explain the Care and maintenance of wet card compass.	U	
1.11	**Course Recorder**		
	Understand the Working Principle of Course recorder. Importance of Course recorder as evidence in the cases of Collision and Marine Accidents.	U	
2	**Speed Log**		**12**

2.1	State the difference between ground reference speed and water reference speed.	K	
2.2	Explain: Principle, limitations of Doppler speed log & Electro-Magnetic log.	U	
2.3	Sketch & explain with the help of a Block Diagram how ship's speed transmitted to display unit and how indication of distance run is derived from a speed log.	AP	
2.4	Explain causes of Errors in speed log. Explain Janus Configuration	U	
	Echo Sounder:		
2.5	Describe the basic principles of marine echo-sounding equipment	U	
2.6	Draw a simple Block diagram of an echo-sounder, and state the function of main components (Transducer, Oscillator, Amplifier & recorder)	AP	
2.7	Describe the controls of Echo sounder	U	
2.8	Describe the physical factors which affect the velocity sound in seawater	U	
2.9	Differentiates between range and phase, causes of errors and explains the dangers of using the wrong phase.	AN	
	Other Equipment in the Wheel House		
2.10	Describe the Electric telegraph and explain its operation.	U	
2.11	Describe the use & care of the Day Light Signalling Lamp and explain the reasons for considering it an emergency source of power.	U	
2.12	Describe the use, care and precautions while operating wipers & Clean View Screen (CVS)	U	
2.13	Explain the use of Binocular	U	
2.14	Explain the use of Chronometer and its errors	U	
3	**Steering systems**		**12**
3.1	Demonstrate clear, concise communication and acknowledgement at all times on the bridge in a manner with due regards to Standard Marine Communication Phrases.	AP	
3.2	Describe the various methods to call the Master to the bridge.	U	
3.3	Explain the inter-switching of Follow-up & Non-Follow-up and Emergency Steering system	U	
	Steering control systems (Autopilot)		
3.4	Explain the principle of an automatic pilot system	U	
3.5	Explain the functions of the manual settings	U	
3.6	Describe the procedures for changeover from automatic to manual steering and vice versa	U	
3.7	Explain what is meant by an adaptive automatic pilot and briefly explain how it functions	U	
3.8	Describe the course monitor and the off-course alarm	U	
3.9	Describe the operation of the course recorder log	U	
3.10	State that the automatic pilot should be included in the steering gear testing prior to the ship's departure	K	
3.11	Explain the regulation regarding the use of the automatic pilot	U	
3.12	Explain in the recommendation on performance, standards for automatic pilots	U	
3.13	Explain the need for regular checking of the automatic pilot to ensure that it is steering the correct course	U	

3.14	State that the automatic pilot should be tested manually at least once per watch	K	
3.15	Describe the factors to take into account regarding the changeover to manual control of steering in order to deal with a potentially hazardous situation	U	
3.16	Explain Wheel House posters and the use of Rate of Turn Indicator (ROTI)	U	
4	**COLREGS Rules 1 to 41**		**12**
4.1	Describe the application of the rules as set out in Rule 1	U	
4.2	describe the responsibility to comply with the rules as set out in Rule 2	U	
4.3	Describe examples of precautions which may be required by the ordinary practice of seamen or by the special circumstances of the case	U	
4.4	state the general definitions which apply throughout the rules (Rule-3)	K	
4.5	Steering & Sailing Rules- 'a proper look-out' and interprets the intent of 'full appraisal of the situation and the risk of collision'	U	
4.6	explain what is meant by a safe speed, factors to be taken into account in determining a safe speed	U	
4.7	explain what is meant by risk of collision	U	
4.8	describe the proper use of radar/ARPA in determining whether a risk of collision exists	U	
4.9	Actions to avoid collision positive action in ample time large enough to be readily apparent	U	
4.10	demonstrate an understanding of Rule 9 by:	U	
4.11	defining the terms 'narrow channel' and 'fairway'	K	
4.12	Describe how to proceed along the course of a narrow channel -a small craft, sailing vessel, fishing vessel, overtaking in narrow channel.	U	
4.13	Define the term 'traffic separation scheme' 'traffic lane', 'separation line', 'separation zone', 'inshore traffic zone 'entering and leaving the traffic separation scheme, traffic lane, crossing lanes	K	
4.14	State that the exemptions for vessels engaged in an operation for the maintenance of safety of navigation laying, servicing or picking up of a submarine cable	K	
4.15	Conduct of vessels in sight of one another (Rules 11-18) - Sailing vessel - Overtaking - Head-on situation - Crossing situation - Give way and Stand on vessel - Responsibilities between vessels	K	
4.16	Explain the application of Rule 19	K	
4.17	Explain COLREGS Rules from rule 20 to 41 concerning Lights, shape and Sound Signals. Describe the sound signals to be used by vessels in sight of one another, vessels in or near an area of restricted visibility, to attract attention		
5	**IALA Maritime Buoyage System and Record keeping**		**12**
5.1	Explain the principles and rules of the International Association of Lighthouse Authorities (IALA) Maritime Buoyage System, Systems "A" and "B"	U	
5.2	Recognize the lights and shapes displayed on lateral and cardinal marks	AN	
5.3	Recognize the lights and shapes displayed on other types of buoys in the system	AN	

5.4	Maritime Phonetics A-Z and 0-9. Single letter Flag meaning A – Z, Morse Code A-Z and 0-9	AN	
5.5	**Record keeping and Entries in logbook:**		
5.6	Explain the importance of recording all relevant information in Logbooks, monitoring of navigational instruments, recording their performance and other relevant details,	U	
5.7	Recording all movements & activities related to the navigation of the ship and voyage records,	U	
5.8	Record keeping of different kinds of logs during ocean passages, coastal navigation & in port as per the company's ISM/SMS & IMO Guidelines for recording of events related to Navigation Res A. 916 (22)	U	
	Keeping an effective Anchor watch:		
5.9	State the importance of beam bearings, use of Global Position Fixing System (GPS) and Radar during anchor watch.	K	
5.10	Explain a swinging Circle in relation to length of vessel and length of cable used and the swinging of vessel anchored to tide/wind.	U	
5.11	State the indications of anchor dragging and the use of shapes, lights and sound signals as per IRPCS 1972.	K	
	Pilot embarking & disembarking		
5.12	State the importance of compliance with safe procedures for embarking and disembarking of Pilots and Pilot transfer arrangements, as per SOLAS, & its upkeep.	K	

TEXT BOOKS	
1	Bridge Equipment, Charts & Publication Nutshell Series Book 5- Capt. H. Subramaniam 1 Jan 2017
2	Bridge equipment and watching keeping by Capt.A.G. Bhatia-2022 Edition
3	Rules of The Road, Bhandarkar Publications 15th Edition
REFERENCE BOOKS	
1	Modern electronic Navigation Aids- Bhatia and Sinha, 2021
2	Bridge Procedure Guide - ICS
3	Bridge Team work - Nautical Institute
4	Mariners Handbook – HMSO Publication
5	Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House, Publisher: Routledge Taylor & Francis
Pedagogy	
.	Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning

Practical -Minor Stream (PL/MS)	UD11P6108– Physics Practical	PRACTICAL HOURS	CREDITS
		30	1

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand Ohm's Law
CLO2	Measure moment of inertia of flywheel
CLO3	Measure angle of repose of grain
CLO4	Use thermistor as heat sensor
CLO5	Operate Venturimeter

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	M	L	--	-
CLO2	M	L	-	-
CLO3	M	L	-	-
CLO4	M	L	-	-
CLO5	M	L	-	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 30
1	**Determination resistance per cm of a given wire by plotting a graph of potential difference versus current using Ohm's Law**		**5**
1.1.	Perform the experiment and write down the observation table	AP	
2	**Moment of inertia of a flywheel and frictional torque.**		**5**
2.1	Perform the experiment and write down the observation table	AP	
2.2	Calculate the moment of inertia and frictional torque by using formula	AP	
3	**Determination of angle of repose of grains and friction**		**5**
3.1	Perform the practical and write the observation table	AP	
4	**Verification of KVL &KCL:**		**5**
4.1	Performance of KVL and KCL experiments on practical setup	AP	

4.2	Verification of KVL and KCL Law theoretically and practically	AP	
4.3	Applications of KVL and KCL in different electrical and electronics circuits	AP	
5	**Use of thermistor as temperature / heat sensor:**		**5**
5.1	Comparison between thermistor and thermocouple type heat sensors	AN	
5.2	Performance of thermistor experiment to find the temperature of hot water.	AP	
5.3	Draw a graph between resistance Vs temperature change	AP	
5.4	Compare the characteristics curve of thermistor with RTD type temperature sensor	AN	
5.5	Application of thermistor in different fields	AP	
6	**Study of Venturimeter:**		**5**
6.1	Compare Venturimeter with other flow meters (like Orifice and Rotameter)	AN	
6.2	Perform the experiment on Venturimeter apparatus	AP	
6.3	Calculate the theoretical and practical value of discharge and discharge coefficient	AP	
6.4	Apply Venturimeter in different field	AP	

Practical Core Course <PL/CC>	UD11P6109 Chart Work Plotting and ECDIS Practical	PRACTICAL HOURS	CREDITS
		60	2

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Draw courses, distances on the chart between the and find position of the vessel
CLO2	Determine on the chart, the course and speed made good of the vessel
CLO3	Operate and Familiarise the ECDIS equipment

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	H	H	L	-	H
CLO2	H	H	L	-	H
CLO3	H	H	L	-	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60
1	**Chart work exercises: (English Channel Chart)** Determine the Ship's position, Course, Distance, Set & Drift: i. Latitude and Longitude ii. Bearing and Distance off from a Navigational mark iii. Compass bearings of two or more shore objects iv. Two Radar Distances v. One Visual Bearing and one Radar Distance vi. Two Horizontal Sextant Angles vii. One Range and One Horizontal Sextant Angle **viii.** One Bearing and One Vertical Sextant Angle	AP	20
2	**Chart work plotting exercises: (English Channel Chart)** Determine the Course to Steer, CMG, SMG, Distance, Set & Rate of Current, Drift, Leeway and ETA to a given point: i. Determines the True/Compass Course and Distance between any two points on the chart ii. Plots a course to pass a light house at a given distance and bow angle including beam bearing and doubling the angle at the bow method iii. Horizontal Sextant Angle method iv. Running fix, with and without Set, Rate of current, Drift and Leeway v. Exercise on Planning a Passage from Point A to B	AP	20

3	**Demonstrate the use of ECDIS on Simulator:** ECDIS Simulator Set up the ECDIS display as per following list - - Four modes of Display (Base, Standard, ALL, Custom) (Reference to MSC 232.82) - Understand Scale of an ENC and equivalence with Radar range scales - N/UP, C/UP, H/UP display modes - Centred / Off-centred display - TM/RM display modes - Day / Night modes - 2 or 4 colour display - Explain Over scale Issue on display - Setting active ENC to compilation scale - Controls such as Auto-load, Auto-scale, Auto-centre, Home (Centre- ship) command Apply **Own ship settings** in ECDIS. **Sensor Management** settings in ECDIS. Create a **Simple Route** in ECDIS between 2 positions Apply following alarm settings in ECDIS - Guard zone or safety frame or sector, - activate-deactivate different types of area alerts, - activate-deactivate route alarms (XTE alarm, Wpt approach alarm, Early course change or wheel over alarm, End of route alarm) - Setting of route alarms.	**AP**	**20**

TEXT BOOKS Chart Work for Mariner-Capt. S.K. Puri 1 Jan 2016 English Channel Chart (Photocopy) Parallel Ruler, Divider, Compass, 2B pencil and Eraser
REFERENCE BOOKS ECDIS simulator manual
Pedagogy Group Discussion, and Activity based Learning.

Practical Core Course (PL/CC)	UD11P6110 Seamanship Practical	PRACTICAL HOURS	CREDITS
		60	2

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Carry out various deck work on board vessels
CLO2	Handle lifting appliances
CLO3	Work in enclosed spaces
CLO4	Carry out corrosion prevention activities on ships
CLO5	Demonstrate Firefighting appliances

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	H	M	L
CLO2	H	H	M	L
CLO3	H	H	M	L
CLO4	H	H	M	L
CLO5	H	H	M	L

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60
1	**Deck Work**		**12**
1.1	Identify Between Right Hand Lay And Left Hand Lay Ropes	AP	
1.2	Demonstrate Various Types Of Whippings.	AP	
1.3	Demonstrate Various Types Of Knots, Bends And Hitches. Practical Usage Of Knots And Understanding Where Each Knot Is Used	AP	
1.4	Practice Splicing - Eye splice & Back Splice of fibre ropes	AP	
1.5	Demonstrate Coiling And Uncoiling Wire Ropes And Removing Kinks (Group Activity)	AP	
1.6	Demonstrate Taking Soundings and Ullage.	AP	
1.7	Demonstrate Taking Hold Temperature.	AP	
1.8	Conduct Practical Exercises In Reading drafts - Metric and Foot system	AP	
1.9	Stenciling	AP	
2	**Access and lifting appliances**		**12**
2.1	Learn And Demonstrate How A 'Pilot Ladder' Can Be Rigged Up According To The Relevant Rule Requirements	AP	
2.2	Demonstrate How To Climb Up & Down A 'Pilot Ladder' After Taking All Due Safety Precautions	AP	

2.3	Learn And Demonstrate How A 'Gangway' Can Be Rigged Up According To The Relevant Rule Requirements	AP	
2.4	Demonstrate How To Climb Up & Down A 'Gangway' After Taking All Due Safety Precautions	AP	
2.5	Working Aloft - Safety Procedure Involved In Working Aloft On Stage And A Bosun's Chair	AP	
2.6	Demonstrate The Ability To Climb A Ship's Mast	AP	
2.7	Demonstrate Ability To Carry Objects Up Or Down The Ladders Or Stairs	AP	
2.8	Demonstrate Hazards Associated With The Use Of Portable Ladders Onboard.	AP	
	Portable Lifting Appliances		
2.9	Conduct Practical Exercise On The Use Of Blocks, Snatch Blocks And The Differential Pulley (Chain Blocks).	AP	
2.10	Conduct Practical Exercises On The Use And Maintenance Of Various Types Of Blocks, Tackles, Shackles And Bottle Screws / Turnbuckles, Including Opening, Greasing	AP	
2.11	Demonstrate The Use Of Bulldog Grips And Bottle Screws / Turnbuckles In Joining Wires	AP	
3	**Fire Fighting and Enclosed Space**	AP	**12**
3.1	Learn To Refill Foam and DCP Types Portable Fire Extinguishers Which were Discharged During A Drill	AP	
3.2	Learn To Operate The SCBA Compressor And Refill The Air Bottles Which Were Used Up When SCBA Was Being Used During A Drill	AP	
3.3	Learn To Do Pressure Testing Of Fire Hoses By Attaching To A Hydrant	AP	
3.4	Learn To Attach fire hose Coupling using the tools available in the hydrant box	AP	
3.5	**Enclosed Spaces & Gas Measurement**		
3.6	Gas Measuring Equipment- Explosimeter, O2 Analyzer	AP	
3.7	Demonstrate Entering Enclosed Spaces With Atmospheres Suspected To Be Unsafe For Entry- Donning SCBA, Permit Systems And Adequate Safe Working Practices, Filling up Entry Permit.	AP	
3.8	Demonstrate actions to be taken if alarm received in gas meter when inside enclosed space	AP	
3.9	Demonstrate rendering immediate assistance to casualty in enclosed space and methods of safe evacuation of casualty.	AP	
4	**Corrosion Prevention**		**12**
4.1	Demonstrate Understanding Of Importance Of 'Surface Preparation Methods' Required Prior Painting A Surface	AP	
4.2	Demonstrate various scales of Surface preparation as per ISO 8501 (SA 0.0 to 3.0)	AP	
4.3	Explain The Difference In Results After Painting A Surface Using A Brush, A Roller And Using spray painting machine	AP	
4.4	Demonstrate how wet & And Dry' Film Thickness Can Be Measured After Painting	AP	
5	**Mooring Stations**		**12**
5.1	Demonstrate The Method Of Connecting A Heaving Line / Messenger Line To A Hawser.	AP	

5.2	Demonstrate The Method Of Belaying And Racking A Wire Rope.	AP	
5.3	Demonstrate Throwing Heaving Lines, Use Of Rope And Chain Stoppers, Mooring Shackle And Safe Handling Of Mooring Ropes. Use Of Slip-Ropes, messenger lines and Fenders, dangers of bight in rope	AP	
5.4	Exercise Laying of ropes and wires in mooring winch & warping drum	AP	
5.5	Identify Whip Lash zones in a rope taken around a lead.	AP	
5.6	identify the parts & uses, Terminology, reporting the lead of chain, safety when at anchor station	AP	

	Text Book Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House, Publisher: Routledge Taylor & Francis

Studio Activities – Summer Internship (SA/SI)	UD11F6111 Field Practice (Swimming Training and Industry Visit)	PRACTICAL HOURS	CREDITS
		15	0.5

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Practice swimming in the swimming pool
CLO2	Exercise survival techniques using life raft
CLO3	Demonstrate rowing boat in the sheltered waters
CLO4	Experience the port/Harbour structures and observe berthing and Unberthing of ships
CLO5	See the operations of light house Experience the celestial objects useful for navigation

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	L	H	-	-
CLO2	L	H	-	-
CLO3	L	H	-	-
CLO4	H	L	-	-
CLO5	H	L	-	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVELEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 15
	Colleges should follow unit 1 to unit 3 and unit 4 or unit 5 that is feasible based on availability / location		15
1	**Swimming Training** - learn free style swimming, - able to float freely for atleast 10minutes - displays Jumping from a height of 2 meters with life-vest on - Regular swimming practices - Swimming test	AP	
2	**Life Raft Exercises** - Jump from a height with life-vest on and board the Life-Raft - Upright an inverted Liferaft - Paddle the Liferaft and move to one end to the another end of the swimming pool	AP	
3	**Boat Rowing Exercises** - Boat Rowing exercises with oars - Understand the steering and manoeuvring of Boat - Understand the Davit arrangement - Understand the Boat lowering and stowing arrangement.	AP	

4	**Port / Harbour or Ship visit** - A visit to a port and or, ship yard, and or Harbour and a ship visit - To understand the port facility, jetty, Berth, Tug - To understand various structures onboard ship wrt ship construction such as Fore castle deck, poop deck, superstructure, Gangway, Hatches, Air pipe, Sounding pipe, Draft Mark. Stem, Bulbous bow, Stern, Gaff, Port of Registry, Name of the ship, Windlass, Anchor, Mooring winches Write a detail assignment on Industrial visit		
5	**Light House or Meteorological Lab or Planetarium museum visit** - A visit to a Light House or a Meteorological lab and write a report on the experience and knowledge gained by the visit - visit to a Planetarium and observe celestial objects and write an essay on the experience		

Detailed Teaching Syllabus - Semester II

SEMESTER - II						
S.No	**Course code**	**Course Title**	**Course Category**	**Total Lecture/ practical Hours per week**	**Total Lecture/ Practical Hours per semester**	**Total Credits**
Theory Courses						
1	UD11T6201	Marine Meteorology	AE	3	45	3
2	UD11T6202	Contingency Preparedness	MD	3	45	3
3	UD11T6203	Marine Pollution Prevention	VA	3	45	3
4	UD11T6204	Celestial Navigation	CC	4	60	4
5	UD11T6205	Cargo Work II	CC	4	60	4
6	UD11T6206	Ship Construction and Ship Stability - II	CC	4	60	4
7	UD11T6207	Bridge Electronic Equipment and Watch Keeping	CC	4	60	4
Practical Courses						
9	UD11P6208	Computer Practical	PL <MS>	3	45	1.5
8	UD11P6209	Nav Equipment and OOW Simulator Practical	PL <CC>	4	60	2
10	UD11P6210	Engine Room Machinery and Workshop Practical	PL <MD>	3	45	1.5
11	UD11F6211	Book review	SA <SI>	1	15	0.5
		Total		**36**	**540**	**30.5**

Ability Enhancement Course (AE)	UD11T6201 – Marine Meteorology	LECTURE HOURS	CREDITS
		45	3

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand Earth's atmosphere and the wind pattern around the earth
CLO2	Calculate true wind from the relative wind and velocity
CLO3	Understand the role of water vapour in the atmosphere
CLO4	Comprehend on ocean circulation system, TRS, waves and meteorological phenomena
CLO5	Analyse the weather report for evading TRS

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	H	L	M
CLO2	H	H	L	M
CLO3	H	H	L	M
CLO4	H	H	L	M
CLO5	H	H	L	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/ AP/AN/C)	LECTURE HOURS 45
1	**Earth's Atmosphere and atmospheric pressure**		**9**
1.1	Describe the composition of the earth's atmosphere, mentioning dry air and its constituents, water vapour and aerosols.	U	
1.2	Draw a typical vertical temperature profile through the lower 100 km of the earth's atmosphere. Define 'troposphere', 'tropopause', 'stratosphere', 'stratopause', 'mesosphere', 'mesopause' and 'thermosphere. Describe the main features of the troposphere.	U	
1.3	Describe the importance of the sun as the principal energy source for atmospheric processes. Describe the nature of solar radiation (scattering, reflection and absorption). Explain the effect on insolation of a variation in latitude. Explain the effect on insolation of a variation in the sun's declination. Explain the effect on insolation of a variation in the length of daylight.	U	
1.4	Explain the Greenhouse effect, global warming, heat exchange process (conduction, convection and radiation) and radiation budget of the earth/atmosphere system.	U	
1.5	Explain environmental lapse rate and inversion, Diurnal, seasonal and geographical variation of temperature, Dry Adiabatic Lapse Rate (DALR) and Saturated Adiabatic Lapse Rate (SALR), Saturation; Evaporation, Condensation, Latent Heat, and Vapour Pressure.	U	
1.6	Explain Ozone depletion and air pollution.	U	
	Atmospheric Pressure:		
1.7	State that pressure equals force per unit area.	K	
1.8	State that the atmosphere exerts a pressure on any surface	K	

	placed within it.		
1.9	State that the atmospheric pressure on a unit area of a surface is equal to the weight of the "air column" extending from that surface to the outer fringes of the atmosphere.	K	
1.10	State that atmospheric pressure decreases with height above sea level.	K	
1.11	State that atmospheric pressure acts in all directions.	K	
1.12	State that the basic unit of pressure is N/m2.	K	
1.13	State that 1 millibar = 1/1000 bar = 102 N/m2	K	
1.14	State that the atmospheric pressure at sea level normally varies between about 940 mbar and 1050 mbar.	K	
1.15	State that the average pressure at sea level is 1013.2 mbar.	K	
1.16	State that the surface pressure rises if air is added to the 'column' above the surface, and vice versa.	K	
1.17	Define 'isobar, Diurnal variation of pressure, Barometric tendency, Pressure Gradient.	K	
	Wind		
1.18	Define 'wind'	K	
1.19	Describe the Beaufort scale of wind force.	U	
1.2	Explain qualitatively the pressure gradient force.	U	
1.21	Explain qualitatively the Coriolis (geostrophic) force and cyclostrophic winds, surface wind circulation around high- and low-pressure centres.	U	
1.22	Explain Buys-Ballot's Law.	U	
1.23	Explain the method of estimating the strength of the wind from the appearance of the sea surface, using the Beaufort wind scale.	U	
1.24	List the factors, other than the wind speed, which affect the appearance of the sea surface.	K	
1.25	Explain the differences between apparent and true wind.	U	
1.26	Determine the true wind velocity by using a vector diagram, given the apparent wind and the ship's course and speed.	AN	
1.27	Describe the method of estimating the wind direction from the appearance of the sea surface.	U	
1.28	Explain interpretation of wind rose.	U	
1.29	Describe the wind and Pressure systems over the oceans.	U	
1.30	Draw the mean surface pressure and wind distribution over the earth's surface.	AN	
1.31	Describe the characteristics and location of the doldrums, intertropical convergence zone, trade winds, subtropical oceanic highs, westerlies and polar easterlies	U	
1.32	Apply the concept of horizontal temperature differences to a qualitative explanation of the formation of land and sea breezes	AP	
1.33	Explain the formation of anabatic and katabatic winds	U	
1.34	List the regions of occurrence of anabatic and katabatic winds	K	
1.35	Provide examples of local winds	K	
1.36	Describe a monsoon regime , monsoons of the Indian Ocean, China Sea, north coast of Australia, west coast of Africa and the north-east coast of Brazil	U	
2	**Cloud and Precipitation:**		**9**
2.1	State that clouds form when air containing water vapour rises, cools adiabatically and becomes saturated.	K	
2.2	Describe the need for and define condensation nuclei.	U	
2.3	State that a cloud can consist of ice crystals, super cooled water droplets, water droplets or any combination of these.	K	
2.4	List and describe the ten basic cloud types.	K	

2.5	Describe the probable base heights of the ten principal cloud types.	U	
2.6	Define 'precipitation', 'rain', 'drizzle', 'hail', 'snow' and 'sleet', Dew.	K	
	Visibility:		
2.7	State that visibility is reduced by the presence of particles in the atmosphere, near the earth's surface and define 'fog', 'mist' and 'haze'	K	
2.8	Apply the concept of processes leading to super saturation to a classification of fogs as mixing, cooling or evaporation fogs	AP	
2.9	Explain qualitatively the formation of radiation fog, mentioning areas, seasons and reasons for its dispersal	U	
2.10	State the effect of pollution on the formation of radiation fog	K	
2.11	Explain qualitatively the formation of advection fog, mentioning areas, seasons and reasons for dispersal	U	
2.12	Explain qualitatively the conditions leading to the formation of sea smoke, and typical areas where sea smoke may be encountered	U	
2.13	Describe methods of estimating the visibility at sea, by day and by night, and the difficulties involved	U	
	Water Vapour:		
2.14	Define 'water vapour'	K	
2.15	Describe the properties of water vapour in the atmosphere	U	
2.16	Define 'evaporation', 'condensation', 'latent heat of vaporization'	K	
2.17	Define 'saturated air'	K	
2.18	Describe the processes of mixing, cooling and the evaporation of water vapour, by which a sample of air may be brought to saturation	U	
2.19	Define 'dewpoint', 'absolute humidity', 'relative humidity'.	K	
2.20	Define super cooling, and frost point.	K	
2.21	Explain diurnal and seasonal variation of water vapour.	U	
3	**Ocean Circulation System and Meteorological instruments**		**9**
3.1	Identify of main ocean currents on the world map;	U	
3.2	Describe causes of ocean currents; Characteristics of ocean currents; General circulation of currents; Effect of ocean currents on the climate; Seasonal changes; Formation, source region and movement of water masses.	U	
3.3	**Oceanic Waves and Tides:**		
3.4	Explain Speed, length, period, height and significance of waves; difference between waves and swell, types of waves, wave energy, behaviour of wave in deep and shallow waters; sea waves, swell, storm surge, tsunami, bore tides; tide producing forces, types of tides, tide prediction and analysis; tidal streams. Relationship between tides and phases of moon.	U	
3.5	**Sea Water:**		
3.6	Describe the properties of ocean water- Temperature, salinity, density - their relationship and measurement; and vertical and horizontal distribution	U	
3.7	**Ship Borne Meteorological Instruments:**		
3.8	Explain the principle, use and operation of Aneroid Barometer, Barograph, Hygrometer, Hydrometer, Stevenson's screen, Whirling psychrometer, Anemometer.	U	
	Ice on the Sea:		
3.9	Understand different types of ice, icebergs, limits of icebergs, accumulation of ice on ships and organizations for issuing ice	U	

	warnings.		
4	**Tropical Revolving Storms (TRS) and weather system**		**9**
4.1	Identify the Local names, seasons and areas affected by the TRS	U	
4.2	Express the origin, structure, movement and lifespan of TRS; Weather associated with TRS;	U	
4.3	Explain definitions and nomenclature; Warning signs of an approaching TRS;	U	
	Characteristics of TRS; Forecasting techniques;		
4.4	narrate the action to be taken when the presence of TRS is confirmed;	U	
4.5	Describe cyclone tracking and warning bulletins under international conventions;	U	
4.6	Explain the Practical Rules for navigation for manoeuvring in the vicinity of TRS;	U	
4.7	Describe avoidance of storm centers and the dangerous quadrants; Ideal conditions for the formation of TRS;	U	
4.8	Compare between a TRS and a temperate latitude depression;	AN	
4.9	Describe TRS – 1-2-3 theory and sector theory for avoiding cyclone	U	
4.1	Define 'anticyclone'	U	
4.11	Draw a synoptic pattern of an anticyclone, for both northern and southern hemispheres, showing isobars and wind circulation	AP	
4.12	Describe the weather associated with anticyclones	U	
4.13	Describe a ridge of high pressure	U	
4.14	Draw a synoptic pattern for a ridge, showing isobars and wind directions	AP	
4.15	Describe a typical weather sequence during the passage of a ridge between depressions across the observer's position	U	
4.16	Describe a col or a void between a convergence of pressure systems	U	
4.17	Draw a synoptic pattern for a col or a void between a convergence of pressure systems, showing isobars and wind directions	AP	
4.18	Describe the weather associated with a col or a void between a convergence of pressure systems.	U	
	Weather Systems and weather report		
4.19	Define 'air mass'	K	
4.20	Explain the formation of an air mass	U	
4.21	Define 'source region'	K	
4.22	Explain the characteristics required of a source region	U	
4.23	Describe the source region characteristics of arctic, polar, tropical and equatorial air-mass types – defines 'warm front', 'cold front'	U	
4.24	know the symbols for warm and cold fronts and identifies them on a weather map	K	
4.25	Describe, with the aid of a diagram, the weather experienced during the passage of an idealized warm front	U	
4.26	Describe, with the aid of a diagram, the weather experienced during the passage of an idealized cold front	U	
4.27	Understand the origin, life and movement of Frontal Depressions, Structure of Depressions.	U	
4.28	Describe the weather associated with cyclone, Anticyclone, Ridge, col, Trough and other pressure systems.	U	
5	**Weather Reports and weather warnings**		**9**
5.1	Describe the organization, functions and objectives of the World Meteorological Organization, Indian Meteorological Department.	U	

5.2	Describe the sources of weather information available to shipping including internet and email	U	
5.3	Understand the weather reporting and recording procedures.	U	
5.4	Describe the services provided for shipping by Meteorological Offices	U	
5.5	Describe the appropriate weather bulletin (SAT-C) and the contents of each of its sections	U	
5.6	Describe the types of information received by facsimile machine	U	
5.7	Describe the services provided for storm warnings (At Port)	U	
5.8	Interpretation of symbols and isobaric patterns on weather charts and facsimile charts.	U	
5.9	Identify cold and Warm Front, occlusion on a synoptic chart.	U	
5.10	Interpret of synoptic and prognostic charts to ascertain wind directions, areas of strong winds, cloud and precipitation areas, fog areas, ice, and areas of fine weather	AN	
5.11	Explain how weather observations at a ship can be used to improve the forecast derived from synoptic and prognostic charts	U	
5.12	Evaluate the weather forecast information received.	AN	
5.13	Define Voluntary observing fleet under I.M.D; type and nature of information collected and International system of weather reporting.	K	
5.14	Explain the need for meteorological codes	U	
5.15	Describe Indian monsoon, EL Nino, IOD, local atmospheric phenomena such as water spout, thunder storm, aurora and halo.	U	
5.16	Understand weather routing and its uses for safe and efficient vessel navigation	U	

TEXT BOOKS

1 Marine Meteorology Nutshell Series Book-2 by Capt.H. Subramaniam,Edition 5, Published by Vijaya Publications

REFERENCE BOOKS

1 Meteorology for Mariners- HMSO
2 Meteorology for Seafarers- Frampton, R.M, November 2007
3 Meteorology Demystified: self-teaching guide- Gibilisco Stan, 16 December 2005
4 Dynamical Meteorology: an introductory selection- Atkinson, B.W, January 1, 1981
5 Mariners Handbook (NP 100) – Admiralty, 2 April 2020
6 Cloud Types for Observers- HMSO, 1989
7 Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House, Publisher: Routledge Taylor & Francis

Pedagogy

Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.

Multi-Disciplinary (MD)	UD11T6202 – Contingency preparedness	LECTURE HOURS	CREDITS
		45	3

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand hazards and its identification
CLO2	Apply risk assessment on various deck works
CLO3	Respond to shipboard emergencies
CLO4	Respond to distress signals at sea

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	H	L	H
CLO2	H	H	L	H
CLO3	H	H	L	H
CLO4	H	H	L	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45
1	**Hazard Identification and Reporting**		**9**
1.1	Give an overview of Ship design and structure for identification of Hazards on board ship.	U	
1.2	Explain the Hazards which can be removed /Hazards which cannot be removed.	U	
1.3	Explain Categories of Hazard.	U	
1.4	Explain Common areas of Hazard.	U	
1.5	Define Hazard Checklist	K	
1.6	Explain what should be assessed / who has to carry out the assessment / process of Identifying Hazards.	U	
2	**Risk Assessment**		**9**
2.1	Define Risk assessment, Health and Safety at work place.	K	
2.2	Describe the obligation of Employer and Employee.	U	
2.3	Explain the Principles of Risk Assessment	U	
2.4	Explain Risk Assessment in practice, such as Tool Box Meeting,	U	
2.5	State the Main Elements of Risk Assessment	K	
2.6	Classify Work Activities- Identify Hazards-Identify Risk Controls- Estimate Risk-Determine the tolerability of the risks-Prepare Risk	K	

2.7	Understand Control Action Plan to improve risk controls as necessary-Review adequacy of Action Plan-confirm whether the risks are now tolerable-Ensure risk assessment and controls are effective and up- to-date-	U	
2.8	Risk Assessment exercise.	AP	
3	**Emergencies**		**9**
3.1	Describe various emergencies and actions to be taken as per contingency plans in following emergencies - Grounding & Beaching, Collision, Fire on board (Accommodation/ Engine Room/ Cargo), Steering failure including use of emergency steering, Parting of moorings at Berth, Cargo shifting, Piracy Attack on the vessel, Rescue from Enclosed spaces, Spills of dangerous goods, M/E failure in Coastal Waters.	U	
3.2	Describe Precautions for the protection and safety of passengers in emergency situations; warning the passengers, evacuating all passengers, taking a roll call, instructing passengers for donning lifejackets. Distribution of blankets to passengers.	U	
3.3	Describe the arrangement for towing and being taken in tow. Explain towing equipment and tools on board ship, describe methods of towing disabled ship and communication between two ships.	U	
3.4	List the precautions required to be observed prior entering battery room and paint room.	K	
4	**Respond to Emergencies**		**9**
4.1	State the purpose of emergency drills.	K	
4.2	List the contents of muster list. State the purpose of division of crew into different teams.	K	
4.3	Understand the role of ship's crew during various emergencies as per Muster list.	U	
4.4	Identify different element of Muster list in regard to handle emergencies relating to Oil Spill, Rescue from Enclosed space & Piracy	AP	
4.5	Explain contents of Fire control plans and importance of fire drills.	U	
4.6	Describe the immediate response on hearing an Emergency Alarm.	U	
4.7	Describe the procedure for abandoning ship.	U	
4.8	Explain the importance of clear and concise communication.	U	
5	**Respond to Distress Signal at Sea**		**9**
5.1	Describe the actions to be taken on receipt of a distress message / sighting a distress signal and consequent response.	U	

5.2	Describe the procedures for carrying out SAR – various search patterns & signals to be made by ships & aircraft.	U	
5.3	Describe the precautions to be taken while manoeuvring the ship prior to the launching of lifeboat or rescue boats.	U	
5.4	Describe the methods of picking up the survivors from sea using lifeboats and life rafts.	U	
5.5	Describe procedures and precautions during Helicopter Operations.	U	
5.6	Understand the contents and application of IAMSAR Volume III, and various Search Patterns	U	
5.7	Understand the use of man overboard function in GPS for homing into the man in the water.	U	
5.8	Explain the actions to be taken in case of a man overboard including the initial manoeuvring and immediate actions.	U	
5.9	Describe various types of turns used for rescuing Man Overboard (Williamson Turn, Scharnow turn, Single Turn/Anderson Turn).	U	

TEXT BOOKS	
1	Safety Emergencies & Environmental Protection by Capt. Errol Fernandes
2	Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House, Publisher: Routledge Taylor & Francis
REFERENCE BOOKS	
1	Ship Board Operations by H.I. Lavery Code of Safe Working Practices, 15 February 1990
2	ISM Code.
3	M & MS Notices for Case Studies.
4	Theory and Practice of Seamanship - Danton G., 31 October 1996
5	Seamanship Notes - Kemp & Young, 9 November 1992
6	Code of Safe Working Practices.
7	
Pedagogy	
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.	

Value Added Course (VA)	UD11T6203 – Marine Pollution Prevention	LECTURE HOURS	CREDITS
		45	3

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand MARPOL and its annexes
CLO2	Demonstrating Marine pollution prevention equipment
CLO3	Understand Ballast Water Management and Anti-fouling conventions
CLO4	Understand Ship recycling and NPDES of USA

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	M	H	H	H
CLO2	M	H	H	H
CLO3	H	M	L	M
CLO4	L	H	M	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45
1	**MARPOL 73/78 Convention General -**	U	**9**
1.1	Explain brief history of MARPOL convention.	U	
1.2	Define, harmful substance, discharge, ship, and incident.	K	
1.3	State that violations of the Convention are prohibited.	K	
1.4	Describe the inspections which may be made by Port State authorities and outline actions which they may take.	U	
1.5	Describe the provisions for the detection of violations and enforcement of the Convention.	U	
1.6	State that reports on incidents involving harmful substances must be made without delay.	K	
	MARPOL Annex I: (Regulations for the Prevention of Pollution by Oil)		
1.7	Define/explain- oil, oily mixture, oil fuel, oil tanker, combination carrier, nearest land, special area, and instantaneous rate of discharge of oil content, wing tank, center tank, slop tank, clean ballast, and segregated ballast, Particularly Sensitive Sea Areas (PSSA), Vessel response plan (VRP), bilge water holding tank, oily water separator.	K	
1.8	Describe the surveys and inspections required under the provisions of MARPOL.	U	
1.9	State that the condition of the ship and its equipment should be maintained to conform to the provisions of the Convention.	K	
1.10	State that the certificate issued after survey is the International Oil Pollution Prevention (IOPP) Certificate.	K	

1.11	List the conditions under which oily mixtures may be discharged into the sea from an oil tanker.	K	
1.12	List the conditions under which oily mixtures from machinery-space bilges may be discharged into the sea	K	
1.13	State that the provisions do not apply to the discharge of clean or segregated ballast.	K	
1.14	Describe the conditions under which the provisions do not apply to the discharge of oily mixtures from machinery spaces where the oil content without dilution does not exceed 15 parts per million.	U	
1.15	State that residues which cannot be discharged into the sea in compliance with the regulations must be retained on board or discharged to reception facilities.	K	
1.16	List the special areas for the purposes of Annex I.	K	
1.17	State that any discharge into the sea of oil or oily mixtures from an oil tanker or other ships of 400 tons gross tonnage and above is prohibited while in a special area.	U	
1.18	Describe the conditions under which an oil tanker may discharge oily mixtures through ODMCS.	U	
1.19	Describe the conditions under which a ship, other than an oil tanker, may discharge oily mixtures in a special area.	U	
1.2	Describe conditions in which processed bilge water from machinery spaces may be discharged in a special area.	U	
1.21	State that ballast water should not normally be carried in cargo tanks of tankers provided with segregated ballast tanks.	K	
1.22	Explain the exceptions in which ballast may be carried in cargo tanks.	U	
1.23	State that, in new ships of 400 tons gross tonnage and above and in new oil tankers of 150 tons gross tonnage and above, no ballast water should normally be carried in any oil fuel tank.	K	
1.24	Pumping, piping and discharge arrangement in oil tankers including MARPOL line.	K	
1.25	Oil Record Book (Part I – Machinery space operations and Part II – Cargo/ ballast operations)	K	
1.26	Describe the requirements for the provision of Oil Record Books.	U	
1.27	List the various entries that need to be made in the Oil Record Book with respect to above for following operations:	K	
1.28	Explain that each completed operation shall be signed by the officer or officers in charge of the operations and master of the ship.	U	
1.29	State that the Oil Record Book should be kept on board readily available for inspection and should be preserved for a period of three years after the last entry has been made.	K	
	SOPEP		
1.30	State that the Shipboard Oil Pollution Emergency Plan (SOPEP) is to be seen as an information from the owners to the master of a ship.	K	
1.31	State it is an advice to the master how to react in case of an oil spill to prevent or at least mitigate negative effects on the environment.	K	

1.32	State that the Plan contains operational aspects for various oil spill scenarios and lists communication information to be used in case of such incidents.	K	
1.33	State that it is compulsory for all ships of more than 400 gross tons (oil tankers of more than 150 GT) to carry a SOPEP on board.	K	
1.34	List the contents of SOPEP.	K	
1.35	Describe that the Plan consists generally of 4 sections with the mandatory contents and its appendices with additional information as contact addresses and data plus a set of certain drawings for easy reference for the master	U	
2	**Marpol Annex II: (Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk) Cargo categories -**	U	**9**
2.1	State that the requirements of Annex II apply to all ships carrying noxious liquid substances in bulk.	K	
2.2	Explain the categories of noxious liquid chemicals	U	
2.3	State the conditions for the discharge of any effluent containing substances falling in those categories.	K	
2.4	State that more stringent requirements apply in special areas	K	
2.5	State that pumping and piping arrangements are to be such that, after unloading, the tanks designated for the carriage of liquids do not retain more than certain stipulated quantities of residue.	K	
	Procedures and Arrangements Manual		
2.6	State that the Manual identifies the arrangements and equipment needed to comply with Annex II and specifies the operational procedures with respect to cargo handling, tank cleaning, slops handling, residue discharging, ballasting and deballasting, prewash and ventilation procedures.	K	
	Cargo Record Book		
2.7	State that the record book to be completed, on a tank-by-tank basis, whenever any operations with respect to a noxious liquid substance take place.	K	
	Shipboard Marine Pollution Emergency Plan (SMPEP) -		
2.8	Explain that this plan is to be seen as an information from the owners to the master of a particular ship advising the master how to react in case of a spill of noxious liquid substances to prevent or at least mitigate negative effects on the environment.	U	
2.9	Describe that the Plan contains operational aspects for various spill scenarios and lists communication information to be used in case of such incidents.	U	
2.10	Explain that if a combined plan “Shipboard Marine Pollution Emergency Plan” (SMPEP) is carried, it has to be in accordance with the guidelines and such plan has to fulfil the requirements for an oil spill mitigation and additionally it should have a mitigation plan for noxious liquid substances.	U	
2.11	Explain Reception facilities and cargo unloading Terminal arrangements	U	

	Marpol Annex III: (Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form)		
2.12	State that for the purpose of this Annex, empty receptacles, freight containers portable tanks and road and rail tank wagons which have been used previously for the carriage of harmful substances are treated as harmful substances themselves unless precautions have been taken to ensure that they contain no residue that is hazardous to the marine environment.	K	
2.13	State that packaging, containers and tanks should be adequate to minimize hazard to the marine environment	K	
2.14	State that the requirements for marking and labelling packages, freight containers, tanks and wagons to be as per IMDG Code	K	
2.15	Describe the documentation relating to the carriage of harmful substances by sea	U	
2.16	State that certain harmful substances may be prohibited for carriage or limited as to the quantity which may be carried aboard any one ship	K	
2.17	State that jettisoning of harmful substances is prohibited except for the purpose of securing the safety of the ship or saving life at sea	K	
3	**Marpol Annex IV: (Regulations for the Prevention of Pollution by Sewage from Ships)**		**9**
3.1	State that Annex IV contains a set of regulations regarding the discharge of sewage into the sea, ships' equipment and systems for the control of sewage discharge, the provision of facilities at ports and terminals for the reception of sewage, and requirements for survey and certification	K	
3.2	Describe the provisions regarding the discharge of sewage into the sea including discharge into Baltic Sea (special area for passenger ships)	U	
3.3	State that an International Sewage Pollution Prevention Certificate is issued by national shipping administrations to ships under their jurisdiction showing compliance	K	
3.4	State that the annex requires ships to be equipped with either a sewage treatment plant or a sewage comminuting and disinfecting system or a sewage holding tank, Standard discharge connection.	K	
3.5	State that the discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land; or is discharging sewage which is not comminuted or disinfected at a distance of more than 12 nautical miles from the nearest land.	K	
	Marpol Annex V: (Regulations for the Prevention of Pollution by Garbage from Ships)		
3.6	Define, for the purposes of Annex V: Garbage, nearest land, special area.	K	
3.7	State that the disposal into the sea of all plastics is prohibited	K	

3.8 3.9	State the regulations concerning the disposal of other garbage List the special areas for the purposes of Annex V	K K	
	Garbage Management Plan		
3.10	State that the ships have to carry a garbage management plan which the crew are required to follow	K	
3.11	Describe the content of the Garbage Management Plan, Garbage Record Book and Explain Placards	U	
3.12	Garbage Record Book - Parts I and II. Describe various operations when the Garbage Record Book has to be completed and various entries that need to be made.	U	
3.13	Explain the disposal criteria for cargo residues/cargo hold washing water residues.	U	
4	**Marpol Annex VI: (Regulations for the Prevention of Air Pollution from ship)**		**9**
4.1	Define, for the purposes of Annex VI: continuous feeding, emission control area (ECA), Nitrogen Oxide (NOx) technical code, Ozone depleting substances, sludge oil, shipboard incineration, particular matter (PM), volatile organic compounds (VOCs), EEDI , EEXI, CII	K	
4.2	Describe the requirement for SOx control	U	
4.3	List the Emission control areas for the purposes of Annex VI	K	
4.4	Explain Volatile Organic Compounds (VOC)	K	
4.5	Volatile Organic Compound (VOC) Management Plan	K	
4.6	Explain that VOC emissions from ships can be due to incomplete combustion processes and include crankcase, exhaust and evaporation emissions	K	
4.7	Describe the requirement for fuel oil quality and Bunker delivery Note	K	
5	**International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM) and Antifouling System**		**9**
5.1	Define: Ballast water, ballast water management, sediments	K	
5.2	State that in order to show compliance with the Convention each vessel shall have on board a valid Certificate, a Ballast Water Management Plan and a Ballast Water Record Book	K	
5.3	Describe D-2 Ballast water management standard	U	
5.4	Describe the various types of Ballast water Treatment systems available.	U	
5.5	Form of International Ballast Water Management Certificate	K	
	Anti -Pollution Equipment's (Introduction):		
5.6	Draw /Describe the operating procedures of Sewage plant, Incinerator	U	
5.7	Precautions in using Communitor and Compactor (Annex V)	U	
	International Convention on the Control of Harmful Anti-fouling Systems on Ships		
5.8	Describe, Brief History, Effects, Antifouling purpose and types, Environmental Impact.	U	
5.9	State that convention prohibits the use of harmful organotins and cybutryne compounds in anti-fouling paints used on ships.	K	

5.10	State that the Convention provides for the establishment of a "technical group", to review proposals for other substances used in anti-fouling systems to be prohibited or restricted.	K	
5.11	State that in order to show compliance with the Convention each vessel shall have on board a valid International Antifouling Certificate	K	

TEXT BOOKS
1) Introduction to Marine Environment Protection, Second Edition, by Capt Subroto Khan, 2021 2) Course Notes by the Faculty
REFERENCE BOOKS
1.MARPOL 73/ 78 as Amended (Latest Edition)
2. International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM)
3. International Convention on the Control of Harmful Anti-fouling Systems on Ships
4. The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships
5. Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House, Publisher: Routledge Taylor & Francis
Pedagogy
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.

Core Course (CC)	UD11T6204 - Celestial Navigation	LECTURE HOURS	CREDITS
		60	4

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand terminologies in celestial sphere
CLO2	Apply formula to calculate various hour angles in determining position
CLO3	Calculate azimuth, amplitude of celestial body
CLO4	Apply formula for finding position line by Lat by Mer Alt method (Sun)
CLO5	Calculate position line by intercept method

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	H	L	-
CLO2	H	H	L	-
CLO3	H	H	L	-
CLO4	H	H	L	-
CLO5	H	H	L	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/ AP/AN/C)	LECTURE HOURS 60
1	**Celestial Sphere and Equinoctial System of Coordinates:**		**12**
1.1	Describe the celestial sphere.	U	
1.2	Explain the apparent annual motion of sun and the concept of ecliptic.	U	
1.3	Define celestial poles, celestial meridian, equinoctial, Vertical circles, Prime vertical and obliquity of ecliptic	K	
1.4	State the equinoctial as fixed reference plane and the direction of first point of Aries as reference direction (ignoring the effect of precession).	K	
1.5	Describe the equinoctial system of coordinates.	K	
	Solar System:		
1.6	State the composition and dimensions of the Solar System.	K	
1.7	Explain Kepler's laws of planetary motion.	U	
1.8	Name inferior and superior planet.	K	
1.9	Describe the earth's elliptical orbit.	K	
1.10	State approximate Aphelion and Perihelion distance and date.	K	
1.11	Explain the eccentricity of earth's orbit.	U	
1.12	Describe the inclination of earth's axis to the plane of orbit and the stability of the axis (ignoring precession) and its effect on the Seasons.	U	
1.13	State the date of solstice and equinoxes.	K	

1.14	Explain the concept of earth's axial rotation giving day and night.	U	
1.15	Explain the varying length of daylight throughout the year.	U	
1.16	Explain the daylight and darkness condition in various latitudes at the solstice and equinoxes.	U	
1.17	Describe the significance of tropic of Cancer and Capricorn and of Arctic and Antarctic circles.	U	
1.18	Describe Earth and Moon system; Phases of moon; Solar and lunar eclipses; Condition necessary for occurrence of solar or lunar eclipse; Umbra and Penumbra.	U	
	Hour Angle and Time,		
1.19	Describe the concept of earths axial rotation causing change in hours angle of the body	U	
1.20	Define Greenwich hour angle (GHA), Local hour angle (LHA), sidereal hour angle, declination, longitude and explain their relationship.	K	
1.21	Define Time and hour angle, Greenwich time, Zone time, Standard time, GMT, LMT, relationship between longitude and time.	K	
1.22	Describe the rate of change of GHA of sun and Aries, Polar distance and Right Ascension (RA).	U	
1.23	Identify Position of heavenly body on celestial sphere by its declination and GHA or by its altitude and azimuth.	AP	
1.24	Identify the tabulation of SHA, GHA and declination ('d' and 'v' corrections) in Nautical almanac for all celestial bodies.	AP	
1.25	Determine the geographical position of a body for any given GMT. Calculation based on above.	AP	
2	**Altitude Corrections and Pole Star Observation:**		**12**
2.1	Define sextant altitude. Demonstrate how to retrieve and return the Sextant into the storage box. Demonstrate how to read a sextant.	U	
2.2	Show how to correct a sextant into which has been introduced one or more of errors of perpendicularity, side error or index error.	U	
2.3	Demonstrate how to find the index error of the sextant by the horizon.	**U**	
2.4	Describe how to find index error of the sextant by the sun	U	
2.5	Demonstrate use of sextant for taking horizontal and vertical angles.	U	
2.6	Describe the purpose of altitude correction. Define visible, sensible and Rational horizons.	U	
2.7	Define observed altitude and true altitude	K	
2.8	Define dip, refraction, semi-diameter and parallax and explains their causes.	K	
29	Illustrates the effect of terrestrial refraction on dip and the distance of the sea horizon.	U	
2.10	Demonstrate the use of altitude correction tables in Nautical Almanac.	U	

2.11	Obtain the true zenith distance from the true altitude of the body.	AP	
2.12	Calculation based on above.	AP	
	Daily Motion and Horizontal System of Coordinates:		
2.13	Define Rational horizon, Zenith and Nadir, elevated pole and depressed pole.	K	
2.14	Describe the relationship between altitudes of elevated pole and the latitude of the observer.	U	
2.15	Find the value of polar distance of the body, using its declination.	AP	
2.16	Apply the polar distance to the true altitude of the body at lower transit to find the altitude of the elevated pole and the latitude.	AP	
2.17	Define a position line/position circle.	K	
2.18	Describe the direction of the position line through the observer.	U	
2.19	Define the observers upper and lower celestial meridian.	K	
2.20	Explain the true and apparent motion of bodies.	U	
2.21	Explain the relationship between azimuth and quadrantal bearings and 360 degrees' notation bearing.	U	
2.22	Recognise the parts of PZX triangle. Draw figure on the plane of rational horizon and of the observer's celestial meridian to illustrate navigational problems and principles.	K	
	Polaris (Pole Star) observation:		
2.23	Explain how the pole star Identified during Night.	U	
2.24	Explain why the pole star is visible only in the Northern Hemisphere.	U	
2.25	Calculate Latitude of the observer using Polaris.	AP	
2.26	Calculate using pole star the Compass Error and given Variation find out Deviation.	AP	
3	**Azimuth(Sun, Star and Planets) , Amplitude (Sun)**		**12**
3.1	Calculate the Azimuth of a Heavenly body (Sun, Star and Planets only) at any given time (LMT, GMT/UTC).	AP	
3.2	Find the Gyro and Mag Compass Error, calculate the Deviation if Variation given visa-versa.	AP	
3.3	Calculate Sun Rise, Sun Set time.	AP	
3.4	Calculate Amplitude (Sun).	AP	
3.5	Find the Gyro and Mag Compass Error, calculate the Deviation if Variation given.	AP	
4	**Lat by Mer Alt (Sun):**		**12**
4.1	Latitude by Meridian Altitude (Sun):	AP	
4.2	Apply the zenith distance of a body when it is on observer's meridian to the declination of the body to obtain observers latitude. Apply these correctly when declination and latitude have same name and different name.	AP	
4.3	Describe the direction of the position line through the observer when taking a meridian altitude.	U	
4.4	Calculate Time of the meridian passage of Sun.	AP	

4.5	Calculate latitude by meridian altitude of Sun.	AP	
4.6	Find the Direction of the position line and the position through which it passes.	AP	
5	**Twilight and Circumpolar bodies**		**12**
5.1	Define Twilight.	K	
5.2	Explain the Civil, Nautical and Astronomical Twilight.	U	
5.3	Calculate Civil, Nautical and Astronomical Twilight timings in the morning and Evening hours.	AP	
5.4	Define Circumpolar bodies.	K	
5.5	Describe the conditions for the heavenly bodies to be circumpolar.	U	
5.6	Explain the upper and the lower Meridian Passages.	U	
5.7	Calculate the Latitude using the circumpolar bodies.	AP	
5.8	Use of Star Identifier, Identify important Constellations (Ursa Major, Cassiopeia, Orion, Canis Major, Centaurus, Crux, and Carina) and the Stars on the Night Sky	K	

TEXT BOOKS:	
1	Principles of Navigation by Capt.S.S.S Rewari & Capt. T.K.Joseph , 1 Jan 2018
2	Practical Navigation Nutshell Series Book-1 with Almanac by Capt.H. Subramaniam-2010 Edition
3	Nautical Almanac 2008 Selected page
REFERENCE BOOKS	
1	The Admiralty Manual of Navigation: Principles of Navigation: Vol. 1-NauticalInstitute
2	The Admiralty Manual of Navigation: Astro NavigationVol.2- Nautical Institute
3	Norrie's Nautical Tables
4	Star Identifier set
Pedagogy	
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.	

CORE COURSE (CC)	UD11T6205 – Cargo work II	LECTURE HOURS	CREDITS
		60	4

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand the general arrangement of oil tankers and their piping and pumping arrangements.
CLO2	Explain the oil tanker cargo operation procedures
CLO3	Explain chemical and gas cargo operation procedures.
CLO4	Understand the principles of watch keeping in Ports
CLO5	Apply cargo stowage plan for loading and unloading on an oil tanker

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	H	M	H
CLO2	H	H	M	H
CLO3	H	H	M	H
CLO4	M	H	H	H
CLO5	H	H	M	H

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 60
1	**Oil tankers**		**12**
1.1	Describe, for crude carriers and product tankers, the general arrangement of:	K	
	– cargo tanks		
	– pump-rooms		
	– segregated ballast tanks		
	– slop tanks		
	– cofferdams – peak tanks – deep tanks		
	– accommodation		
	– ventilators leading to accommodation and machinery spaces		
	Cargo piping system		
1.2	Describe the direct pipeline arrangement in crude carriers	K	
1.3	Describe the ring-main system in a product tanker	K	
1.4	Describe the piping arrangements in a pump-room	K	
1.5	Describe the system of individual deep-well pumps for a product tanker	K	
1.6	Explain the arrangement and use of:	K	
	– deck lines		
	– drop lines		

	– stripping lines		
	– crossovers		
	– bypasses		
	– master valves		
	– tank suction valves		
	– sea suction valves including how to test cargo sea chests		
	-- Overboard Valves (Ballast and Cargo)		
	-- Manifold Valves and Reducers		
	-- Tank Cleaning systems		
	-- Cargo heating systems - Heating coils (Steam, Thermal Oil) and Deck Heaters		
	Cargo pumps		
1.7	Describe the main operating principle and features of Centrifugal pumps, Deep-well and Submersible pumps (Framo pumps and Electric submersible).	U	
1.8	Describe the main operating principle and features of the following types of positive-displacement pumps: – Reciprocating – Twin screw	U	
1.9	State the principle and use of Eductors	K	
1.10	State the conditions for which the pumps are being used such as stripping	K	
1.11	Define Hazardous cargo, state the Hazards of Oil Cargoes, Flash point, Flammability diagram, Vapour pressure	K	
1.12	State the Hazards associated with chemical cargoes (Reactivity, Flammability, Toxicity, Cargo compatibility, Health & Pollution Hazards) and control measures, PPE.	K	
1.13	Define static Electricity	K	
1.14	State the Sources of Static electricity on board a ship	K	
	Gas Measuring Instruments		
1.15	Outline and basic operating principles of Fixed Gas sampling systems found on Oil, Chemical and Gas carriers	k	
1.16	Portable Gas detection equipment (Multi-gas meters, Draeger pumps) - Principles & precautions	k	
1.17	Personal Gas meters (O2 meters, H2S meters, Multi gas meters) - Principles & precautions	k	
	Cargo Measuring Instruments		
1.18	Hermetic Locks for gauging and cargo sampling.	K	
1.19	Ullage Temperature Interface (UTI) Portable Tank gauge, Remote Microwave Gauging Instrument principles and use (eg. Saab Marine)	K	
1.20	Describe main types of Ballast Treatment systems used on board	K	
1.21	Basic understanding of Hull Stress Monitors	K	
2	**Oil tankers (ISGOTT)**		**12**
2.1	State the Hazards on an Oil Tanker, Spontaneous Combustion, Auto ignition, Concepts of API, Density and Relative density	K	
2.2	Define Cargo operation planning, Stowage plan and Approved Stability Instrument on Tankers (Loadicator)	K	
2.3	Define Setting Lines and Valves, Loading procedures with VECS system in operation, High and Overfill alarms on cargo tanks	K	
2.4	Understand Maximum Permissible loading rates for Tankers, precautions while starting Cargo operations, Pressure Surges in	K	

	cargo lines		
2.5	Explain in brief Topping off and Stripping operations	K	
2.6	Describe a typical Inert gas system including boiler uptake valve, scrubber, blowers, oxygen analyser, deck seal, non-return valve, PV valve, PV breaker and mast riser.	K	
2.7	Explain Inerting (Dilution and displacement method) and hazards of Inert gas.	K	
2.8	Explain Purging and gas freeing operations (Fixed and Portable gas freeing fans)	K	
2.9	Enumerate Crude Oil Washing, its hazards and benefits	K	
3	**Chemical Tankers**		
3.1	Explain IMO ST 1, ST 2 and ST 3 tankers as per IBC Ch 17	U	**12**
3.2	Explain various categories (X, Y, Z, OS) of cargoes.	U	
3.3	State the purpose and use of IBC code and the Certificate of Fitness	K	
3.4	Explain the Independent piping system found on chemical tankers.	K	
3.5	Basic introduction to Nitrogen generators	K	
3.6	Explain the Hazards involved with Tank cleaning operation and use of Tank cleaning matrix	K	
3.7	Various types of tank coatings, introduction to CHRIS Code.	U	
4	**Gas Tankers(Ch. VII of SOLAS, SIGTTO and IGC Code) LNG, LPG, and Chemical Gases in Bulk:**		**12**
4.1	State the Hazards associated with Gas cargoes (Toxicity, Asphyxia, Frostbite, Brittle Fracture) and control measures adopted	K	
4.2	Describe types of Liquefied Gas Carriers considering Survival Capacity as per IGC code (1G , 2G, 2PG, 3G)	K	
4.3	Explain Cargo Containment Systems (Types of tanks integral, membrane, semi-membrane, independent and internally insulated tank)	U	
4.4	Explain the three categories of independent tanks: type A, type B and type C (pressure vessels) as per IGC Code	K	
4.5	Describe the Various types of ships (Fully pressurized, Semi pressurized, Fully refrigerated)	K	
4.6	Basics of Pumping and piping arrangements on Gas carriers	K	
4.7	State the purpose and objectives of the IGC Code and the Certificate of fitness.	K	
4.8	Definitions - Boiling point, Cargo area, cargo containment systems, gas carrier, gas/dangerous zone, gas- safe space, hold space, inter barrier space, MARVS, primary and secondary barrier, BLEVE	K	
4.9	Concept of cargo Heel and Boil Off	K	
4.10	Gas Carrier Safety Systems - Basic concepts- High/Overfill alarms, Ship shore link, Emergency Shutdown safety system, Powered Emergency Release Couplings	K	
4.11	Basic understanding of a LNG reliquefaction plant.	K	
5	**Cargo calculations(oil tanker) and cargo watch**		**12**
5.1	Define 'ullage'	K	
5.2	describe the uses of tank calibration tables and given cargo density to calculate the weight in a tank	U	
5.3	correct densities for temperature	AP	

5.4	describe the uses of tank calibration tables and given weights and densities of cargo to determine the ullages required	U	
5.5	determine the ullage to leave to produce a given minimum ullage after allowing for expansion of cargo	AP	
	Keeping a cargo watch		
5.6	state that arrangements for keeping watch in port should:	K	
5.7	ensure the safety of life, ship, cargo and port		
5.8	observe international, national and local rules, Dock labour regulations pertaining to cargo handling covering dust, personal protection and awareness of moving parts of machinery.		
5.9	maintain order and the normal routine of the ship		
5.10	Describe taking over the watch and lists the information which the officer being relieved should pass to the relieving officer	U	
5.11	list the matters on which the relieving officer should satisfy themselves before assuming charge of the watch	K	
5.12	describe how the watch should be kept and lists the points to which attention should be paid	U	
5.13	describe the actions to take on receiving a storm warning or in an emergency threatening the safety of the ship	U	
5.14	list the entries which should be made in the logbook	K	

TEXT BOOKS	
1	Cargo Work for Ship officer – Capt Errol Fernandes Published by Marinez Enterprises Published on 1 Jan 1993 Course Notes by the Faculty
REFERENCE BOOKS	
1	Cargo Work – Kemp and Young 19 May 1998
2	Cargo Works – Taylor , 1 August 1978
3	Cargo Notes- Dhananjay Swadi, 31 July 2009
4	Cargo Work for Maritime Operation- D.J. House, (13 July 2015)
5	ISGOTT, IGC Code, IBC Code
Pedagogy	
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.	

Core Course (CC)	UD11T6206 – Ship Construction and Ship Stability - II	LECTURE HOURS	CREDITS
		60	4

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Understand various fittings on ships
CLO2	Learn various stresses action on the ships
CLO3	Analyse the transverse statical stability of the vessel
CLO4	Calculate the list of the vessel after cargo operations
CLO5	Apply stability related knowledge in Hindship calculations

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	H	M	M
CLO2	H	H	M	M
CLO3	H	H	M	M
CLO4	H	H	M	M
CLO5	H	H	M	M

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL(K/U/ AP/AN/C)	LECTURE HOURS 60
	Ship Construction		
1	**Fittings on Forecastle deck, Fire main and Bilge piping system**		**12**
1.1	Describe The Cleating Arrangements For The Hatch Covers	U	
1.2	Draw A Sketch Of A Typical Forecastle Mooring And Anchoring Arrangements (Hawse Pipe, Spurling Pipe, Cable Stopper, Bitter End, Chain Locker), Showing The Leads Of Moorings	AP	
1.3	Describe The Bilge Piping System Of A Cargo Ship	U	
1.4	Describe That Each Section Is Fitted With A Screw-Down Non Return Suction Valve.	U	
1.5	Describe The Arrangement Of A Fire Main And List What Pumps May Be Used To Pressurize It	U	
1.6	Sketch And Label Air Pipes To Ballast Tanks / Fuel Oil Tanks	AP	
1.7	Describe The Use Of Save-All And Drip Trays.	U	
2	**Ship Stresses and Loadicator**		**12**
2.1	Define Terms Shear Force (SF) And Bending Moments (BM)	K	
2.2	Explain What Is Meant By 'Hogging' And By 'Sagging' And Distinguish between them (Static and Dynamic both)	U	
2.3	Describe The Loading Conditions and Sea condition Which Give Rise To Hogging And Sagging Stresses	AP	
2.4	Describe Liquid Pressure Loading On the Tank Structures. Stress due to Torsion on Hull girder	U	
2.5	Describe Qualitatively The Stresses Set Up By Liquid Sloshing In A Partly Filled Tank	U	
2.6	Describe Racking Stress And Its Causes	U	

2.7	Explain What Is Meant By 'Pounding' Or 'Slamming' And List parts of the Ship that are Affected	U	
2.8	Explain What Is Meant By 'Panting' And List parts of The Ship that are Affected.	U	
2.9	Describe Stresses Caused By Localized Loading	U	
2.10	Describe The Input and Output Data from Stress Calculation Machines (Loadicator). Briefly state about class certificate of Loadicator, approved Loadicator manual and approved test conditions & testing requirements by ship staff and annual testing in presence of Class	U	
	Ship Stability		
3	**Transverse Statical Stability and Equilibrium of Ships:**		**12**
3.1	Draw the midship diagram for a box shaped vessel & show Keel, COB, COG, Metacentre, Metacentric height, righting lever.	K	
3.2	Explain Righting Moment can be calculated as a product of displacement & Righting Lever.	U	
3.3	State the Wall sided Formula for calculating Righting lever for large angles of heel.	K	
3.4	Calculate Moment of Statical Stability for small as well as large angles of heel.	AP	
3.5	Define Stiff and Tender ships. Compare and contrast the various characteristics of stiff and tender ships.	K	
3.6	Define Stable, unstable and neutral equilibrium	K	
3.7	Sketch the midship transverse section of a box shaped vessel to show Stable equilibrium.	AP	
3.8	Sketch the midship transverse section of a box shaped vessel to show Unstable equilibrium.	AP	
3.9	Sketch the midship transverse section of a box shaped vessel to show neutral equilibrium.	AP	
4	**Free Surface effect and List**		**12**
4.1	Sketch the midship transverse section of a heeled ship & explain Free Surface Effect.	AP	
4.2	State formula for calculating Free Surface correction (FSC) due to single slack tank.	K	
4.3	State formula for calculating Free Surface correction (FSC) due to multiple slack tanks.	K	
4.4	State formula for calculating Free Surface Correction (FSC) when tanks are subdivided into identical compartments.	K	
4.5	Calculate FSC due to slack tanks and compute GM (fluid).	AP	
4.6	Define List as the transverse inclination caused when the COG of the ship is off the center line.	K	
4.7	State the difference between and list & heel.	K	
4.8	Sketch the midship transverse section of a listed ship and show Tan Θ = GG1/GM	AP	
4.9	State that the GM considered for calculating List will always be GM(Fluid)	K	
4.10	Calculate List while Loading, Discharging and/or shifting weights.	AP	
4.11	Explain procedure to correct List by loading, discharging or shifting weights.	U	
4.12	Solve numerical for correction of List.	AP	
5	**M.V. HINDSHIP:**		**12**
5.1	Demonstrate the use of Ship and Hydrostatic particulars of M.V. Hindship.	U	

5.2	Apply knowledge of above topics and calculate numerical from 1 to 25 from M.V.Hindship.	AP	

TEXT BOOKS

1. Ship Construction Notes for Ship Mates - by Edrich Fernandes Pro-Navigator Books 1999
2. Ship Stability at the Operational Level- Capt. Subramaniam H 1-Jan-2021
3. Stability, trim and cargo calculations on M.V. Hindship and Oil Tankers- Capt. Joseph & Capt. Rewari 2018
4. Stability Table Trim & stability particulars of M.V. Hindship (Stability tables)-Bhandarkar Publication.

REFERENCE BOOKS

1. Ship Stability for Masters & / Mates - Bryan Barrass , Capt D R Derrett , 5 September 2012
2. Ship Stability for Mates & Masters - Martin A. Rhodes 1 December 2003
3. Ship Construction Sketches & Notes - by Kemp & Young, 12 December 1997
4. Ship & Naval Architecture - by R. Munro-Smith, 1 May 1977
5. Ship Constructions - by D.J. Eyres, 22 May 2012
6. Ship Construction for Marine Engineer - by Paul A Russell , E A Stokoe , 04 Aug 2022

Pedagogy

Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.

Core Course (CC)	UD11T6207 Bridge Electronic Equipment and Watch Keeping	LECTURE HOURS	CREDITS
		60	4

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Demonstrating RADAR, its operation and uses
CLO2	Apply RADAR plotting for calculating CPA and TCPA
CLO3	Demonstrate operation of the various bridge equipment
CLO4	Apply watch keeping procedures for conducting safe navigational watch at various condition

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	M	H	L
CLO2	H	H	H	L
CLO3	H	M	H	L
CLO4	H	M	H	L

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNINGOBJECTIVES (TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	LECTURE HOURS 45
1	**RADAR and ARPA**		**12**
	Fundamental Principles of Radar		
1.1	Explain RADAR is an acronym for Radio Detection and Ranging. Explain the Principle in which a Marine Radar works. Explain radiation hazards and precautions, safety precautions necessary in the vicinity of open equipment, radiation hazard near antennae and open waveguides.	U	
1.2	Describe the characteristics of Radar sets: Bearing and Range accuracy, HBW. VBW, pulse length, pulse recurrence rate	U	
1.3	Sketch a simple Block diagram and explain use of various controls	AP	
1.4	Describe maximum & minimum Range of Radar, Range and Bearing discrimination	U	
1.5	Explain Atmospheric interference affecting radar detection, radar horizon, sub refraction, super refraction & ducting, effect of precipitation and sea on radar detection	U	
1.6	Explain factors that might cause spurious interpretation: Indirect echoes, side echoes, multiple echoes, second 'trace echoes.	U	
1.7	Explain range & bearing accuracy, error in range & bearing	U	
1.8	Radar Plotting - Plot relative motion triangle (OAW Triangle) and identify various vectors and angles, course, speed and aspect of other ships in relative and true presentation. Closest point of approach (CPA) and time to point of approach (TCPA), Bow pass, in relative and true presentation.	AP	

	Automatic Radar Plotting Aid (ARPA):		
1.9	Define Controls & Graphic symbols of ARPA	K	
1.10	Explain 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.	U	
1.11	Explain advantages of compass stabilization of a relative display, Trial Manoeuvre.	U	
1.12	**Use of Radar in Navigation**		
1.13	Obtain position fix by radar bearings and ranges**,**	AP	
1.14	Explain use of Aids to radar navigation: Use of passive (trails, history) and active aids, RACONs and SARTs.	U	
1.15	Explain AIS overlay on radar / ARPA	U	
1.16	Describe use of parallel indexing technique in radar navigation:	U	
2	**Gyro Compass and ECDIS**		**12**
2.1	Describe a free gyroscope and its gimbal mountings	U	
2.2	State that in the absence of disturbing forces the spin axis of a free gyroscope maintains its direction in space	K	
2.3	Explain what is meant by gyroscopic inertia and precession	U	
2.4	Describe the precession resulting from a torque about axes perpendicular to the spin axis	U	
2.5	Explain that friction at gimbal pivots produces torques which give rise to precession	U	
2.6	State that the rate of precession is proportional to the applied torque	K	
2.7	State that 'tilt' as movement of the spin axis in the vertical plane	K	
2.8	State that 'drift' as the apparent movement of the gyroscope in azimuth resulting from the earth's rotation	K	
2.9	Explain how a free gyroscope can be made north-seeking by the use of gravity control and describe the resulting oscillations of the axis	U	
2.10	Describe the use of damping in azimuth and damping in tilt to cause settling of the axis and thus produce a gyrocompass.	U	
	ECDIS		
2.11	Describe the differences between Vector and Raster Charts	U	
2.12	Describe the route planning information; route planning calculation; calculation the voyage schedule; construction of a route; planned route checking for navigator safety; alternative route; optimization of route planning and ultimate route selection	U	
2.13	Describe Alarm relating to ECDIS	U	
2.14	Describe the possible risk of over-reliance and complacency on ECDIS.	U	

3	**GNSS and DGNSS**		**12**
	Global Positioning System -		
3.1	Describe World Geodetic System 1984 (WGS 84) as a terrestrial reference system (geodetic datum) which is used by the GPS satellites for position fixing.	U	
3.2	Explain the basic working principle of GPS	U	
3.3	GPS - advantages & limitations, alarm setting & errors, system configuration, frequencies used.	U	
3.4	GPS - C/A & P/A codes, basic line measurement, Dilution of Precision (DOP), various DOPs used, selective availability and its effect on the accuracy of a fix, accuracy of GPS and how the accuracy can be downgraded.	U	
3.5	Explain Why a fix obtained from the GPS receiver cannot be plotted directly onto a navigational chart, datum shifts.	U	
	Augmented Satellite systems (DGPS):		
3.6	Explain working principle & limitations of Differential GPS (DGPS) system.	U	
	Regional Satellite Navigation systems and India's IRNSS		
3.7	Introduction to RSNS- Explain China's BeiDou (COMPASS) Navigation satellite system, , Japan's Quasi-Zenith satellite system (QZSS) and France's Doppler Orbitography and Radio Positioning Integrated by satellite (DORIS), GLONASS, Galileo.	U	
3.8	Explain India's Indian Regional Navigational satellite system (IRNSS-Navik) and its current stage.	U	
4	**Various Bridge Electronic Equipment's**		**12**
	Automatic Identification System (AIS)		
4.1	Describe types and purpose of AIS information exchange, data exchange.	U	
4.2	Information displayed on AIS screen,	U	
4.3	Limitations & precautions of AIS during use of AIS for collision avoidance.	U	
	LRIT (Long Range Identification and Tracking)		
4.4	Explain purpose of LRIT, Data transmitted by LRIT, authorized receivers/ users of LRIT.	U	
4.5	Compare LRIT and AIS.	AN	
	VDR (Voyage Data Recorder)		
4.6	Describe concept and purpose of VDR, details & duration of data recorded on VDR, modules of VDR float free Playback Options S-VDR.	U	
	Bridge Navigation Watch Alarm System (BNWAS)		
4.7	Explain operation, precautions and limitations of BNWAS	U	
5	**Bridge Procedures Guide Contents and Keeping a safe Navigational Watch:**		**12**
5.1	Explain Watch-keeping Arrangements in accordance with the situations any limitation in qualifications or fitness of individuals, Individual roles, responsibility and team roles shall be established, Effective use of the resources available.	U	

5.2	States that the Officer Of the Watch (OOW) is responsible for navigating safely, with particular regard to avoiding collision and stranding	U	
5.3	Describe the principles to be observed in keeping a navigational watch as set out in section A-VIII of the STCW Code regarding:	U	
	. navigation		
	. navigational equipment		
	. navigational duties and responsibilities		
	. handing over and taking over the watch		
	. lookout		
	. navigation with a pilot embarked		
	. protection of the marine environment		
	. Bridge Navigation Watch Alarm system		
	. blind pilotage technique		
	. general principles for ship reporting systems and with VTS procedures		
5.4	Describe the recommendation on operational guidance for officers in charge of a navigational watch contained in chapter VIII, section A-VIII/2 of the STCW Code:	U	
	. maintenance of an efficient lookout		
	. the use of engines and sound signaling apparatus		
	. taking over the navigational watch		
	. periodic checks of navigational equipment		
	. compliance with SOLAS V/19 regarding the use of the automatic pilot and the changeover to manual steering and vice versa		
	. electronic navigational aids		
	. the use of radar		
	. navigation in coastal waters		
	. conduct of the watch in clear weather		
	. actions to take in restricted visibility		
	. the circumstances in which the officer of the watch should call the master		
	. navigation with a pilot embarked		
	. briefing of watch keeping personnel		
	. Describe the duties of the officer of the watch while at anchor		
	. list the entries which should be made in the logbook.		
	Handing over and taking over watch:		
5.5	-Describe the procedure for handing over and taking over Bridge Watches.	U	
	Bridge manning levels:		
5.6	Describe the basic principles of Bridge Resource management	U	
5.7	Explain the circumstances in which the Officer On Watch (OOW) should call the Master	U	

5.8	Describe the responsibilities of OOW when in-charge of Navigational watch and Extra lookout requirement	U	
5.9	Explain the navigation duties with Pilot embarked	U	
5.10	List the parameters to be recorded and kept during the watch of the movements and activities relating to the navigation of the ship, Steering the correct course.	K	
5.11	Determine standard compass error is at least once a watch and, when possible, after any major alteration of course.	U	
5.12	Compare standard and gyro compasses and repeaters frequently, and synchronize with the master compass.	AP	
5.13	Describe manual testing of automatic pilot, functioning of navigation and signal lights, radio equipment.	U	
5.14	Describe importance of a lookout, blind pilotage techniques in restricted visibility, navigation with a pilot embarked, VTS procedures, watch keeping procedures at anchor, usefulness of Ship Reporting Systems, and circumstances in which to call the master.	U	
5.15	Action to be taken on receiving Storm Warning- Read barometer pressure, wind speed & direction, state of sea, gathering information from weather reports.	U	
	Watch Keeping at Sea under Different Conditions in Different Area as explained in the Bridge Procedure Guide, use of those checklists		
5.16	Explain watch keeping in clear weather, in hours of darkness, in coastal and congested waters and in rough weather.	U	
5.17	Describe Ice navigation & Ice patrolling as per SOLAS (SAFETY OF NAVIGATION)	U	
	Tests as per Safety of Life at Sea (SOLAS), as amended		
5.18	-Describe preparation, tests control for proceeding to sea, making port and entering Harbours.	U	

TEXT BOOKS	
1	Basic of electronic aids for surface navigation by Dr. Veera Senthil Kumar and Capt. Mihir Chandra 2023
2	Bridge Equipment and watch keeping Capt.A.G. Bhatia-2022 Edition
3	Ship Borne Radar and ARPA Nutshell Series Book 3 by Capt H. Subramaniam, 11 September 2019
REFERENCE BOOKS	
1	IMO : Standard Marine Communication Phrases - by Sterling Book House IMO SMCP:
2	A Guide to the Collision Avoidance Rules - by Cockcroft and Lameijer
3	Bridge Procedure Guide – ICS
4	Bridge Team work - Nautical Institute
5	Electronic Navigation Systems by L. Tetley & D. Calcutt, 20 March 2001
6	Ship Magnetic Compass- Capt T.K. Joseph & Capt. S S S Rewari, 1 January 2018
7	Bridge Equipment, Charts & Publication Nutshell Series Book 5- Capt. H. Subramaniam, 1 January 2017
8	Modern electronic Navigation Aids-Bhatia & Sinha, 2021
Pedagogy	
Lecture, PPT, Assignment, Seminar, Group Discussion, and Activity based Learning.	

Practical – Minor Stream (PL/MS)	UD11P6208– Computer Practical	PRACTICAL HOURS	CREDITS
		45	1.5

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Identify hardware and operating system
CLO2	Demonstrate proficiency in utilizing MS office (MS Word, MS Excel and MS PowerPoint)
CLO3	Connect the computers in network
CLO4	Understand cyber security procedures

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	M	L	-	-
CLO2	M	L	--	-
CLO3	M	L	-	-
CLO4	M	L	-	-

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 45
1	**Basic Hardware Familiarization and operating system**		**9**
1.1	Identify various hardware components of computer such as input and output devices, CPU, data storage devices	AP	
1.2	Manage Files and Folders - Creating, Opening, Renaming and Deleting Files and Folders. Performing Searches for Specific Files and Folders.	AP	
1.3	Use Common Keyboard Shortcuts to Speed Up Operations.	AP	
1.4	Determine The Ways to Sort Out / Fix Minor Computer Issues by Using Control Panel Options.	AP	
1.5	De-Fragmenting A Drive For Optimum Usage And Speed And Demonstrate Same.	AP	
1.6	Demonstrate The Procedure Of Finding/ Sorting / Archiving Files.	AP	
2	**MS-WORD**		**9**
2.1	Create and Save Documentation. File (Data) Import and Export features	AP	
2.2	Open, Find, And Rename Files and Folders.	AP	
2.3	Use "Print" Commands.	AP	
2.4	Use "Paragraph" Options, "Bullets" And "Numbering".	AP	
2.5	Use "Formatting Toolbar".	AP	
2.6	Use Spelling And Grammar Checks In The Document.	AP	
2.7	Use "Headers And Footers".	AP	

2.8 2.9	Insert Symbols And Pictures. Create Tables In Ms-Word.	AP AP	
2.10	Convert MS-WORD document into PDF file.	AP	
~~3~~	**MS-EXCEL**		**9**
3.1	Create Workbooks, Working With Rows, Columns, Cells And Worksheets.	AP	
3.2	Insert Pictures And Graphics.	AP	
3.3	Format Cells.	AP	
3.4	Use Conditional Formatting On Data In Cells.	AP	
3.5	Perform Basic Calculations - Add, Subtract, Multiply, Divide.	AP	
3.6	Calculate Averages, Find The Maximum Value.	AP	
3.7	Format Worksheets - Draw Tales, Format Text, Format Cells, Adjust Columns And Rows, Print Worksheets.	AP	
3.8	Manipulate Data - Move, Copy, And Paste, Add/Delete Columns, Add/Delete Rows, Employ Multiple Worksheets, Insert/Delete Worksheets.	AP	
3.9	Create Formulas, Employ The Function Wizard, Add Comments, Create Charts.	C	
3.10	File (Data) Import and Export features, Convert MS-EXCEL document into PDF file.	AP	
4	**MS- POWER POINT**		**9**
4.1	Create A Presentation Create A Slide, Add New Slides, Insert Pictures, Format Text, Format Pictures, Preview A Presentation.	C	
4.2	Insert Tables And Charts, Employ Design Templates, Employ A Master Slide, And Rearrange Slides.	C	
4.3	Animate Text, Animate Graphics, Create Slide Transitions, Advance Slides Automatically, Preparing Live Presentations, Make Presentations Portable.	C	
4.4	File (Data) Import and Export features, Convert MS-POWER POINT document into PDF file.	AP	
5	**Networks and cyber security**		**9**
5.1	Explain Networking Concepts	U	
5.2	Explain Networking Infrastructure (Lan, Wan, Man) And Topologies	U	
5.3	State The Type Of Network Used In A Company And Its Limitations	K	
5.4	Explain The Significance As To How A Networking Can Improve Business Operations	U	
5.5	List Basic Network Technology Terms	K	
5.6	Demonstrate The Procedures For Net Working computers	AP	
5.7	Identifying Network Cable Cat 5 And Cat 6 And Explain Crippling And Punching Of The Network Cable.	AP	
	Cyber security		
5.8	Introduction to cyber security	K	

5.9	Password Management (Importance and Guideline for strong password). Precautions to safeguard against Cyber threat	K	
5.10	Different types of Cyber Crimes	K	
5.11	Explain cybersecurity challenges in maritime industry	K	

TEXT BOOKS

Course Notes by the faculty and Manual

REFERENCE BOOKS

Learn Microsoft Office 2019 By Linda Foulkes, 29 May 2020

Microsoft Office Step by Step (Office 2021 and Microsoft 365) By Joan Lambert, Curtis Frye, 12 June 2022

WEB RESOURCES

1. https://www.hattelandtechnology.com/blog/introduction-to-computer-networks-on-ships
2. **https://www.youtube.com/watch?v=JRqPpJQT_6o**
3. The Guidelines on Cyber Security Onboard Ships Version 4 - https://www.ics-shipping.org/wp-content/uploads/2021/02/2021-Cyber-Security-Guidelines.pdf

Practical Core Course (PL/CC)	UD11P6209 - Nav Equipment and OOW Practical	PRACTICAL HOURS	CREDITS
		60	2

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Use of sextant azimuth mirror identify vessels
CLO2	Operate hand steering and autopilot
CLO3	Demonstrate Look out duties and action to avoid collision as per ROR
CLO4	Operate Meteorological equipments and enter observations in log books
CLO5	Demonstrate Electronic navigational aids and Radar/ARPA

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	M	-	M	-
CLO2	M	M	M	
CLO3	H	M	H	-
CLO4	H	H	M	-
CLO5	H	M	M	M

H-High; M-Medium; L-Low

UNIT NO	DETERMINING ERROR ON SEXTANT;	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 60
1	**Altitude and Azimuth Measuring instruments**		**15**
1.1	Demonstrate parts of sextant. Demonstrate the use of sextant in measuring altitude of sun, Horizontal and Vertical Sextant angles	AP	
1.2	Determine the Errors on sextant	AP	
1.3	Demonstrate the use of azimuth mirror in a binnacle/ repeater;	AP	
1.4	Practice determining compass error and log keeping	AP	
2	**Steering and Lookout**		**15**
2.1	Steer a steady course on OOW simulator**.**	AP	
2.2	Respond to steering orders and Execute Steering orders	AP	
2.3	Execute Handing over wheel to the relieving helmsman	AP	
2.4	Practice communication while on hand steering	AP	
2.5	Practice Change over from hand steering to auto pilot and vice versa	AP	
	Look out		
2.6	Report of target on OOW Simulator;	AP	
2.7	Identify the types of vessel by its day and night signals	AP	

2.8	Identify vessels by its sound signals in restricted visibility	AP	
2.9	Demonstrate the actions to avoid collision by models	AP	
3	**Meteorological equipment**		**15**
3.1	Demonstrate the use of hygrometer, psychrometer, barometer, barograph, anemometer;	AP	
3.2	Record weather observation;	AP	
3.3	Practice Log book writing,	AP	
4	**Electronic Navigational Equipment**		**15**
4.1	Demonstrate use of GPS, Echo sounder, Doppler log and AIS	AP	
4.2	Operate GPS, Echo sounder, Doppler log, AIS in simulator	AP	
4.3	Operate the controls on marine radar, interpret radar display on a simulator;	AP	
4.4	Use of ARPA and parallel index technique during the passage.	AP	
1	**REFERENCE BOOKS** Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House, Publisher: Routledge Taylor & Francis		

-

Practical - Multi Disciplinary (PL/MD)	UD21P6210 Engine Room Machinery and Workshop Practices	PRACTICAL HOURS	CREDITS
		45	1.5

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Demonstrate fitting and carpentry workshop exercises
CLO2	Practice electrical and pneumatic workshop exercises
CLO3	Practice hydraulic workshop
CLO4	Demonstrate machinery maintenance
CLO5	Practice welding workshop

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	M	H	L	L
CLO2	M	H	L	L
CLO3	M	H	L	L
CLO4	M	H	L	L
CLO5	M	H	L	L

H-High; M-Medium; L-Low

UNIT NO	SPECIFIC LEARNING OBJECTIVES(TOPICS)	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 45
1	**Fitting and Carpentry work Shop**		**9**
1.1	Draw the general Layout of ship Board Engine Room and show the various machineries and workshops inside the engine room	AP	
1.2	Demonstrate The Ability To Perform At Least Four Basic Fitting Jobs Of Given Dimension By Using Proper Hand Tools Such As Files, Hacksaw, Chisel, Hammer, Etc. (Group Activity Of 2-3 Cadets). Safety precautions.	AP	
1.3	Demonstrate The Use Of Feeler Gauge, Thread Gauge, Screw Gauge, Vernier Calliper, On The Above Said Job.	AP	
1.4	Identify Various Spanners, Nuts and Bolts, Allen Screws, Studs and Demonstrates Their Use. Demonstrates their uses such as boxing up of manhole cover using the appropriate packing	AP	
1.5	Demonstrate The Use Of Grinding Machine Including Portable Grinders And Drilling Machine on the said job, incl safety precautions.	AP	
1.6	Identify Carpentry Hand Tools Such As Chisel, Jack Plane, Augur, Mortise Gauge, Etc. Safety precautions.	AP	
1.7	Identify Various Wood For Specific Purposes Treatment Materials.	AP	
1.8	Identify Various Wood Jointing Material Using Adhesive, Nails, Screws Etc.	AP	

1.9	Demonstrate The Ability To Execute Wood Jointing (Group Activity Of 2-3 Cadets)	AP	
1.10	Use Of Fibre Glass Repair Kits. (Instructor Demonstration For Group Of 20 Cadets)	AP	
2	**Electrical and Pneumatics Workshop**		**9**
2.1	Identify Electrical Insulated Hand Tools. 7	AP	
2.2	Demonstrate The Ability To Identify Electrical Conductors (Wires And Cables). NAVIGATION LIGHT ALARM	AP	
2.3	Identify The Electrical Accessories Such As Fuse, Circuit Breakers, Choke, Starters, Etc. And Demonstrates The Use Of It In Electrical Circuits.	AP	
2.4	Demonstrate The Ability To Carry Out Battery Check And Maintenance - Voltage, Acid Density And Battery Capacity By Continuous Current Drain (Group Activity Of 2-3 Cadets). Safety precautions.	AP	
2.5	Identifies Safety Precautions To Take To Avoid Shock And To Rescue A Person From Electrical Shock Location. (Instructor Demonstration For A Group Of 5 Cadets).	AP	
2.6	Identify The Various Equipment Operated By Pneumatics Such As Pneumatics Wrench, Lights, Grinders, Drilling Machines, Spray Painting Machines Etc.	AP	
2.7	Identify Various Components Used In Pneumatics Like Relays, Transmitters, Actuators Etc.	AP	
2.8	Identify Symbols Used In Pneumatics And How They Are Different Than The Hydraulics.	AP	
2.9	Trace The Simple Pneumatic Circuits	AP	
2.10	Detect And Rectify Common Faults In Pneumatic Circuits.	AP	
2.11	Demonstrate The Ability To Clean Compressed Air Filters Including Dryers	AP	
3	**Hydraulics Shop**		**9**
3.1	Identify Various Components Used In Hydraulic System.	AP	
3.2	Interpret Basic Hydraulic Circuit Diagrams .Explain With Sketch The Purpose And Symbols Of Direction Control Valves And Methods Of Their Operation.	AP	
3.3	Identify Symbols Of Various Accessories Used In Hydraulics Such As Heater, Cooler And Filters , Pressure Control Valves And Flow Control Valves, Actuators And Pumps.	AP	
3.4	Use Ermeto Type Couplings For Joining Pipes Taking Safety Precautions.	AP	
3.5	Execute Common Fault Finding And Rectification In Hydraulic System	AP	
3.6	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).	AP	
4	**Machinery Maintenance**		**9**
4.1	Identify Various Fasteners Such As Nut And Bolts, Allen Screws, Studs And Demonstrates Its Use.	AP	
4.2	Identify Valves And Cocks Used Onboard.	AP	
4.3	Overhaul A Globe Valve And Butterfly Valve By Using Appropriate Tools And Gaskets	AP	

4.4	Demonstrate The Procedure To Carry Out Greasing And Oiling Pumps And Motor By Using Grease Gun, Oilcans And Pneumatic Grease Gun.	AP	
5 5.1	**Welding Workshop** Demonstrate The Safety Precautions To Be Observed While Welding Including Earthing. (Instructor Demonstration For A Group Of 20 Cadets).	AP	**9**
5.2	Identify The Arc And Gas Welding Tools And Welding Kits and Ferrous And Non-Ferrous Metals.	AP	
5.3	Demonstrates The Ability To Carry Out Oxyacetylene Gas Cutting.	AP	
5.4	Connects The Arc Welding Kit And Selects The Current / Electrode & Carry Out Arc Welding.	AP	

	Reference Books Basic Marine Engineering by Ch. Engr. J K Dhar 12th Edition			

Field Practice - Summer Internship (FP/SI)	UD11F6211 - Book Review (any good English book of student's choice, literature, fiction, non-fiction, historic, time travel etc)	PRACTICAL HOURS	CREDITS
		15	0.5

Course Learning Outcomes (CLO)

On the successful completion of the course, students will be able to

CLOs	CLO STATEMENT
CLO1	Analyse book review
CLO2	Analyse **Literary Elements**
CLO3	Explore different writing style
CLO4	Write book review

Mapping with Programme Learning Outcomes (PLO)

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4
CLO1	H	L	M	-
CLO2	H	L	M	-
CLO3	H	L	M	-
CLO4	H	L	M	-

H-High; M-Medium; L-Low

UNIT NO	Details	COGNITIVE LEVEL (K/U/AP/AN/C)	PRACTICAL HOURS 15
			15
1	**Introduction to Book Reviewing**		
	Explore the importance of book reviews in literary criticism Analysis of sample book reviews from various publications	AP AN	
2	**Literary Elements**		
	Identifying and analyzing key literary elements (plot, character, setting, theme, etc.)	AP	
3	**Genre Exploration**		
	Explore different genres of literature (fiction, non-fiction, poetry, etc.) Study genre-specific conventions and expectations	AP AP	
4	**Writing Style and Voice**		
	Exercise different writing styles and voices in book reviews	AP	
5	**Write a book review after reading a book (Refer to Circular No. 2303 date 12.04.2023 for detailed Instructions)** The students are to write a 'Book Review' on any book of their choice (literature, fiction or non-fiction). The review should have the following: i. An introductory paragraph: ii. **The body of the review**: iii. **Conclusion**	**AP**	

Question Paper Template for Core courses

INDIAN MARITIME UNIVERSITY
(A Central University Government of India)
Diploma in Nautical Science Leading to B.Sc (Applied Nautical Science)
Semester I/II

Course Title **Course Code**

Max. Marks: 70 **Pass Marks: 35**
Date : **Time: 3 hours**

Note: All the Questions in Section A (10 Marks), Section B (10 Marks) and Section C (50 Marks) are compulsory.
Whichever required for the course from the following may be mentioned in Question paper
Use BA Chart 813 (South Coast of Sri Lanka) for Chart work
Use of Selected pages of Nautical Almanac 2008, Norie's Tables and
Non-programmable type Scientific Calculator is allowed in the Exam Hall.

Section – A

Answer all the Questions (10X1=10 Marks)

1. MCQ or True/False - Unit 1
2. Fill in the blanks - Unit 1
3. MCQ or True/False - Unit 2
4. Fill in the blanks - Unit 2
5. MCQ or True/False - Unit 3
6. Fill in the blanks - Unit 3
7. MCQ or True/False - Unit 4
8. Fill in the blanks - Unit 4
9. MCQ or True/False - Unit 5
10. Fill in the blanks - Unit 5

Section – B

Answer all the Questions (5X2=10 Marks)

11. From unit1
12. From unit2
13. From unit3
14. From unit4
15. From unit5

Section – C

Answer all the Questions (5X10=50 Marks)

16. From unit 1 (could also be of 2 questions of 5 mark each)
17. From unit 2 (could also be of 2 questions of 5 mark each)
18. From unit 3 (could also be of 2 questions of 5 mark each)
19. From unit 4 (could also be of 2 questions of 5 mark each)
20. From unit 5 (could also be of 2 questions of 5 mark each)

In addition, QP Setter's the instructions from IMU Examination Section may be followed

Question Paper Template for other theory non-core courses like - Minor Stream/ Multi-Disciplinary/ Ability Enhancement / Skill Enhancement / Value Added Course

INDIAN MARITIME UNIVERSITY
(A Central University Government of India)
Diploma in Nautical Science Leading to B.Sc (Applied Nautical Science)
Semester I/II

Course Title **Course Code**

Max. Marks: 70 **Pass Marks: 35**
Date: **Time: 3 hours**

Note: All the Questions in Section A (10 Marks) and Section B (10 Marks) are compulsory.
Section C (50 Marks) - Answer any 5 questions out 7 given questions
Whichever required for the cour se from the following may be mentioned in Question paper
Use BA Chart 813 (South Coast of Sri Lanka) for Chart work
Use of Selected pages of Nautical Almanac 2008, Norie's Tables and
Non-programmable type Scientific Calculator is allowed in the Exam Hall.

Section – A

Answer all the Questions (10X1=10 Marks)

1. MCQ or True/False - Unit 1
2. Fill in the blanks - Unit 1
3. MCQ or True/False - Unit 2
4. Fill in the blanks - Unit 2
5. MCQ or True/False - Unit 3
6. Fill in the blanks - Unit 3
7. MCQ or True/False - Unit 4
8. Fill in the blanks - Unit 4
9. MCQ or True/False - Unit 5
10. Fill in the blanks - Unit 5

Section – A

Answer all the Questions (5X2=10 Marks)

11. From unit1
12. From unit2
13. From unit3
14. From unit4
15. From unit5

Section – C

Answer any five Questions (5X10=50 Marks)

16. From unit 1 (could also be of 2 questions of 5 mark each)
17. From unit 2 (could also be of 2 questions of 5 mark each)
18. From unit 3 (could also be of 2 questions of 5 mark each)
19. From unit 4 (could also be of 2 questions of 5 mark each)
20. From unit 5 (could also be of 2 questions of 5 mark each)
21. Any 2 units (could also be of 2 questions of 5 mark each)
22. Any 2 units other than from Question 21 (could also be of 2 questions of 5 mark each)

Note - Question 21 and 22 may be formulated covering syllabus/content from at least four units (5 marks each), which holds considerable importance.
In addition, QP Setter's the instructions from IMU Examination Section may be followed

Books Prescribed by "Indian Maritime University" For Issuance to Students

The IMU Campuses/Affiliated Colleges to issue to the students the following books semester-wise

S.No	Courses	Books
	Semester I	
1	Maritime English	1) * Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House, Publisher: Routledge Taylor & Francis 2) Course notes by the faculty
2	Mathematics	1) Spherical Trigonometry by Capt. H. Subramaniam, Edition 1, Published by Vijaya Publications, Published on 20-Aug-2019. 2) Engineering Mathematics by H Grewal, Standard Edition, Published by Khanna Publishers, Published on 1-Jan-1965
3	Physics	1) Electrical Technology by B. L. Thereja&A.K Theraja, Volume 1Published by S.Chand ,Published on 10 Jun 2006. 2) Principles of Electronics by V. K. Mehta,Rohit Metha, Edition 7, Published by S.chand, Published on 3 Feb 2014
4	Terrestrial Navigation	1) Principles of Navigation by Capt. S.S.S. Rewari & Capt. T.K. Joseph, Edition 2, Published by Applied Research International, Published on 1 Jan 2018 2) Practical Navigation by Capt.H. Subramaniam – 2010 Edition 3) Chart Work for Mariner by Capt. S.K. Puri,Edition 6, Published by Marine Publications of India, Published on 1 Jan 2016. 4) Selected pages of Tide Tables (Std Ports)
5	Cargo Work I	1) Cargo Work for Ship officer – Capt Errol Fernandes Published by Marinez Enterprises Published on 1 Jan 1993 2) Course notes by the faculty
6	Ship Construction and Ship Stability - I	1) Ship Stability at the Operational Level- Capt. Subramaniam H 1-Jan-2021 2) Ship Construction Notes for Ship Mates - by Edrich Fernandes Pro-Navigator Books 1999
7	Bridge Equipment and COLREGS	1) Bridge Equipment, Charts & Publication Nutshell Series Book 5- Capt. H. Subramaniam 1 Jan 2017 2) Bridge equipment and watching keeping Capt.A.G. Bhatia-2022 3) Rules of The Road Bhandarkar Publications 15th Edition
8	Physics Practical	Lab manual
9	Chart Work Plotting and ECDIS Practical	1) Chart Work for Mariner-Capt. S.K. Puri 1 Jan 2016 Other Materials to be issued English Channel Chart (Shall be Photocopy) Parallel Ruler, Divider, Compass, 2B pencil and Eraser
10	Seamanship Practical	1) * Seamanship Techniques : Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House, Publisher: Routledge Taylor & Francis *
11	Field Practice (Swimming & Industry visit)	Faculty Guidance
	Semester II	
1	Marine Meteorology	1) Marine Meteorology Nutshell Series Book-2 by Capt.H. Subramaniam, Edition 5, Published by Vijaya Publications
2	Contingency Preparedness	1) Safety Emergencies & Environmental Protection by Capt. Errol Fernandes

		2) * Seamanship Techniques: Shipboard & Marine Operations, 5th Edition (special Indian Edition) By: D. J. House, Publisher: Routledge Taylor & Francis * 3) Course notes by the faculty
3	Marine Pollution Prevention	1) Introduction to Marine Environment Protection, Second Edition, by Capt Subroto Khan 2021 Course notes by the faculty
4	Celestial Navigation	1) Principles of Navigation by Capt.S.S.S Rewari & Capt. T.K.Joseph, 1 Jan 2018 2) Practical Navigation Nutshell Series Book-1 with Almanac by Capt.H. Subramaniam-2010 Edition 3) Nautical Almanac 2008 selected Pages
5	Cargo Work II	1) Cargo Work for Ship officer –Capt Errol Fernandes Published by Marinez Enterprises Published on 1 Jan 1993 Edition 2) Course notes by the faculty
6	Ship Construction and Ship Stability - II	1) Ship Construction Notes for Ship Mates - by Edrich Fernandes Pro-Navigator Books 1999 2) Ship Stability at the Operational Level- Capt. Subramaniam H 1-Jan-2021 3) Stability, trim and cargo calculations on M.V. Hindship and Oil Tankers- Capt. Joseph & Capt. Rewari 2018 4) Stability Table Trim & stability particulars of M.V. Hindship (Stability tables)-Bhandarkar Publication 2016
7	Bridge Electronic Equipment and Watch Keeping	1) Basic of electronic aids for surface navigation by Dr. Veera Senthil Kumar and Capt. Mihir Chandra 2023 2) Bridge Equipment and watch keeping Capt.A.G. Bhatia-2022 Edition 3) Ship Borne Radar and ARPA Nutshell Series Book 3 by Capt H. Subramaniam 11 September 2019
8	Computer Practical	Lab Manual
9	Nav Equipment and OOW Simulator Practical	Simulator Manual
10	Engine Room Machinery and Workshop Practical	Basic Marine Engineering – J.K. Dhar 12th Edition
11	Book Review	eBooks from website

Note :

1) *** Covers many courses within a semester**

2) **In addition to the above issuance of books, the college Library should have adequate copy of Reference books to issue to students in the respective semester.**

INDIAN MARITIME UNIVERSITY

(A Central University under the Ministry of ports, Shipping and Waterways, Govt. of India)
East Coast Road Semmencherry,
Chennai-600119,
Tamil Nadu, India
Tel:+ +91 (44) 2453 9020
Website https://www.imu.edu.in/imunew